MOBILE EQUIPMENT SALES CATALOG

HALE

Class 1

MOBILE EQUIPMENT SALES CATALOG

Introduction

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If you have any questions regarding the information contained on this CD, or if you need additional copies, contact Hale Products Marketing Services Department at 610-825-6300 or via e-mail at rleonard@haleproducts.com.

HALE

Class 1

MOBILE EQUIPMENT SALES CATALOG

Mobile Equipment Brochure

MaxStream Brochure

Literature

Performance Curves

Line Drawings

Pump End Parts Drawings

Manuals

HALE

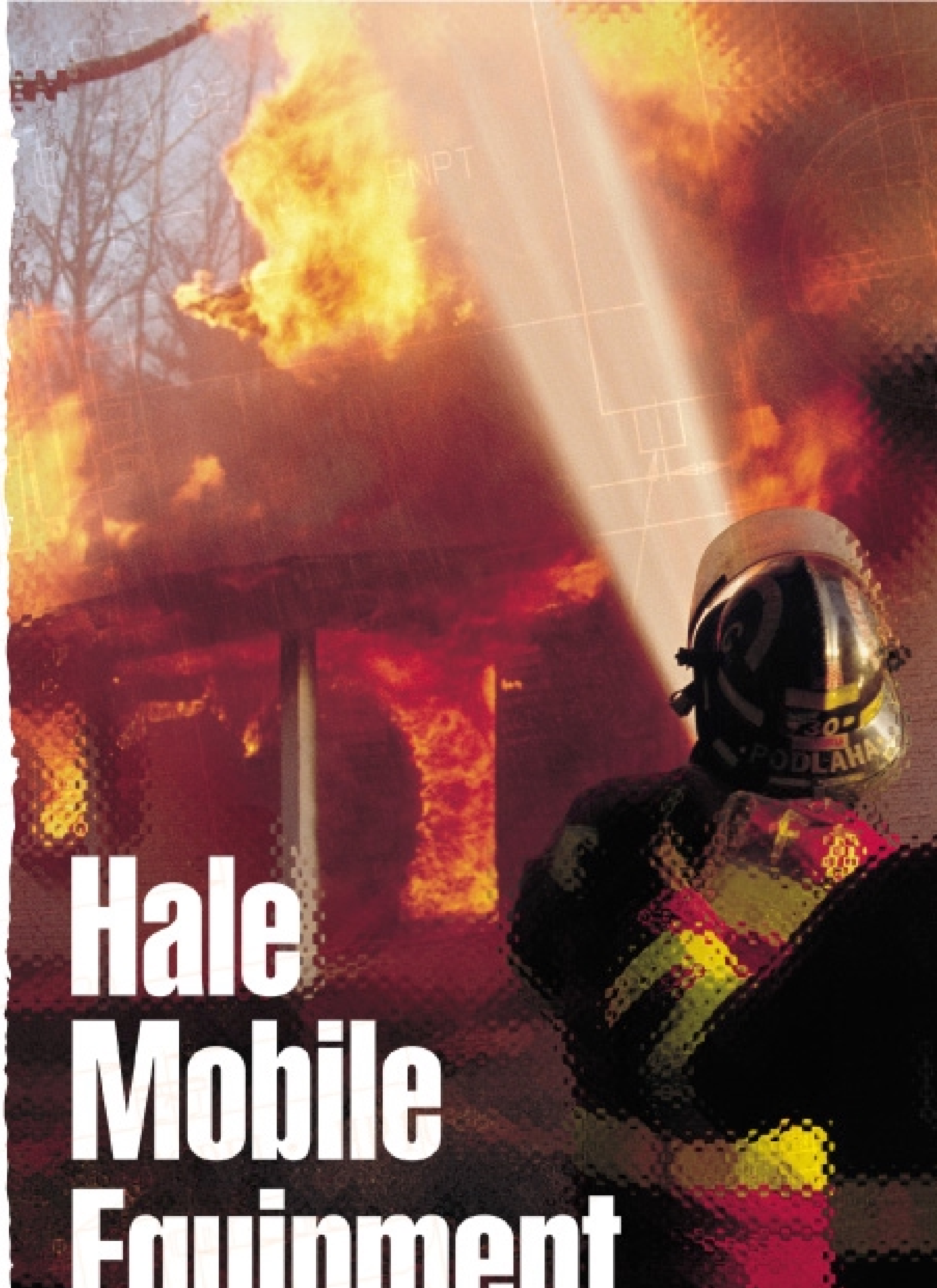
Class 1

Your

Go-Anywhere

Firefighting

Power



Hale Mobile Equipment

HALE Products

Dependable Power

Hale Products offers the right combination of innovative technologies for the job... from fighting wildlands blazes to shuttling water to portable tanks or wading through waist-deep lakes. As the world leader in fire pumps, Hale gives you the confidence that comes with proven performance. After all, we've been the power behind your fire-fighters for more than 85 years – delivering dependable operation, fire after fire.

HP Premium Series fully enclosed portable pump comes complete with an integrated fuel tank and full instrumentation, including prime from panel design. It delivers 25% more pressure, is quiet and safe, and allows for rapid deployment with less personnel. In short, Hale's HP Premium Series gives your squad convenient power when they're on the move.

Easy to use

Compact and lightweight, HP Premium units are equipped with four handles for two-man portability. When not in use, the handles fold away for convenient storage.

The HP75 Premium unit is specifically designed for the demands of forestry fire situations, complete with a 12-volt electric start integral battery.

Hidden beneath the attractive exterior is a protective frame of integral welded steel tubing. Plus, the fuel tank provides three gallons (12 liters) of fuel, allowing the pump to run for two hours under normal operating conditions.

Powerful engine

Power is provided by the mighty Briggs & Stratton Vanguard* – a reliable, air-cooled, 18 BHP, V-twin Overhead Valve engine. The unique overhead valve design delivers more power than conventionally designed side-valve engines. Its electric start with recoil backup ensures performance under all conditions. Plus, an optional exhaust elbow is available to divert hot exhaust to the atmosphere.

Convenient options

Hale offers an optional marine-grade, quick-connect electrical socket, which can be used to power the optional light mast for night operation. This convenient electrical socket also serves as the connection point for a trickle charger to ensure the battery remains charged and the pump is always ready for operation.

Other options include: suction adapters, discharge adapters, an hourmeter, a portable pump thermal relief valve, and protective coatings for seawater applications.

Models available: HP75, HP100, HP200, HP300, HP400

HP Premium Series

Features:

- Pressure capabilities of 340 psi
- Fully enclosed portable with integrated fuel tank
- 12-volt electric start integral battery
- Integral fuel tank
- Rotating discharge valves
- Push-button start and master on/off switch
- Bronze impeller
- Reliable Briggs & Stratton Vanguard engine

HP200

HP400

HALE Products

Portable Power

Hale's HP Trans-Portable Series is a high-performance group of versatile pumps that are specially configured for full portable applications. The lightweight pumping unit is mounted on a steel skid plate base with handles for two-person portability. A remote three-gallon fuel tank with fuel line comes standard. Plus, simple, engine-mounted instrumentation keeps you in control with a throttle lever, choke control, exhaust primer control, low-oil warning light, discharge pressure gauge, and push-button or keyed ignition.

This advanced Hale portable captures the heart of our portable pumps with computer-aided pump design, matching the pump ends to the engine to allow for maximum pump performance at designed flow ranges.

Hale's HP Trans-Portable pumps are powered by a variety of gas and diesel engines to meet your needs.

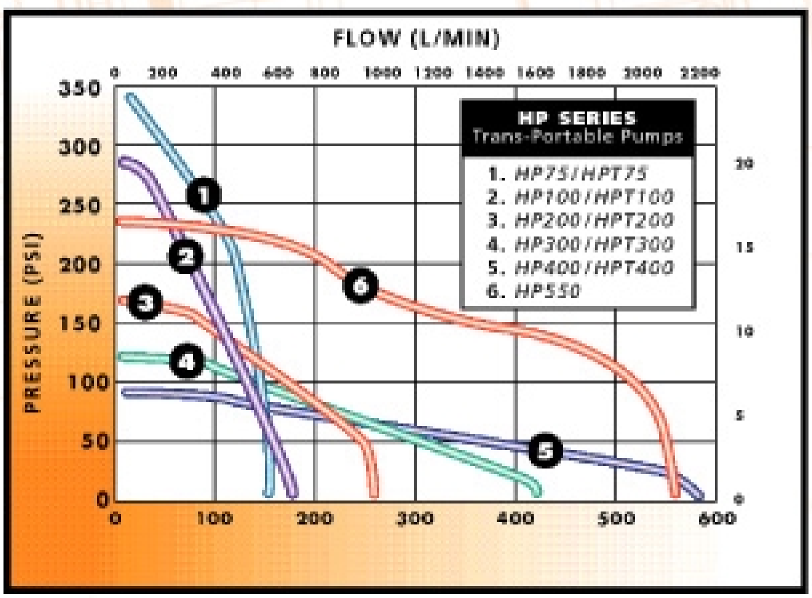
Easy maintenance

Save money, time, and effort with our low-maintenance Trans-Portables. The close-coupled pump is bolted directly to the engine housing, so that there are less parts to maintain. The pump body castings are coupled together with a stainless steel band clamp, which allows for quick pump removal for easy servicing.

Optimum efficiency

Close tolerance in the machining of impeller and wear rings assures that you receive a pump that operates with optimum efficiency.

All of our Trans-Portable models are built tough and rugged, equipped with a stainless steel pump shaft, silicon bronze impeller, and aluminum body. Best of all, these convenient, go-anywhere pumps have maximum pressure ratings up to 340 psi and maximum flow ratings up to 500 GPM. Each model offers a different suction connection.



Models available: HPT75-B18, HPT100-B18, HPT100-YD10, HPT200-B18, HPT200-YD10, HPT300-B18, HPT400-B18, HP550

HP Trans-Portable Series

Features:

- Mounted on steel rail base
- Vibration mounts
- Ergonomic carrying handles
- Protective exhaust blanket
- Manual recoil start backup
- Available in gas and diesel versions

HPT200

HP550

HALE
Products

Convenient Power

Pump up the power with Hale's convenient floating pumps. Reliable, yet powerful... our floating pumps are the ones to count on when you can't count on hydrants. They are easily used with alternative water sources such as streams, lakes, or pools – the Chief II requires only three inches of water to draft!

Chief II – for maximum flow

The Chief II combines reliable, self-priming operation with the highest flow ratings available. It delivers a maximum flow of 410 GPM with two discharge ports or maximum pressure of 25 psig. Ideal for drafting from streams or ponds, the Chief II can throw a water stream more than 90 feet for powerful direct firefighting capabilities.

The pump and motor assembly easily detaches from the float and the float assembly folds in half for convenient storage in truck compartments – folds to 31 inches long (788mm) by 16 inches wide (406mm). The entire lightweight package easily transports and can be carried by two people. The collapsible float assembly is almost unsinkable and extremely tough, made with a high-density polyethylene shell filled with closed-cell polyurethane foam.

With the Chief II, you can say goodbye to rough starts. A positive-type rewind starter and a maintenance-free Megatron™ electronic ignition system ensures that the Chief II will start when you need it. Reliable power comes from the 4-cycle, air-cooled Briggs & Stratton gasoline engine, which can run for more than one hour at full throttle on a single tank of gas.

Fyr Flote – for featherweight transport

The Fyr Flote® is an extremely lightweight, portable centrifugal pump mounted on a high-strength polyethylene float with dual carrying handles and a splash-suppression collar. Our high-volume and high-pressure models are versatile for all your floating pump needs. And, weighing just 49 pounds, Fyr Flote stores easily in most truck compartments. It includes an automatic recoil starter, a spark-arresting muffler, and an engine over-speed control switch.

Fyr Pak/Fyr Port Pumps

The ultimate in portable – this Hale centrifugal pump weighs only 34 pounds (15.5kg) and is mounted on a padded adjustable backpack frame. It doesn't get more convenient. The Fyr Pak can pump water from draft, relay, or hydrant and will deliver discharge pressures up to 220 psi and flows to 75 GPM from draft. The unit includes an automatic recoil starter, a spark-resisting muffler, an engine over-speed control switch, a priming pump, and a priming valve.

The Fyr Port has a wrap-around frame configuration with a 1-gallon, on-board fuel tank.

Specialty Pumps

CHIEF II

- Detachable folding float
- Flows up to 410 GPM
- Drafts in 3" of water

FYR FLOTE

- Lightweight and extremely portable
- Fits in most truck compartments
- Pressure and volume models available

FYR PAK

- Padded, adjustable backpack frame
- Pumps from draft, relay or hydrant

HALE Products

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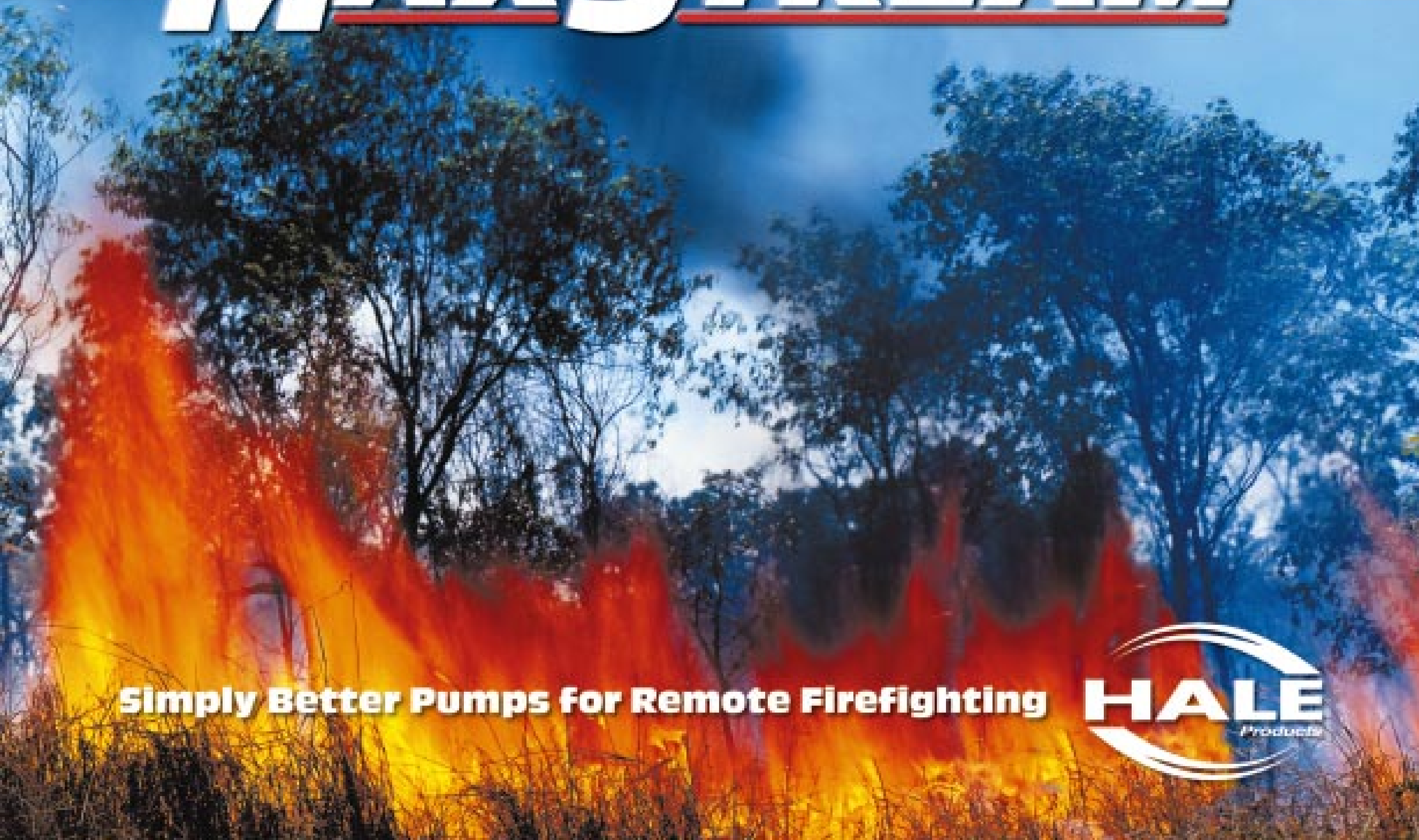
MAXSTREAM™



Simply Better Pumps for Remote Firefighting

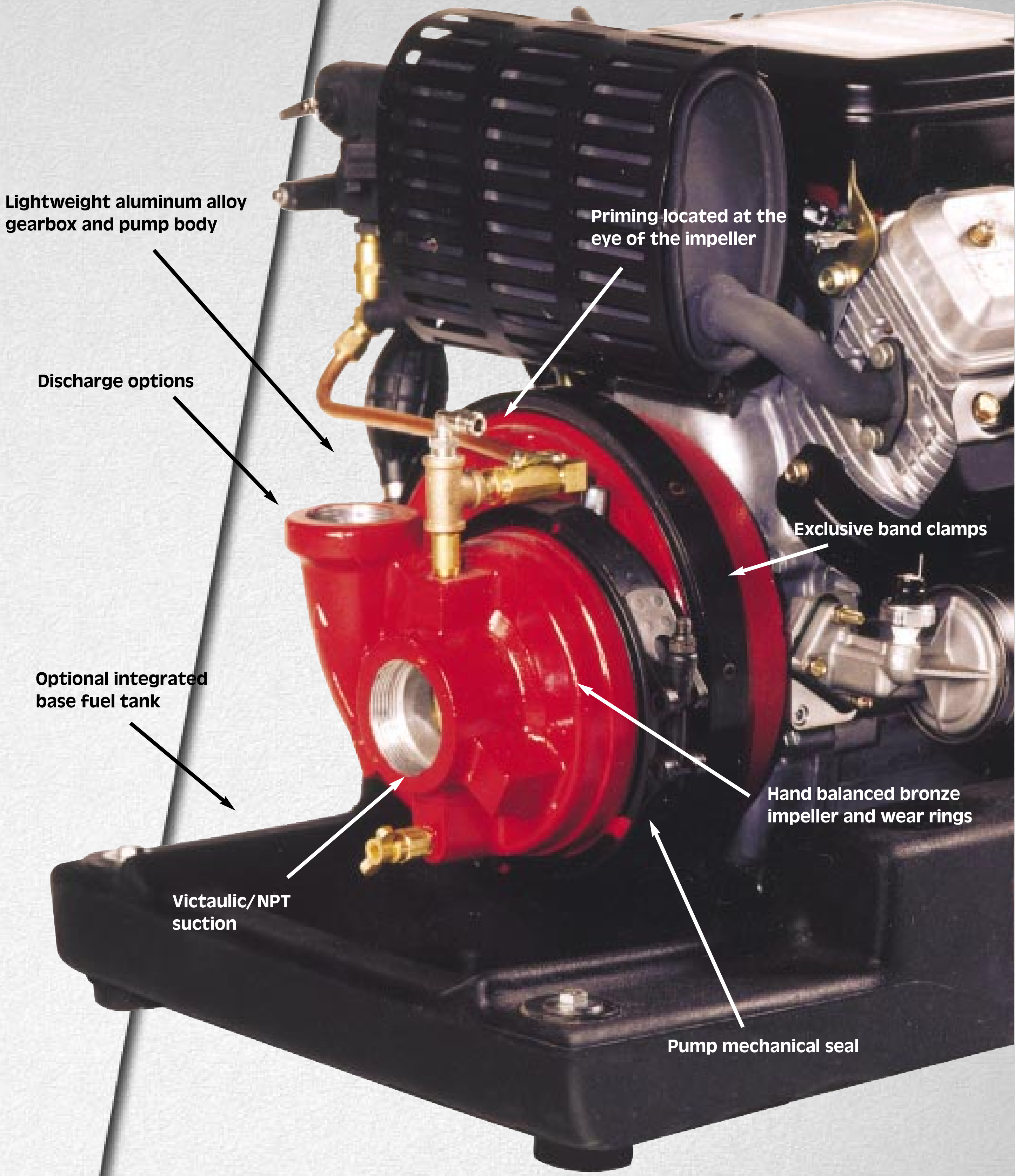
Extraordinary Situations Call For Extraordinary Pumps

Hale's MaxStream pumps are rugged, tough, and engineered to perform where others can't.

Whether you're fighting a forest fire, a grassland blaze, or a burning house, you need a pump that is reliable and durable enough for any circumstance.

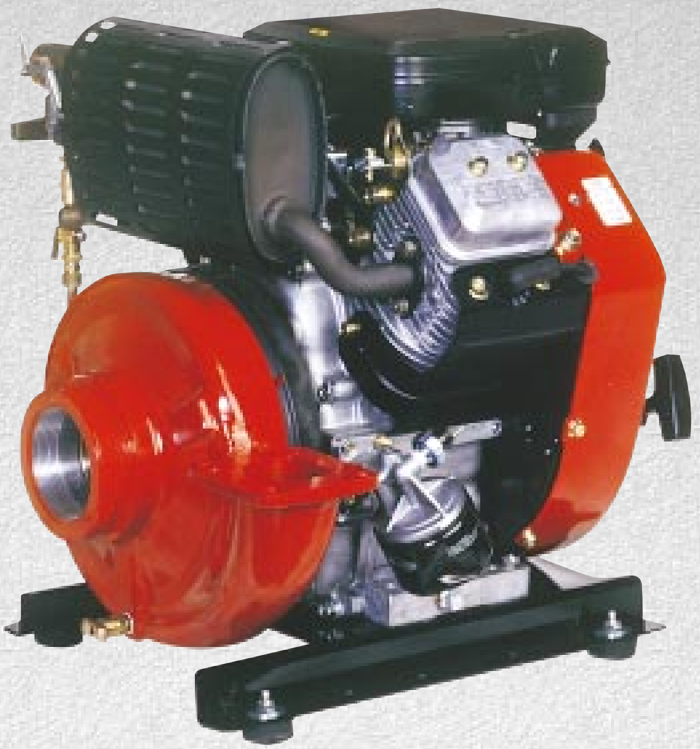
At Hale, we took our 85 years of experience as a leader in the fire pump business, and put together a line of pumps that are especially designed for pump-and-roll or supply applications. The Hale MaxStream pumps are built to last over the long haul, with real-world engineering and hard-working construction that will work under the most severe conditions.

MAXSTREAM™



Hale MaxStream pumps are built with hard-working features you'll count on.

HPX Vanguard Series



Ideal For High Pressure/High Volume Applications

- 18HP Briggs Vanguard V-twin engine
- Exclusive V-series band clamp pump ends
- Five performance classes
- Lightweight aluminum alloy pump construction

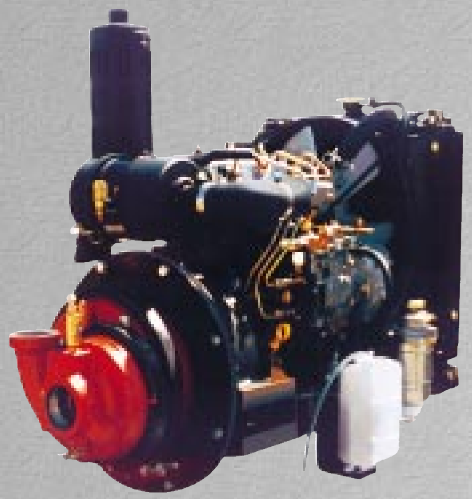
Performance Ratings

HPX75-B18	HPX100-B18	HPX200-B18	HPX300-B18	HPX400-B18
135 GPM @ 50 PSI (511 LPM @ 3.5 BAR)	155 GPM @ 50 PSI (587 LPM @ 3.5 BAR)	245 GPM @ 25 PSI (928 LPM @ 1.75 BAR)	390 GPM @ 25 PSI (1477 LPM @ 1.75 BAR)	500 GPM @ 25 PSI (1893 LPM @ 1.75 BAR)
110 GPM @ 150 PSI (416 LPM @ 10.5 BAR)	100 GPM @ 150 PSI (379 LPM @ 10.5 BAR)	190 GPM @ 75 PSI (719 LPM @ 5.25 BAR)	310 GPM @ 50 PSI (1174 LPM @ 3.5 BAR)	320 GPM @ 50 PSI (1212 LPM @ 3.5 BAR)
50 GPM @ 250 PSI (189 LPM @ 17.5 BAR)	65 GPM @ 200 PSI (246 LPM @ 14 BAR)	110 GPM @ 125 PSI (416 LPM @ 8.75 BAR)	250 GPM @ 75 PSI (947 LPM @ 5.25 BAR)	210 GPM @ 75 PSI (795 LPM @ 5.25 BAR)
25 GPM @ 300 PSI (95 LPM @ 21 BAR)	15 GPM @ 275 PSI (57 LPM @ 19.3 BAR)	60 GPM @ 150 PSI (227 LPM @ 10.5 BAR)	150 GPM @ 100 PSI (568 LPM @ 7 BAR)	95 GPM @ 100 PSI (360 LPM @ 7 BAR)

MAXSTREAM™

Diesel Pumps

HPX100-BD26



Ideal For High Pressure Fire Fighting Applications

- Meets ISO class 9 performance rating
- High pressure to 340 PSI
- Volume flows to 175 GPM
- Reliable Briggs & Stratton diesel engine
- Configured for easy installation by truck builders

Performance Ratings

180 GPM @ 10 PSI (682 LPM @ .7 BAR)

155 GPM @ 100 PSI (587 LPM @ 7 BAR)

115 GPM @ 215 PSI (436 LPM @ 15 BAR)

55 GPM @ 300 PSI (208 LPM @ 21 BAR)

HPX200-BD26

Ideal For Supply And Rural Fire Fighting Applications

- High volume to 290 GPM
- Pressures to 135 PSI
- 3-inch NPT female/4-inch Victaulic suction
- Reliable Briggs & Stratton diesel engine

Performance Ratings

295 GPM @ 10 PSI (1117 LPM @ .7 BAR)

270 GPM @ 50 PSI (1022 LPM @ 3.5 BAR)

200 GPM @ 100 PSI (757 LPM @ 7 BAR)

150 GPM @ 125 PSI (568 LPM @ 8.75 BAR)

HPX100-ZD25 (Not Shown)

Performance Ratings

145 GPM @ 120 PSI (549 LPM @ 8.4 BAR)

80 GPM @ 240 PSI (303 LPM @ 16.8 BAR)

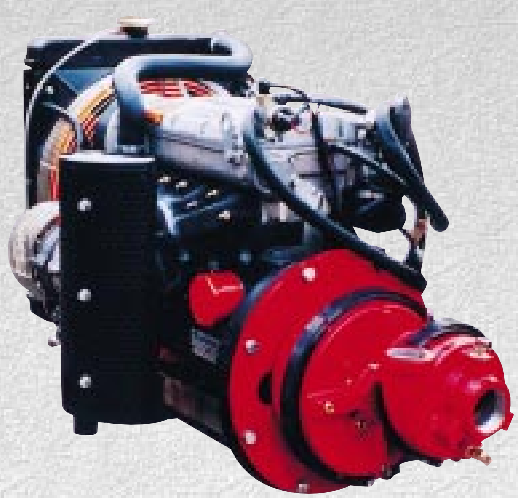
50 GPM @ 300 PSI (189 LPM @ 21 BAR)

10 GPM @ 390 PSI (38 LPM @ 27.3 BAR)

Ideal for Forestry Situations, High Pressure Fog and Long Hose Lays of Small Diameter Hose

- High pressures to 390 PSI
- Volume flows to 150 GPM
- Isuzu LB1 series diesel engine
- Bronze impeller, mechanical pump seal, lightweight aluminum alloy pump end

HPX100-LD23



Engineered For High Pressure Fire Fighting Applications

- Designed for high pressure fog/long hose lay applications
- Pressure applications to 325 PSI
- Volume flows to 155 GPM
- Lightweight and compact package
- Meets ISO Class 9 performance rating

Performance Ratings

160 GPM @ 10 PSI (606 LPM @ .7 BAR)

135 GPM @ 100 PSI (511 LPM @ 7 BAR)

90 GPM @ 200 PSI (341 LPM @ 14 BAR)

30 GPM @ 300 PSI (114 LPM @ 21 BAR)

HPX75-YD10 and HPX200-YD10

Diesel Compatibility: Refueling Convenience With Today's Apparatus

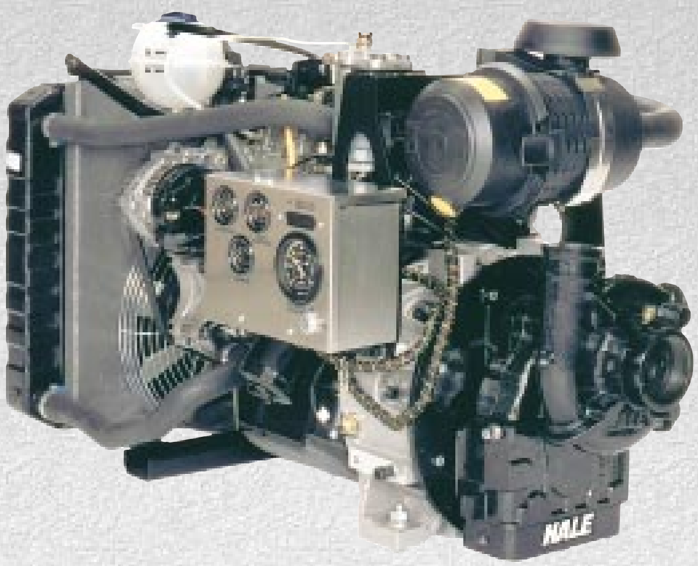
- Lightweight & compact
- Exclusive band clamp design: Quick and easy access for maintenance and repairs
- Our smallest diesel package

Performance Ratings

HPX75-YD10	HPX200-YD10
150 GPM @ 10 PSI (568 LPM @ .7 BAR)	250 GPM @ 10 PSI (947 LPM @ .7 BAR)
95 GPM @ 100 PSI (360 LPM @ 7 BAR)	140 GPM @ 50 PSI (530 LPM @ 3.5 BAR)
60 GPM @ 150 PSI (227 LPM @ 10.5 BAR)	40 GPM @ 100 PSI (151 LPM @ 7 BAR)
35 GPM @ 175 PSI (133 LPM @ 12.25 BAR)	10 GPM @ 125 PSI (38 LPM @ 8.75 BAR)

MAXSTREAM™

FP300DV-0



Ideal For High Pressure Fog Applications, As Well As Long Lays Of Small Diameter Hose

- High pressure applications to 330 PSI
- Volume flows to 500 GPM
- Configured for easy installation for truck builders
- Meets ISO Class 8 & 9 performance ratings

Performance Ratings

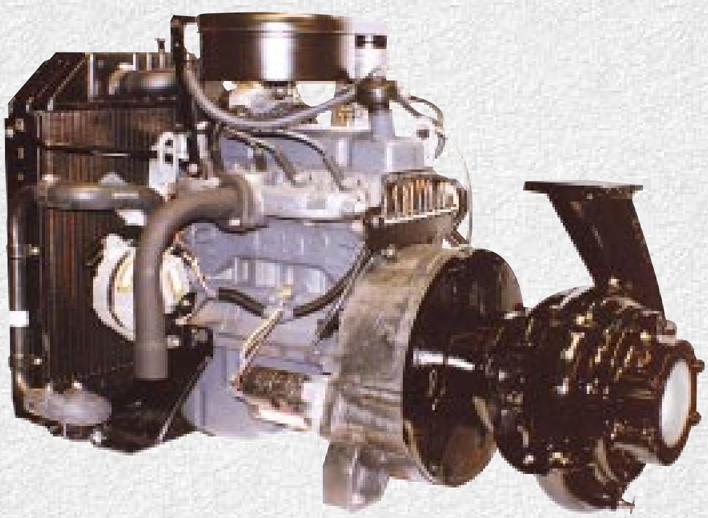
400 GPM @ 80 PSI (1514 LPM @ 5.6 BAR)

300 GPM @ 150 PSI (1139 LPM @ 10.5 BAR)

200 GPM @ 230 PSI (757 LPM @ 16.1 BAR)

25 GPM @ 330 PSI (95 LPM @ 23.1 BAR)

SP200GF-0



Ideal For Cross-Chassis, Pump And Roll Applications

- High volume over 900 GPM
- High efficiency, close coupled pump
- Pressures to 175 PSI
- Engineered for maximum pump performance

Performance Ratings

900 GPM @ 25 PSI (3407 LPM @ 1.75 BAR)

600 GPM @ 80 PSI (2272 LPM @ 5.6 BAR)

200 GPM @ 150 PSI (757 LPM @ 10.5 BAR)

50 GPM @ 170 PSI (189 LPM @ 11.9 BAR)

MAXSTREAM™

Integrated Foam/Portable Pumps

HPXV200-B18 and HPXV300-B18

Foam Capability With Portable Pump Versatility

- Full instrumentation: integrated combined instrument panel shipped loose for remote mounting
- Ideal product for OEM installation
- Unit attached to an easily mounted steel skid base
- Water pressure up to 150 PSI

HPXV200-B18 Performance Ratings

Water	Foam
245 GPM @ 25 PSI (928 LPM @ 1.75 BAR)	**Up to 100 GPM** (379 LPM) **@ 1% Class A**
60 GPM @ 150 PSI (227 LPM @ 10.5 BAR)	**Up to 200 GPM** (757 LPM) **@ .5% Class A**

HPXV300-B18 Performance Ratings

Water	Foam
390 GPM @ 25 PSI (1477 LPM @ 1.75 BAR)	**Up to 250 GPM** (947 LPM) **@ 1% Class A**
150 GPM @ 100 PSI (568 LPM @ 7 BAR)	

HP550

Ideal For Tanker/Supply Applications

- Dependable Honda marine engine
- High volume flows to 550 GPM
- Pressures to 225 PSI
- Lightweight, high efficiency pump
- Available in bronze

Performance Ratings

550 GPM @ 50 PSI (2082 LPM @ 3.5 BAR)

500 GPM @ 90 PSI (1893 LPM @ 6.3 BAR)

250 PSI @ 150 PSI (NFPA) (947 LPM @ 10.5 BAR)

100 GPM @ 210 PSI (379 LPM @ 14.7 BAR)

The Hale Tradition of Leadership

Hale Premium Pumps

- Fully enclosed portable with full instrumentation
- Rotating discharge valves
- Flows to 500 GPM and pressures to 340 PSI
- Complete with integrated base fuel tank and handles

Hale Trans-Portable Pumps

- True portable design, quality features
- Ergonomic carry handles
- Available in gas and diesel versions
- Stainless steel clamp for quick pump removal and easy maintenance

Fyr Flote Floating Pump

- Used with alternative water sources such as streams, lakes or pools
- Lightweight and compact
- Pressure and volume models available

Other Quality Products From Hale

- Skid and Trailer Pumping Units
- PTO Pumps
- Front and Rear Mount Pumps
- Midship Pumps
- Refueler and De-Icer Pumps
- Pedestal Pumps and Pump Ends
- Foam Proportioning Systems

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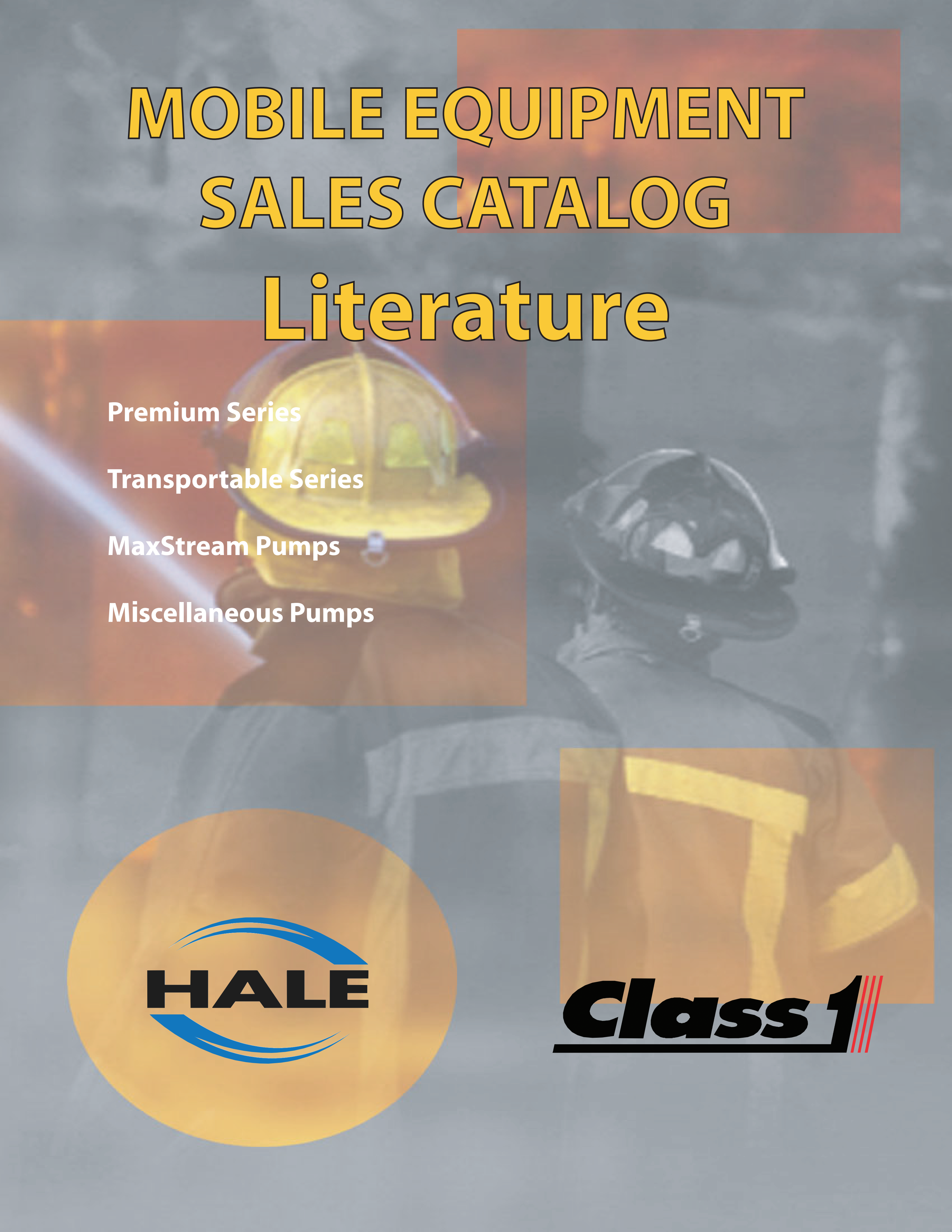

MOBILE EQUIPMENT SALES CATALOG

Literature

Premium Series

Transportable Series

MaxStream Pumps

Miscellaneous Pumps

HP75-B18

Premium Portable Pump

PORTABLE PUMPS

Features and Benefits

Pressure capabilities of 350 PSI (over 25% more than previous models)

Fully Enclosed Portable – Extremely quiet and safe

Integral Fuel Tank – Rapid deployment with fewer personnel

Rotating Discharge Valve – Quick and easy hose layout

Full Instrumentation – Includes prime from panel design

Superior Performance – High pump efficiency

Briggs & Stratton Vanguard Engine – Quiet and powerful

PERFORMANCE RATINGS

135 GPM @ 10 psi
110 GPM @ 150 psi
90 GPM @ 200 psi
10 GPM @ 350 psi

The HP75 Premium series pump has been developed especially for the demands of **forestry fire situations**. Higher pressures and light weight make this pump ideal for both portable and truck mount applications.

The Premium version is compact and lightweight. Premium units feature a sturdy enclosure for safe and quiet operation. Hidden beneath the attractive exterior is a steel, protective frame. The pump is equipped with four handles to provide for two man portability. When not in use, the handles fold away for convenient storage. The HP75 series comes complete with a 12 Volt electric start integral battery. The unique fuel tank is part of the pump base. The fuel tank provides 3 gallons (12 liters) of fuel and will permit the pump to run for two hours under normal operating conditions.

Power is provided by the respected Briggs and Stratton Vanguard engine. The Vanguard power comes from a reliable state-of-the-art, air cooled, 18 BHP, V-twin, Overhead Valve (OHV) engine. The overhead valve design delivers more power than conventionally designed side-valve engines. It has an electric start with recoil backup to ensure starting under all conditions. The HP75 series pump end features a 2-inch NPT female suction connection and a 1-1/2 inch NST male swivel valve. All these exciting features come in a convenient compact design.

The HP Series Premium pump also features Hale's exclusive band clamp design for quick and easy access for maintenance and repair. A bronze impeller and replaceable bronze wear rings are housed in a high strength, lightweight aluminum alloy pump housing. The unit also features a self-adjusting, self-lubricating mechanical pump seal.

Every detail and feature of the HP75 series pumps has been carefully designed and built for years of operation

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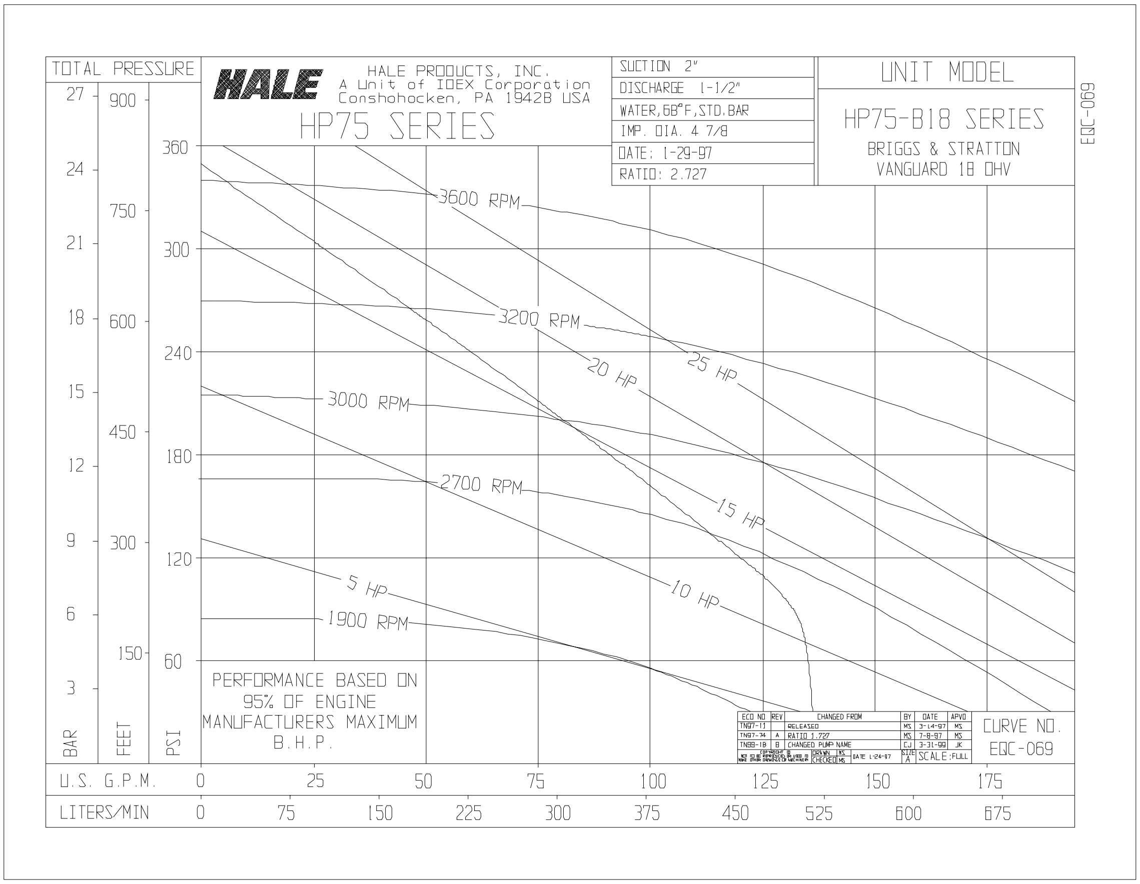
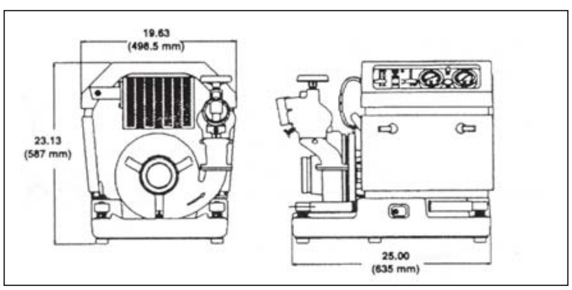
HP75-B18

Premium Portable Pump





EQUIPMENT SPECIFICATIONS

PUMP

Type: Attack pump
Frame**:** Integral welded steel tubing
Suction Connection**:** 2 inch NPT female
Discharge Connection**:** 1-1/2 inch NST Male screw type valve. Swivels 175 degrees for ease of hose layout.
NOTE**:** Suction and discharge connection thread sizes for standard unit. Consult Hale Sales Representative for a full range of factory installed adapters to meet individual user needs.
Body and Volute**:** Aluminum with baked powder coat finish.

Impeller: 4-7/8 inches (123.83 mm) Silicon Bronze.
Pump Shaft**:** Engine Shaft with Bronze Sleeve
Bearing: Ball Type
Priming**:** Exhaust Venturi; 20 inches (508 mm) HG.
Maximum Flow**:** 135 GPM (510 LPM) @ 50 PSI (3.2 BAR).
Maximum Pressure**:** 340 PSI (23.5 BAR).
Weight: 173 pounds (79 KG).
Length: Handles Extended:
35-1/8 inches (892 mm)
Handles Folded
25-5/8 inches (645 mm)
Width: Handles Extended
27-1/2 inches (698.5 mm)
Handles Folded
19-5/8 inches (498.5 mm)
Height: 22-5/8 inches (574.5 mm)

INSTRUMENTATION

Throttle level
Priming control
Master On/Off Switch
Start Push-Button
Choke Control
Low Oil Pressure Warning Light

PORTABLE PUMPS

HP100-B18

Premium Portable Pump

PORTABLE PUMPS

Features and Benefits

Pressure capabilities of 290 PSI

Fully Enclosed Portable – Extremely quiet and safe

Integral Fuel Tank – Rapid deployment with fewer personnel

Rotating Discharge Valve – Quick and easy hose layout

Full Instrumentation – Includes prime from panel design

Superior Performance – High pump efficiency

Briggs & Stratton Vanguard Engine – Quiet and powerful

PERFORMANCE RATINGS
155 GPM @ 50 PSI
100 GPM @ 150 PSI
65 GPM @ 200 PSI
15 GPM @ 275 PSI

Higher pressures and light weight make the HP100 Premium pump ideal for both portable and truck mount applications.

The Premium version is compact and lightweight. Premium units feature a sturdy enclosure for safe and quiet operation. Hidden beneath the attractive exterior is a steel, protective frame. The pump is equipped with four handles to provide for two man portability. When not in use, the handles fold away for convenient storage. The HP100 Premium series comes complete with a 12 Volt electric start and integral battery. The unique fuel tank is part of the pump base. The fuel tank provides 3 gallons (12 liters) of fuel and will permit the pump to run for two hours under normal operating conditions.

Power is provided by the respected Briggs and Stratton Vanguard engine. The Vanguard power comes from a reliable state-of-the-art, air cooled, 18 BHP, V-twin, Overhead Valve (OHV) engine. The overhead valve design delivers more power than conventionally designed side-valve engines. It has an electric start with recoil backup to ensure starting under all conditions. A new optional "exhaust elbow" is available to divert hot exhaust to the atmosphere. All these exciting features come in a convenient compact design.

The HP Series Premium pump also features Hale's exclusive band clamp design for quick and easy access for maintenance and repair. A bronze impeller and replaceable bronze wear rings are housed in a high strength, lightweight aluminum alloy pump housing. The unit also features a self-adjusting, self-lubricating mechanical pump seal.

Every detail and feature of the HP100 series pumps has been carefully designed and built for years of operation.

AVAILABLE OPTIONS
Suction Adapters
Discharge Adapters
Lightmast & Socket
Hourmeter
TRV-120-P Thermal Relief Valve for portable pumps
Protective pump coating for seawater applications

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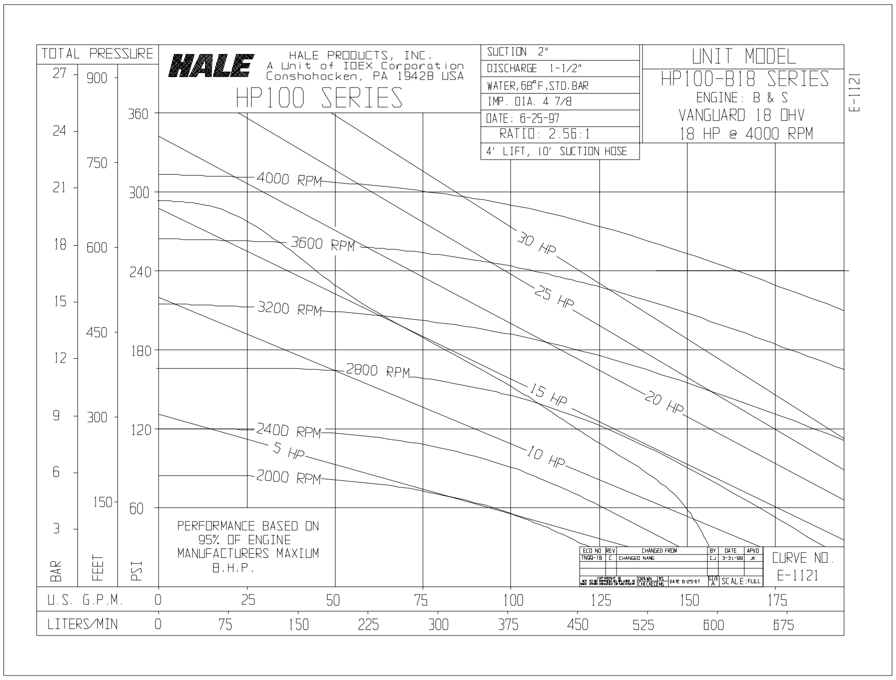
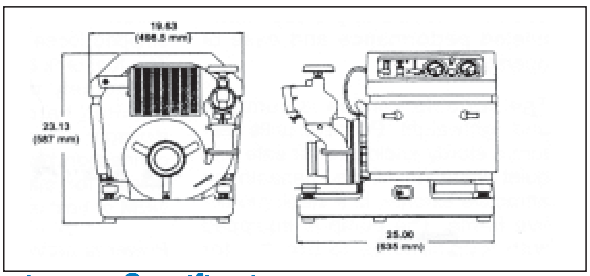
PORTABLE PUMPS

HP100-B18

Premium Portable Pump





Equipment Specifications

PUMP

Type: Portable attack

Frame: Integral welded steel tubing

Suction Connection: 2 inch NPTF

Discharge Connection: Aluminum, 2-1/2 inch male NST screw type valve. Swivels 175 degrees for ease of hose layout and discharge control.

NOTE: Suction and discharge connection thread sizes for standard unit. Consult Hale Sales Representative for a full range of factory installed adapters, including Instantaneous and Storz, to meet individual user needs.

Body and Volute: Aluminum

Impeller: 4-7/8 inches (123.83 mm) Silicon Bronze

Pump Shaft: Stainless steel

Bearing: Ball

Priming: Exhaust Venturi; 20 inches (508 mm) HG

Maximum Flow: 150 GPM (568 LPM) @ 50 PSI (3.2 BAR)

Maximum Pressure: 290 PSI (20 BAR)

Weight: 165 pounds (75 KG)

Length: Handles Extended:
35-1/8 inches (892 mm)
Handles Folded:
25-3/8 inches (645 mm)

Width: Handles Extended:
27-1/2 inches (698.5 mm)
Handles Folded
19-5/8 inches (498.5 mm)

Height: 22-5/8 inches (574.5 mm

Part Number: 545-4050-70-0

INSTRUMENTATION

Throttle level
Priming lever
Master On/Off Switch
Start Push-Button
Choke Control
Low Oil Pressure Warning Light

Suction Gauge: 2-1/2 inches (63.5 mm) Dia. Glycerine filled, 30 inches HG. Vac to 150 PSI (-1 to 10 BAR)

Discharge Gauge: 2-1/2 inches (63.5 mm) Dia. Glycerine filled, 0 to 400 PSI (0 to 28 BAR)

ENGINE (Battery Included)

Make: Briggs and Stratton Vanguard™

Model: 350400 Series

Type: Horizontal shaft, air cooled, V-twin OHV

Horsepower: 18 BHP (13.4. kW) at 4000 RPM

Torque: 30 foot pound (40.7 N-M). Maximum stroke at 2600 RPM

Bore x Stroke: 2.83 x 2-3/4 inches (72 x 77 mm)

Displacement: 34-3/4 cubic inches (570 cc)

Oil Capacity: 3.0 pint (1.4 liter)

Fuel Tank: Cross linked Polyethylene

Fuel Capacity: 3 gallons (12 liters) 2 hours running time

Electrical: 16 AMP alternator

Emissions: Meets 1994 California Air Resources Board Standards

HALE Class 1

HP200-B18

Premium Portable Pump

PORTABLE PUMPS

Features and Benefits

Fully Enclosed Portable – Extremely quiet and safe

Integral Fuel Tank – Rapid deployment with fewer personnel

Rotating Discharge Valve – Quick and easy hose layout

Full Instrumentation – Includes prime from panel design

Superior Performance – High pump efficiency

Briggs & Stratton Vanguard Engine – Quiet and powerful

The HP200 series Premium pump line is the newest, most exciting development in portable pumps in years. Innovative features have been engineered to provide unparalleled performance and ease of operation.

The Premium version is compact and lightweight. Premium units feature a sturdy enclosure for safe and quiet operation. Hidden beneath the attractive exterior is a steel, protective frame. The pump is equipped with four handles to provide for two man portability. When not in use, the handles fold away for convenient storage. The unique fuel tank is an integral part of the pump base. The fuel tank provides 3 gallons (12 liters) of fuel and will permit the pump to run for two hours under normal operating conditions.

Power is provided by the respected Briggs and Stratton Vanguard engine. The Vanguard power comes from a reliable state-of-the-art, air cooled, 18 BHP, V-twin, Overhead Valve (OHV) engine. The overhead valve design delivers more power than conventionally designed side-valve engines. It has an electric start with recoil backup to ensure starting under all conditions. All these exciting features come in a convenient compact design.

PERFORMANCE RATINGS

250 GPM @ 10 psi
190 GPM @ 75 psi
150 GPM @ 100 psi
60 GPM @ 150 psi

The HP200 series pump end features a 3-inch NPT female/4-inch Victaulic suction connection. The discharge is equipped with a 2-1/2 inch NST male Swivel valve.

The HP Series Premium pump also features Hale's exclusive band clamp design for quick and easy access for maintenance and repair. A bronze impeller and replaceable bronze wear rings are housed in a high strength, lightweight aluminum alloy pump housing. The unit also features a self-adjusting, self-lubrication mechanical pump seal.

Every detail and feature of the HP series has been carefully designed and built for years of operation.

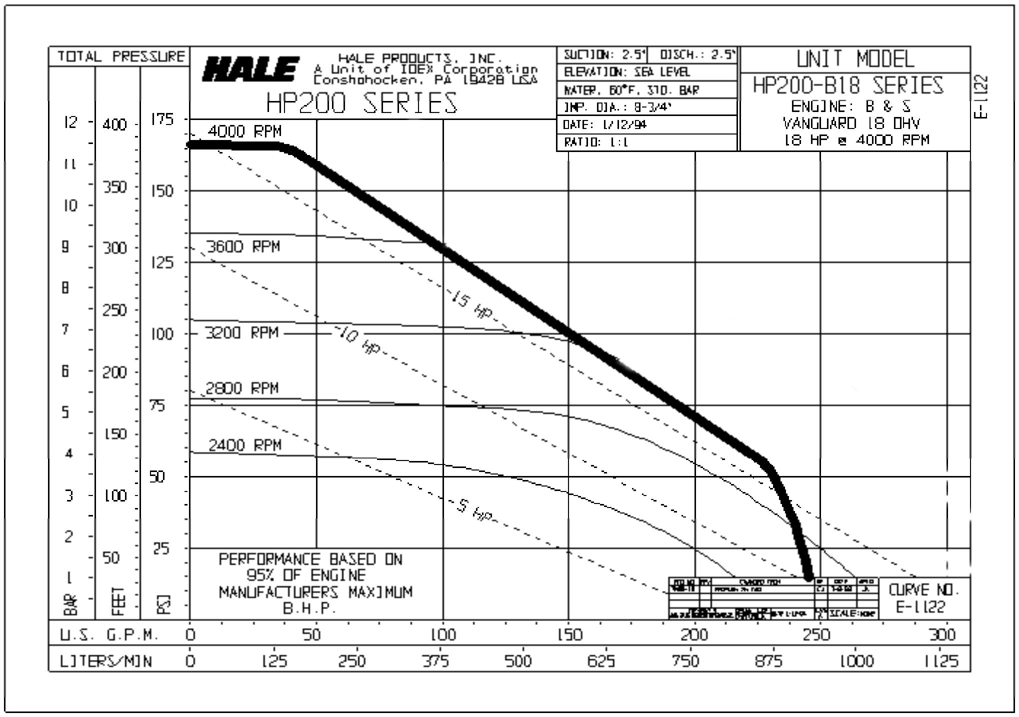
AVAILABLE OPTIONS

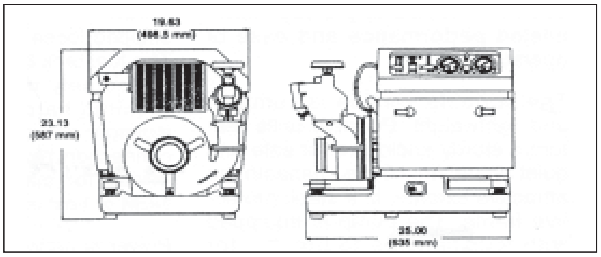
Suction Adapters
Discharge Adapters
Lightmast & Socket
Hourmeter
Trickle Charger
TRV120-P Thermal Relief Valve for portable pumps
Protective pump coating for seawater applications
Exhaust elbow

PORTABLE PUMPS

HP200-B18

Premium Portable Pump





EQUIPMENT SPECIFICATIONS

PUMP

Type: Portable combination.
Frame: Integral welded steel tubing.
Suction Connection: 3 inch NPT female, 4 inch Victaulic.
Discharge Connection: Aluminum, 2-1/2 inch NST male. Swivels 175 degrees for ease of hose layout.
NOTE: Suction and discharge connection thread sizes for standard unit. Consult Hale Sales Representative for a full range of factory installed adapters to meet individual user needs.
Body and Volute: Aluminum.
Impeller: 8-3/4 inches (222.25 mm) Silicon Bronze.
Pump Shaft: Engine shaft with bronze sleeve.
Priming: Exhaust Venturi; 20 inches (508 mm) HG.
Maximum Flow: 225 GPM (852 LPM) @ 50 PSI (3.5 BAR).
Maximum Pressure: 165 PSI (11 BAR).
Weight: 175 pounds (79 KG).
Length: Handles Extended:
35-1/8 inches (892 mm).
Handles Folded:
25-3/8 inches (645 mm).
Width: Handles Extended:
27-1/2 inches (698.5 mm).
Handles Folded:
19-5/8 inches (498.5 mm).
Height: 22-5/8 inches (574.5 mm).

INSTRUMENTATION

Throttle level.
Priming lever.
Master On/Off Switch.
Start Push-Button.
Choke Control.
Low Oil Pressure Warning Light.
Suction Gauge: 2-1/2 inches (63.5 mm) Dia. Glycerine filled, 30 inches HG. Vac to 150 PSI (-1 to 10 BAR).
Discharge Gauge: 2-1/2 inches (63.5 mm) Diameter Glycerine filled, 0 to 400 PSI (0 to 28 BAR).

ENGINE (Battery Included)

Make: Briggs and Stratton Vanguard™..
Model: 350400 Series.
Type: Horizontal shaft, air cooled, V-twin OHV.
Horsepower: 18 BHP (13.4. kW) at 4000 RPM.
Torque: 30 foot pound (40.7 N-M). Maximum stroke at 2600 RPM.
Bore x Stroke: 2.83 x 2-3/4 inches (72 x 77 mm).
Displacement: 34-3/4 cubic inches (570 cc).
Oil Capacity: 3.0 pint (1.4 liter).
Fuel Tank: Cross linked Polyethylene.
Fuel Capacity: 3 gallons (12 liters) 2 hours running time.
Electrical: 16 AMP alternator.
Emissions: Meets 1994 California Air Resources Board Standards.

Note: Hale Products Inc. cannot assume responsibility for product failure resulting from improper maintenance or operation. Hale is responsible only to the limits stated in the product warranty. Product specifications contained in this material are subject to change without notice.

HP300-B18

Premium Portable Pump

PORTABLE PUMPS

Features and Benefits

Fully Enclosed Portable — Extremely quiet and safe.

Integral Fuel Tank — Rapid deployment with fewer personnel.

Rotating Discharge Valve — Quick and easy hose layout.

Full Instrumentation — Includes prime from panel design.

Superior Performance—High pump efficiency.

Briggs & Stratton Vanguard Engine—Quiet and powerful.

PERFORMANCE RATINGS
390 GPM @ 25 PSI
310 GPM @ 50 PSI
250 GPM @ 75 PSI
150 GPM @ 100 PSI

The HP300 series Premium pump line is the newest, most exciting development in portable pumps in years. Innovative features have been engineered to provide unparalleled performance and ease of operation.

The Premium version is compact and lightweight. Premium units feature a sturdy enclosure for safe and quiet operation. Hidden beneath the attractive exterior is a steel, protective frame. The pump is equipped with four handles to provide for two man portability. When not in use, the handles fold away for convenient storage. The unique fuel tank is an integral part of the pump base. The fuel tank provides 3 gallons (12 liters) of fuel and will permit the pump to run for two hours under normal operating conditions.

Power is provided by the respected Briggs and Stratton Vanguard engine. The Vanguard power comes from a reliable state-of-the-art, air cooled, 18 BHP, V-twin, Overhead Valve (OHV) engine. The overhead valve design delivers more power than conventionally designed side-valve engines. It has an electric start with recoil backup to ensure starting under all conditions. All these exciting features come in a convenient compact design.

The HP Series Premium pump also features Hale's exclusive band clamp design for quick and easy access for maintenance and repair. A bronze impeller and replaceable bronze wear rings are housed in a high strength, lightweight aluminum alloy pump housing. The unit also features a self-adjusting, self-lubrication mechanical pump seal.

Every detail and feature of the Premium series has been carefully designed and built for years of operation.

AVAILABLE OPTIONS

Suction Adapters.
Discharge Adapters.
Lightmast and Socket
Hourmeter.
Trickle Charger.
Protective pump coating for seawater applications.
TRV-120P

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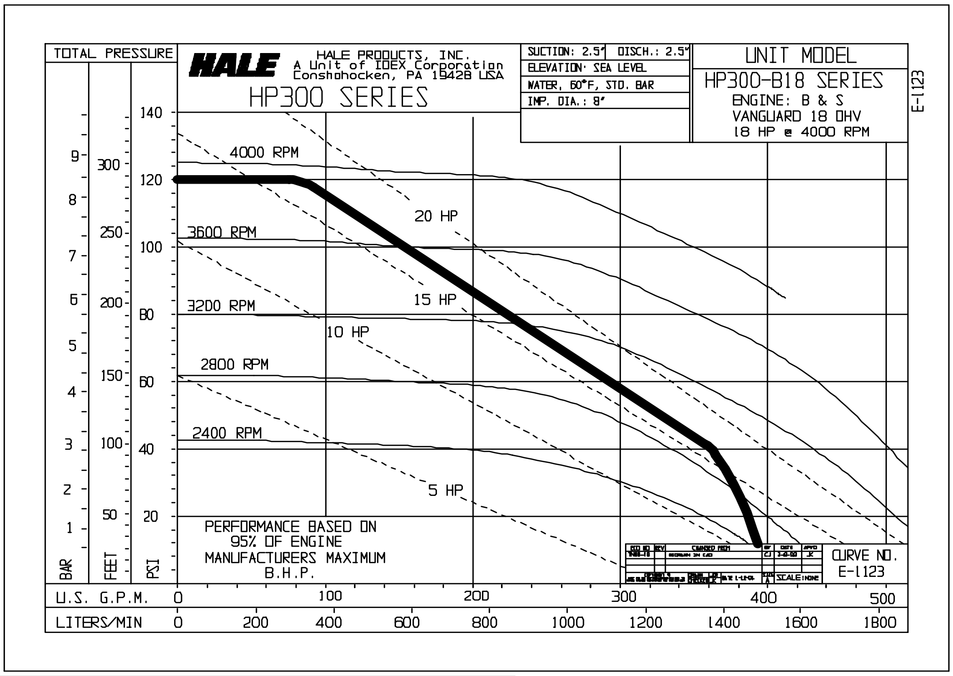
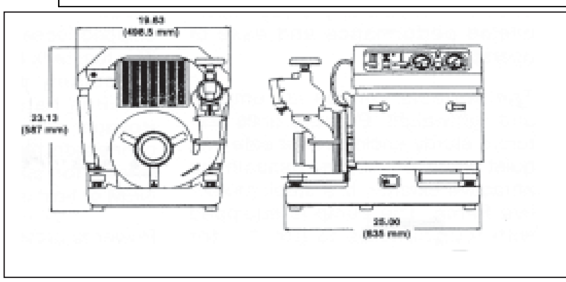
HALE

PORTABLE PUMPS

HP300-B18

Premium Portable Pump





Width: Handles Extended:
27-1/2 inches (698.5 mm)
Handles Folded:
19-5/8 inches (498.5 mm)
Height: 22-5/8 inches (574.5 mm)

EQUIPMENT SPECIFICATIONS

PUMP

Type: Portable supply
Frame: Integral welded steel tubing
Suction Connection: 3 inch NPT female, 4 inch Victaulic
Discharge Connection: Aluminum, 2-1/2 inch male NST screw gate valve. Swivels 175 degrees for ease of hose layout.
NOTE: Suction and discharge connection thread sizes for standard unit. Consult Hale Sales Representative for a full range of factory installed adapters to meet individual user needs.
Body and Volute: Aluminum
Impeller: 8 inches (203.2 mm) Silicon Bronze
Pump Shaft: Engine shaft with bronze sleeve
Priming: Exhaust Venturi; 20 in. (508 mm) HG
Maximum Flow: 400 GPM (1514 LPM) @ 20 PSI (1.5 BAR)
Maximum Pressure: 120 PSI (8 BAR)
Weight: 175 pounds (79 KG)
Length: Handles Extended:
35-1/8 inches (892 mm)
Handles Folded:
25-3/8 inches (645 mm)

INSTRUMENTATION

Throttle level.
Priming lever
Master On/Off Switch
Start Push-Button
Choke Control
Low Oil Pressure Warning Light
Suction Gauge: 2-1/2 inches (63.5 mm) Dia. Glycerine filled, 30 inches HG. Vac to 150 PSI (-1 to 10 BAR)
Discharge Gauge: 2-1/2 inches (63.5 mm) Dia. Glycerine filled, 0 to 400 PSI (0 to 28 BAR)

ENGINE (Battery Included)

Make: Briggs and Stratton Vanguard™
Model: 350400 Series
Type: Horizontal shaft, air cooled, V-twin OHV
Horsepower: 18 BHP (13.4. kW) at 4000 RPM
Torque: 30 foot pound (40.7 N-M). Maximum stroke at 2600 RPM
Bore x Stroke: 2.83 x 2-3/4 inches (72 x 77 mm)
Displacement: 34-3/4 cubic inches (570 cc)
Oil Capacity: 3.0 pint (1.4 liter)
Fuel Tank: Cross linked Polyethylene
Fuel Capacity: 3 gallons (12 liters) 2 hours running time
Electrical: 16 AMP alternator
Emissions: Meets 1994 California Air Resources Board Standards

HP400-B18

Premium Portable Pump

PORTABLE PUMPS

FEATURES AND BENEFITS

Fully Enclosed Portable — Extremely quiet and safe

Integral Fuel Tank — Rapid deployment with fewer personnel

Rotating Discharge Valves — Quick and easy hose layout

Full Instrumentation — Includes prime from panel design

Superior Performance—High pump efficiency

Briggs & Stratton Vanguard Engine—Quiet and powerful

PERFORMANCE RATINGS
390 GPM @ 25 PSI
310 GPM @ 50 PSI
250 GPM @ 75 PSI
150 GPM @ 100 PSI

The HP400 series Premium pump line is the newest, most exciting development in portable pumps in years. Innovative features have been engineered to provide unparalleled performance and ease of operation.

The Premium version is compact and lightweight. Premium units feature a sturdy enclosure for safe and quiet operation. Hidden beneath the attractive exterior is a steel, protective frame. The pump is equipped with four handles to provide for two man portability. When not in use, the handles fold away for convenient storage. The unique fuel tank is an integral part of the pump base. The fuel tank provides 3 gallons (12 liters) of fuel and will permit the pump to run for two hours under normal operating conditions. The HP400 Premium features dual 2-1/2 inch gated discharges and 3-inch female NPT conections for maximum performance.

Power is provided by the respected Briggs and Stratton Vanguard engine. The Vanguard power comes from a reliable state-of-the-art, air cooled, 18 BHP, V-twin, Overhead Valve (OHV) engine. The overhead valve design delivers more power than conventionally designed side-valve engines. It has an electric start with recoil backup to ensure starting under all conditions. All these exciting features come in a convenient compact design.

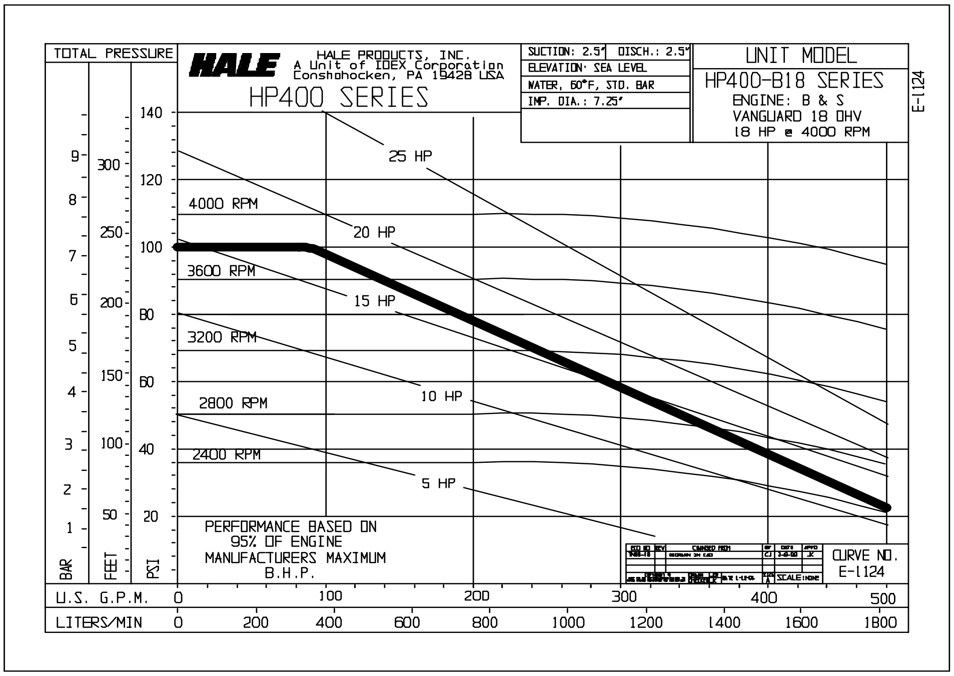
The HP Series Premium pump also features Hale's exclusive band clamp design for quick and easy access for maintenance and repair. A bronze impeller and replaceable bronze wear rings are housed in a high strength, lightweight aluminum alloy pump housing. The unit also features a self-adjusting, self-lubrication mechanical pump seal.

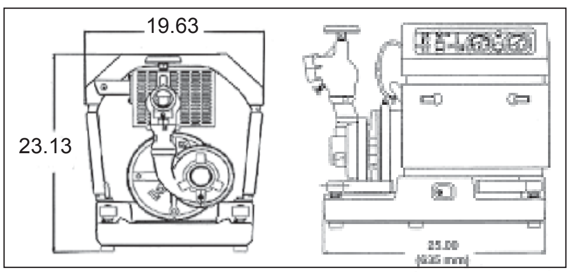
Every detail and feature of the HP series has been carefully designed and built for years of operation.

AVAILABLE OPTIONS
Suction Adapters
Discharge Adapters
Lightmast and socket
Hourmeter
Trickle Charger
Protective pump coating for seawater applications
TRV-120P

HP400-B18

Premium Portable Pump





EQUIPMENT SPECIFICATIONS

PUMP

Type: Portable transfer
***Frame*:** Integral welded steel tubing
***Suction Connection*:** 3 inch NPT female, 4 inch Victaulic
***Discharge Connection*:** Standard dual aluminum, 2-1/2 inch male NST. Swivels 175 degrees for ease of hose layout
***NOTE*:** Suction and discharge connection thread sizes for standard unit. Consult Hale Sales Representative for a full range of factory installed adapters to meet individual user needs
***Body and Volute*:** Aluminum
Impeller: 7-1/4 inches (184.15 mm) Silicon Bronze
***Pump Shaft*:** Engine shaft with bronze sleeve
***Priming*:** Exhaust Venturi; 20 inches (508 mm) HG
***Maximum Flow*:** 500 GPM (1893 LPM) @ 20 PSI (1.4 BAR)
***Maximum Pressure*:** 90 PSI (6 BAR)
Weight: 185 pounds (84 KG)
Length: Handles Extended:
35-1/8 inches (892 mm)
Handles Folded:
25-3/8 inches (645 mm)
***Width*:** Handles Extended:
27-1/2 inches (698.5 mm)
Handles Folded:
19-5/8 inches (498.5 mm)
Height: 22-5/8 inches (574.5 mm)

INSTRUMENTATION

Throttle level
Priming lever
Master Switch
Start Push-Button
Choke Control
Low Oil Pressure Warning Light
***Suction Gauge*:** 2-1/2 inches (63.5 mm) Dia. Glycerine filled, 30 inches HG. Vac to 150 PSI (-1 to 10 BAR)
***Discharge Gauge*:** 2-1/2 inches (63.5 mm) Dia. Glycerine filled, 0 to 400 PSI (0 to 28 BAR)

ENGINE (Battery Included)

Make: Briggs and Stratton Vanguard™
Model: 350400 Series
Type: Horizontal shaft, air cooled, V-twin OHV
Horsepower: 18 BHP (13.4. kW) at 4000 RPM
Torque: 30 foot pound (40.7 N-M). Maximum stroke at 2600 RPM
***Bore x Stroke*:** 2.83 x 2-3/4 inches (72 x 77 mm)
Displacement: 34-3/4 cubic inches (570 cc)
Oil Capacity: 3.0 pint (1.4 liter)
Fuel Tank: Cross linked Polyethylene
Fuel Capacity: 3 gallons (12 liters) 2 hours running time
Electrical: 16 AMP alternator
Emissions: Meets 1994 California Air Resources Board Standards.

Note: Hale Products Inc. cannot assume responsibility for product failure resulting from improper maintenance or operation. Hale is responsible only to the limits stated in the product warranty. Product specifications contained in this material are subject to change without notice.

HPT75-B18

Trans-Portable Pumps

Features and Benefits

Configured for full portable applications

Built-in exhaust priming system. Fast acting and non-freezing

Rotating Discharge Valve — Quick and easy hose layout.

High pump efficiency. Close tolerance machining of impeller and wear rings assures highest efficiency

Easy pump maintenance. Pump body and head are coupled together with a stainless steel band clamp which allows quick pump removal for servicing

Briggs & Stratton Vanguard Engine—Quiet and powerful.

PERFORMANCE RATINGS	
135 GPM @ 50 PSI	50 GPM @ 150 PSI
110 GPM @ 150 PSI	25 GPM @ 300 PSI

The HPT75-B18 series Trans-Portable pump line is the newest, most exciting development in portable pumps in years. Innovative features have been engineered to provide unparalleled performance and ease of operation. Computer-aided pump design precisely matches the HP series pump ends to the Briggs and Stratton Vanguard series engine. This allows for maximum pump performance at designed flow ranges.

The Trans-Portable version is compact and lightweight. The pumping unit is mounted on a steel skid base. The pump is equipped with four handles to provide for two man portability. The remote fuel tank provides 3 gallons (12 liters) of fuel and will permit the pump to run for two hours under normal operating conditions.

Power is provided by the respected Briggs and Stratton Vanguard engine.

The Vanguard power comes from a reliable state-of-the-art, air cooled, 18 BHP, V-twin, Overhead Valve (OHV) engine. The overhead valve design delivers more power than conventionally designed side-valve engines. It has an electric start with recoil backup to ensure starting under all conditions. All these exciting features come in a convenient compact design.

Every detail and feature of the HP Trans-Portable series has been carefully designed and built for years of operation.

EQUIPMENT SPECIFICATIONS

PUMP

Type: Attack pump

***Frame*:** Steel tubing with handles

***Suction Connection*:** 2 inch NPT female

***Discharge Connection*:** 1-1/2 inch NST Male screw type valve. Swivels 175 degrees for ease of hose layout.

***NOTE*:** Suction and discharge connection thread sizes for standard unit. Consult Hale Sales Representative for a full range of factory installed adapters to meet individual user needs.

***Body and Volute*:** Aluminum with baked powder coat finish.

Impeller: 4-7/8 inches (123.83 mm) Silicon Bronze.

***Pump Shaft*:** Engine Shaft with Bronze Sleeve

Bearing: Ball Type

***Priming*:** Exhaust Venturi; 20 inches (508 mm) HG.

***Maximum Flow*:** 135 GPM (510 LPM) @ 50 PSI (3.2 BAR).

***Maximum Pressure*:** 340 PSI (23.5 BAR).

Weight: 159 pounds (72 KG).

Length: 27-5/8 inches (702 mm)

***Width*:** 19-1/4 inches (489 mm)

Height: 20-1/4 inches (514 mm).

INSTRUMENTATION

Throttle level
Priming control
Master On/Off Switch
Start Push-Button
Choke Control
Low Oil Pressure Warning Light

***Discharge Gauge*:** 2-1/2 inches (63.5 mm) Dia. Glycerine filled, 0 to 400 PSI (0 to 28 BAR).

AVAILABLE OPTIONS

- Suction Adapters
- Discharge Adapters
- TRV-120-P Thermal Relief Valve for portable pumps.
- Protective pump coating for seawater applications.

ENGINE (Battery Included)

Make: Briggs and Stratton Vanguard™.

Model: 350400 Series.

Type: Horizontal shaft, air cooled, V-twin OHV.

Horsepower: 18 BHP (13.4. kW) at 4000 RPM.

Torque: 30 foot pound (40.7 N-M). Maximum stroke at 2600 RPM.

***Bore x Stroke*:** 2.83 x 2-3/4 inches (72 x 77 mm).

Displacement: 34-3/4 cubic inches (570 cc).

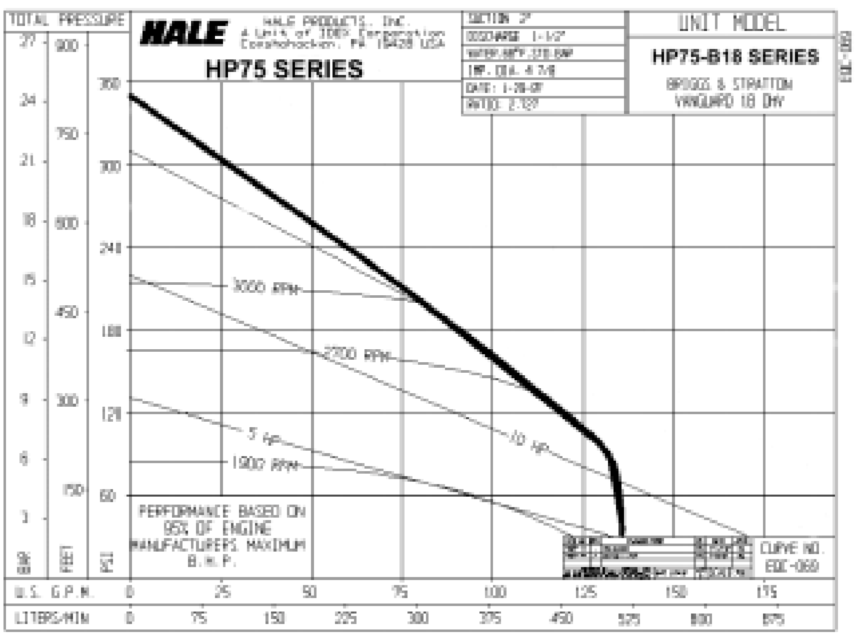
Oil Capacity: 3.0 pint (1.4 liter).

Fuel Tank: Steel

Fuel Capacity: 3 gallons (12 liters) 2 hours running time.

Electrical: 16 AMP alternator.

Emissions: Meets 1994 California Air Resources Board Standards.



HALE
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HALE PRODUCTS INC. ISO 9001

HPT100-B18

Trans-Portable Pump

Features and Benefits

Configured for full portable applications

Built-in exhaust priming system — fast acting and non-freezing

High pump efficiency. Close tolerance machining of impeller and wear rings assures highest efficiency

Easy pump maintenance. Pump body and head are coupled together with a stainless steel band clamp which allows quick pump removal for servicing

Rotating Discharge Valve — Quick and easy hose layout

Briggs & Stratton Vanguard Engine—Quiet and powerful

The HPT100-B18 series Trans-Portable pump line is the newest, most exciting development in portable pumps in years. Innovative features have been engineered to provide unparalleled performance and ease of operation. Computer aided pump design precisely matches the HP series pump ends to the Briggs and Stratton® Vanguard series engine. This allows for maximum pump performance at designed flow ranges.

The Trans-Portable version is compact and lightweight. The pumping unit is mounted on a steel skid base. The pump is equipped with four handles to provide for two man portability. The remote fuel tank provides 3 gallons (12 liters) of fuel and will permit the pump to run for two hours under normal operating conditions.

PERFORMANCE RATINGS
155 GPM @ 50 PSI
100 GPM @ 150 PSI
65 GPM @ 200 PSI
15 GPM @ 275 PSI

Power is provided by the respected Briggs and Stratton Vanguard engine. The Vanguard power comes from a reliable state-of-the-art, air cooled, 18 BHP, V-twin, Overhead Valve (OHV) engine. The overhead valve design delivers more power than conventionally designed side-valve engines. It has an electric start with recoil backup to ensure starting under all conditions. All these exciting features come in a convenient compact design.

Every detail and feature of the HP Trans-Portable series has been carefully designed and built for years of operation.

PORTABLE PUMPS

HALE
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HALE

HPT100-B18

Trans-Portable Pump

PORTABLE PUMPS

EQUIPMENT SPECIFICATIONS

PUMP

Type: Attack pump
Frame: Steel tubing with handles
Suction Connection: 2-inch NPT Female
Discharge Connection: 1-1/2 inch NST Male. Swivels 175 degrees for ease of hose layout
NOTE: Suction and discharge connection thread sizes for standard unit. Consult Hale Sales Representative for a full range of factory installed adapters to meet individual user needs
Body and Volute: Aluminum with baked powder finish
Impeller: 4-3/4 inches (123.83 mm) Silicon Bronze
Pump Shaft: Engine Shaft with Bronze Sleeve
Bearing: Ball Type
Priming: Exhaust Venturi; 20 inches (508 mm) HG
Maximum Flow: 150 GPM (568 LPM) @ 50 PSI (3.5 BAR)
Maximum Pressure: 290 PSI (20 BAR)
Weight: 159 pounds (72 KG)
Length: 27-5/8 inches (702 mm)
Width: 19-1/4 inches (489 mm)
Height: 20-1/4 inches (514 mm)

INSTRUMENTATION

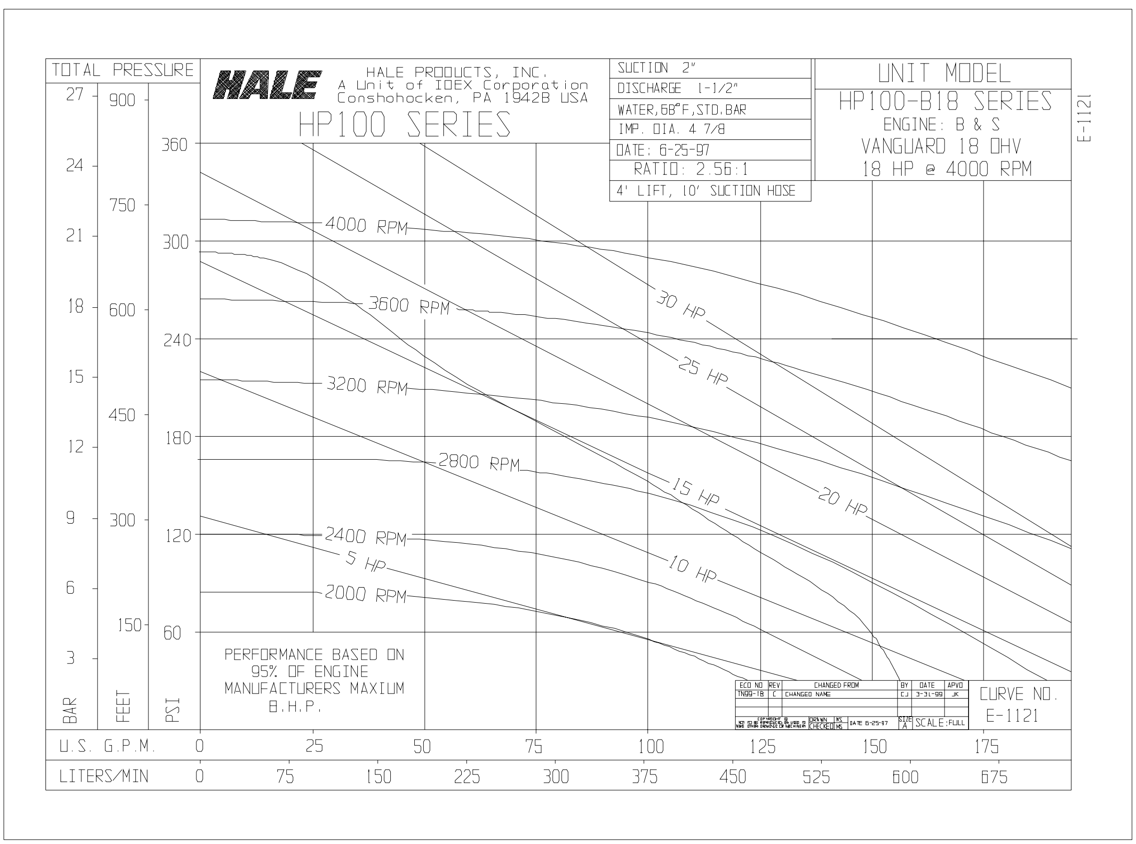
Throttle level
Priming control
Master On/Off Switch
Start Push-Button
Choke Control
Low Oil Pressure Warning Light
Discharge Gauge: 2-1/2 inches (63.5 mm) Dia. Glycerine filled, 0 to 400 PSI (0 to 28 BAR)

AVAILABLE OPTIONS

- Suction Adapters
- Discharge Adapters
- TRV-120-P Thermal Relief Valve for portable pumps
- Protective pump coating for seawater applications

ENGINE (Battery Included)

Make: Briggs and Stratton Vanguard™
Model: 350400 Series
Type: Horizontal shaft, air cooled, V-twin OHV
Horsepower: 18 BHP (13.4. kW) at 4000 RPM
Torque: 30 foot pound (40.7 N-M). Maximum stroke at 2600 RPM
Bore x Stroke: 2.83 x 2-3/4 inches (72 x 77 mm)
Displacement: 34-3/4 cubic inches (570 cc)
Oil Capacity: 3.0 pint (1.4 liter)
Fuel Tank: Steel
Fuel Capacity: 3 gallons (12 liters) 2 hours running time
Electrical: 16 AMP alternator
Emissions: Meets 1994 California Air Resources Board Standards



HPT200-B18

Trans-Portable Pump

PORTABLE PUMPS

Features and Benefits

Configured for full portable applications

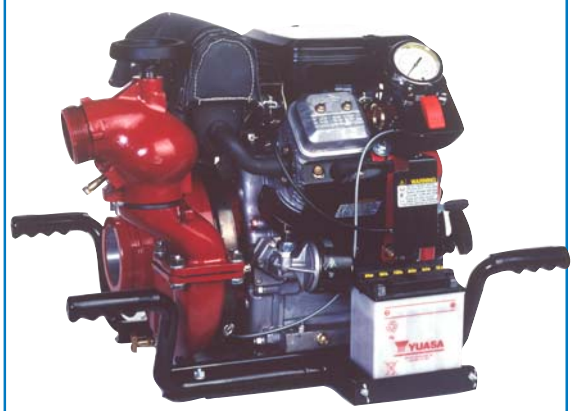
Built-in exhaust priming system. Fast acting and non-freezing

Rotating Discharge Valve — Quick and easy hose layout

High pump efficiency. Close tolerance machining of impeller and wear rings assures highest efficiency

Easy pump maintenance. Pump body and head are coupled together with a stainless steel band clamp which allows quick pump removal for servicing

Briggs & Stratton Vanguard Engine—Quiet and powerful



PERFORMANCE RATINGS
245 GPM @ 25 PSI
190 GPM @ 75 PSI
110 GPM @ 125 PSI
60 GPM @ 150 PSI

The HPT200-B18 series Trans-Portable pump line is the newest, most exciting development in portable pumps in years. Innovative features have been engineered to provide unparalleled performance and ease of operation. Computer-aided pump design precisely matches the HP series pump ends to the Briggs and Stratton Vanguard series engine. This allows for maximum pump performance at designed flow ranges.

The Trans-Portable version is compact and lightweight. The pumping unit is mounted on a steel skid base. The pump is equipped with four handles to provide for two man portability. The remote fuel tank provides 3 gallons (12 liters) of fuel and will permit the pump to run for two hours under normal operating conditions.

Power is provided by the respected Briggs and Stratton Vanguard engine. The Vanguard power comes from a reliable state-of-the-art, air cooled, 18 BHP, V-twin, Overhead Valve (OHV) engine. The overhead valve design delivers more power than conventionally designed side-valve engines. It has an electric start with recoil backup to ensure starting under all conditions. All these exciting features come in a convenient compact design.

Every detail and feature of the HP Trans-Portable series has been carefully designed and built for years of operation.

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PORTABLE PUMPS

HPT200-B18

Trans-Portable Pump

EQUIPMENT SPECIFICATIONS

PUMP

Type: Combination
Frame**:** Steel tubing with handles
Suction Connection**:** 3 inch NPT Female, 4 inch Victaulic
Discharge Connection**:** 2-1/2 inch NST Female Swivels 175 degrees for ease of hose layout
NOTE**:** Suction and discharge connection thread sizes for standard unit. Consult Hale Sales Representative for a full range of factory installed adapters to meet individual user needs
Body and Volute**:** Aluminum with baked powder finish
Impeller: 8-3/4 inches (222.25 mm) Silicon Bronze
Bearing: Ball Type
Priming**:** Exhaust Venturi; 20 inches (508 mm) HG.
Maximum Flow**:** 225 GPM (852 LPM) @ 50 PSI (3.5 BAR).
Maximum Pressure**:** 165 PSI (11 BAR).
Weight: 150 pounds (68 KG).
Length: 27-5/8 inches (702 mm)
Width**:** 19-1/4 inches (489 mm)
Height: 20-/14 inches (514 mm).

INSTRUMENTATION

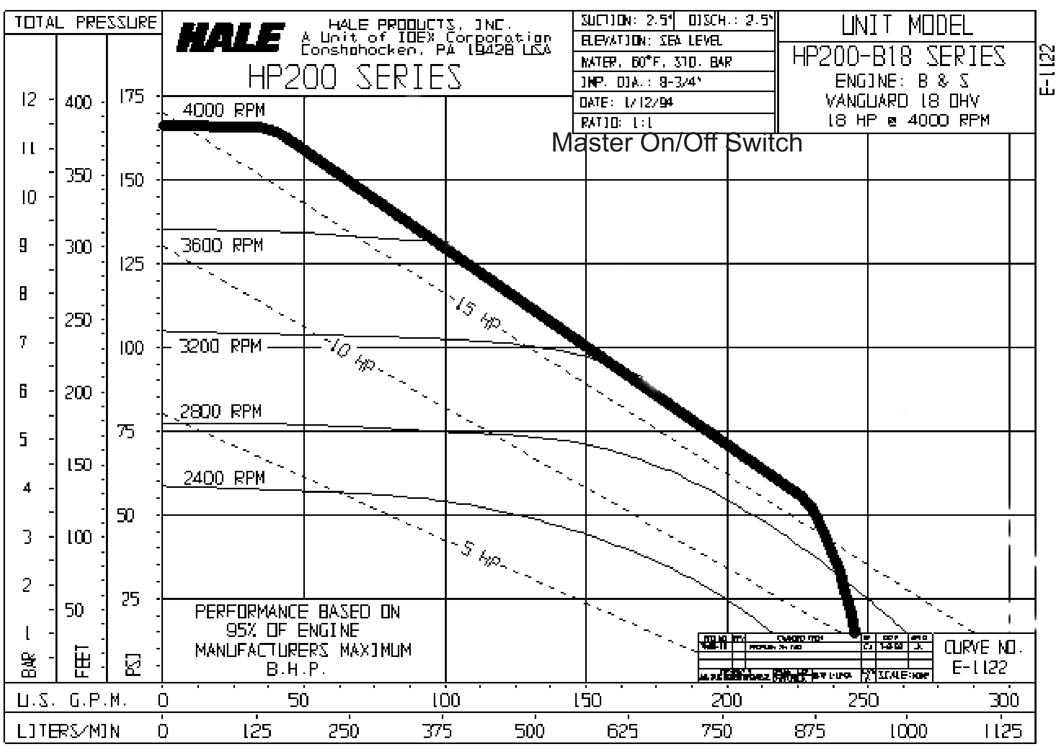
Throttle level
Priming control

AVAILABLE OPTIONS

- Suction Adapters
- Discharge Adapters
- TRV-120-P Thermal Relief Valve for portable pumps
- Protective pump coating for seawater applications

ENGINE (Battery Included)

Make: Briggs and Stratton Vanguard™
Model: 350400 Series
Type: Horizontal shaft, air cooled, V-twin OHV
Horsepower: 18 BHP (13.4. kW) at 4000 RPM
Torque: 30 foot pound (40.7 N-M). Maximum stroke at 2600 RPM
Bore x Stroke**:** 2.83 x 2-3/4 inches (72 x 77 mm)
Displacement: 34-3/4 cubic inches (570 cc)
Oil Capacity: 3.0 pint (1.4 liter)
Fuel Tank: Steel
Fuel Capacity: 3 gallons (12 liters) 2 hours running time
Electrical: 16 AMP alternator
Emissions: Meets 1994 California Air Resources Board Standards



HPT300-B18

Trans-Portable Pump

PORTABLE PUMPS

Features and Benefits

Configured for full portable applications

Built-in exhaust priming system. Fast acting and non-freezing

Rotating Discharge Valve — Quick and easy hose layout.

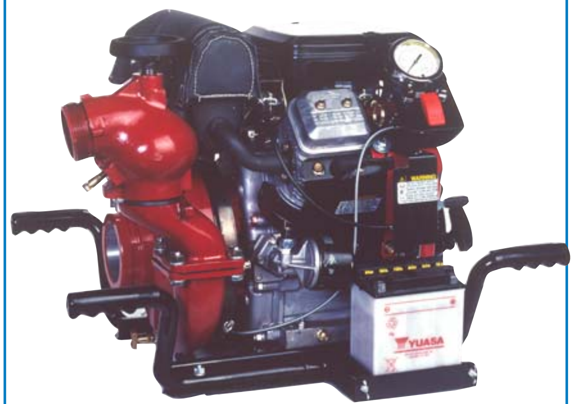
High pump efficiency. Close tolerance machining of impeller and wear rings assures highest efficiency

Easy pump maintenance. Pump body and head are coupled together with a stainless steel band clamp which allows quick pump removal for servicing

Briggs & Stratton Vanguard Engine—Quiet and powerful.

The HPT300-B18 series Trans-Portable pump line is the newest, most exciting development in portable pumps in years. Innovative features have been engineered to provide unparalleled performance and ease of operation. Computer-aided pump design precisely matches the HP series pump ends to the Briggs and Stratton Vanguard series engine. This allows for maximum pump performance at designed flow ranges.

The Trans-Portable version is compact and lightweight. The pumping unit is mounted on a steel skid base. The pump is equipped with four handles to provide for two man portability. The remote fuel tank provides 3 gallons (12 liters) of fuel and will permit the pump to run for two hours under normal operating conditions.



PERFORMANCE RATINGS
390 GPM @ 25 PSI
310 GPM @ 50 PSI
250 GPM @ 75 PSI
150 GPM @ 100 PSI

Power is provided by the respected Briggs and Stratton Vanguard engine. The Vanguard power comes from a reliable state-of-the-art, air cooled, 18 BHP, V-twin, Overhead Valve (OHV) engine. The overhead valve design delivers more power than conventionally designed side-valve engines. It has an electric start with recoil backup to ensure starting under all conditions. All these exciting features come in a convenient compact design.

Every detail and feature of the HP Trans-Portable series has been carefully designed and built for years of operation.

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PORTABLE PUMPS

HPT300-B18

Trans-Portable Pump

EQUIPMENT SPECIFICATIONS

PUMP

Type: Supply pump
Frame: Steel tubing with handles
Suction Connection: 3 inch NPT Female, 4 inch Victaulic
Discharge Connection: 2.5 inch NST Male. Swivels 175 degrees for ease of hose layout
NOTE: Suction and discharge connection thread sizes for standard unit. Consult Hale Sales Representative for a full range of factory installed adapters to meet individual user needs
Body and Volute: Aluminum with baked powder coat finish
Impeller: 8 inches (203.20mm) Silicon Bronze
Pump Shaft: Engine Shaft with Bronze Sleeve
Bearing: Ball Type
Priming: Exhaust Venturi; 20 inches (508 mm) HG
Maximum Flow: 400 GPM (1514LPM) @ 50 PSI (3.5 BAR)
Maximum Pressure: 120 PSI (8 BAR)
Weight: 150 pounds (68 KG)
Length: 27-5/8 inches (657mm)
Width: 19-1/4 inches (235 mm)
Height: 20-1/4 inches (514 mm)

INSTRUMENTATION

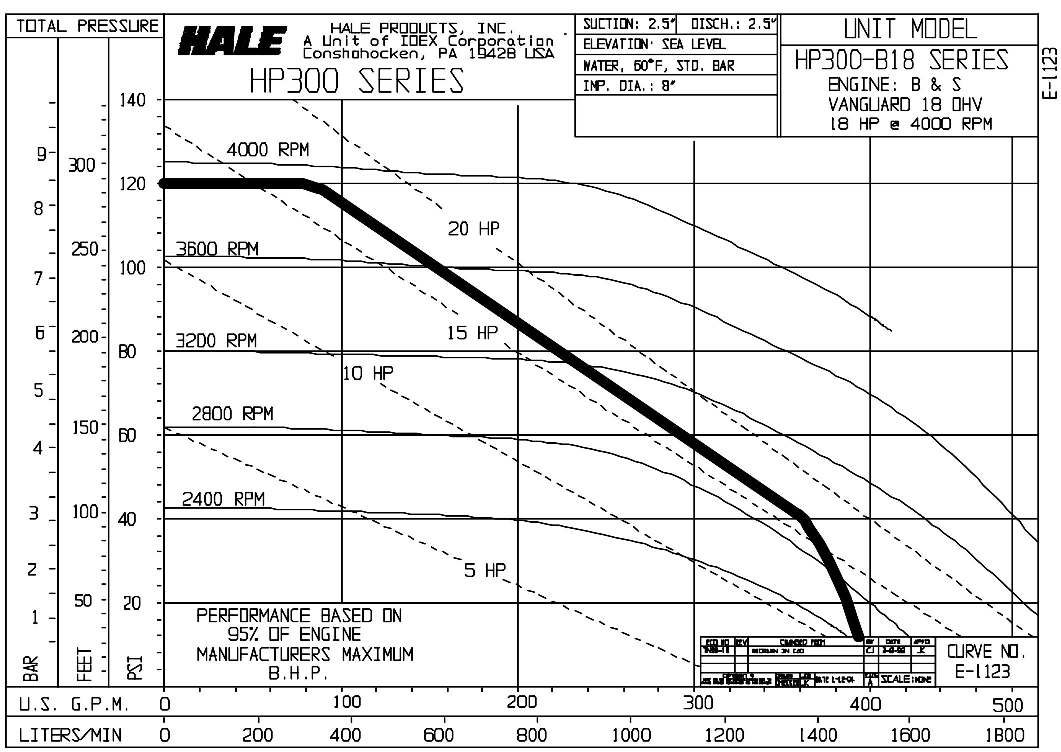
Throttle level
Priming control
Master On/Off Switch
Start Push-Button
Choke Control
Low Oil Pressure Warning Light
Discharge Gauge: 2-1/2 inches (63.5 mm) Dia. Glycerine filled, 0 to 400 PSI (0 to 28 BAR)

AVAILABLE OPTIONS

- Suction Adapters
- Discharge Adapters
- TRV-120-P Thermal Relief Valve for portable pumps
- Protective pump coating for seawater applications

ENGINE (Battery Included)

Make: Briggs and Stratton Vanguard™
Model: 350400 Series
Type: Horizontal shaft, air cooled, V-twin OHV
Horsepower: 18 BHP (13.4. kW) at 4000 RPM
Torque: 30 foot pound (40.7 N-M). Maximum stroke at 2600 RPM.
Bore x Stroke: 2.83 x 2-3/4 inches (72 x 77 mm)
Displacement: 34-3/4 cubic inches (570 cc)
Oil Capacity: 3.0 pint (1.4 liter)
Fuel Tank: Steel
Fuel Capacity: 3 gallons (12 liters) 2 hours running time
Electrical: 16 AMP alternator
Emissions: Meets 1994 California Air Resources Board Standards



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HPT400-B18

Trans-Portable Pump

PORTABLE PUMPS

Features and Benefits

Configured for full portable applications

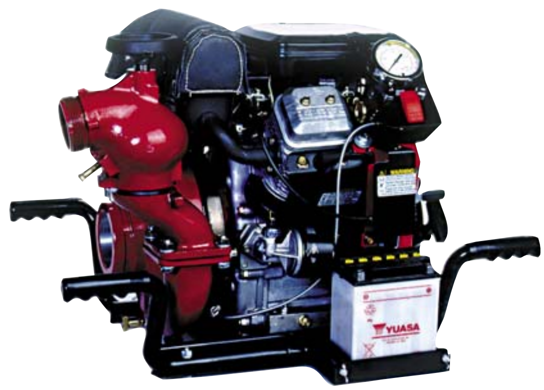
Built-in exhaust priming system. Fast acting and non-freezing

Rotating Discharge Valve — Quick and easy hose layout

High pump efficiency. Close tolerance machining of impeller and wear rings assures highest efficiency

Easy pump maintenance. Pump body and head are coupled together with a stainless steel band clamp which allows quick pump removal for servicing

Briggs & Stratton Vanguard Engine—Quiet and powerful



PERFORMANCE RATINGS
500 GPM @ 25 PSI
320 GPM @ 50 PSI
210 GPM @ 75 PSI
95 GPM @ 100 PSI

The HPT400-B18 series Trans-Portable pump line is the newest, most exciting development in portable pumps in years. Innovative features have been engineered to provide unparalleled performance and ease of operation. Computer-aided pump design precisely matches the HP series pump ends to the Briggs and Stratton Vanguard series engine. This allows for maximum pump performance at designed flow ranges.

The Trans-Portable version is compact and lightweight. The pumping unit is mounted on a steel skid base. The pump is equipped with four handles to provide for two man portability. The remote fuel tank provides 6 gallons (24 liters) of fuel and will permit the pump to run for two hours under normal operating conditions.

Power is provided by the respected Briggs and Stratton Vanguard engine. The Vanguard power comes from a reliable state-of-the-art, air cooled, 18 BHP, V-twin, Overhead Valve (OHV) engine. The overhead valve design delivers more power than conventionally designed side-valve engines. It has an electric start with recoil backup to ensure starting under all conditions. All these exciting features come in a convenient compact design.

Every detail and feature of the HP Trans-Portable series has been carefully designed and built for years of operation.

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HPT400-B18

Trans-Portable Pump

PORTABLE PUMPS

EQUIPMENT SPECIFICATIONS

PUMP

Type: Transfer pump
Frame: Steel tubing with handles
Suction Connection: 3-inch NPT Female, 4-inch Victaulic®
Discharge Connection: (2) 2-1/2 inch NST Male Swivels 175 degrees for ease of hose layout
NOTE: Suction and discharge connection thread sizes for standard unit. Consult Hale Sales Representative for a full range of factory installed adapters to meet individual user needs
Body and Volute: Aluminum with baked powder finish
Impeller: 7-1/4 inches (184.15 mm) Silicon Bronze
Pump Shaft: Engine Shaft with Bronze Sleeve
Bearing: Ball Type
Priming: Exhaust Venturi; 20 inches (508 mm) HG
Maximum Flow: 500 GPM (1893 LPM) @ 20 PSI (1.4 BAR)
Maximum Pressure: 100 PSI (7 BAR)
Weight: 154 pounds (70 KG)
Length: 27-5/8 inches (702 mm)
Width: 19-1/4 inches (489 mm)
Height: 20-1/4 inches (514 mm)

INSTRUMENTATION

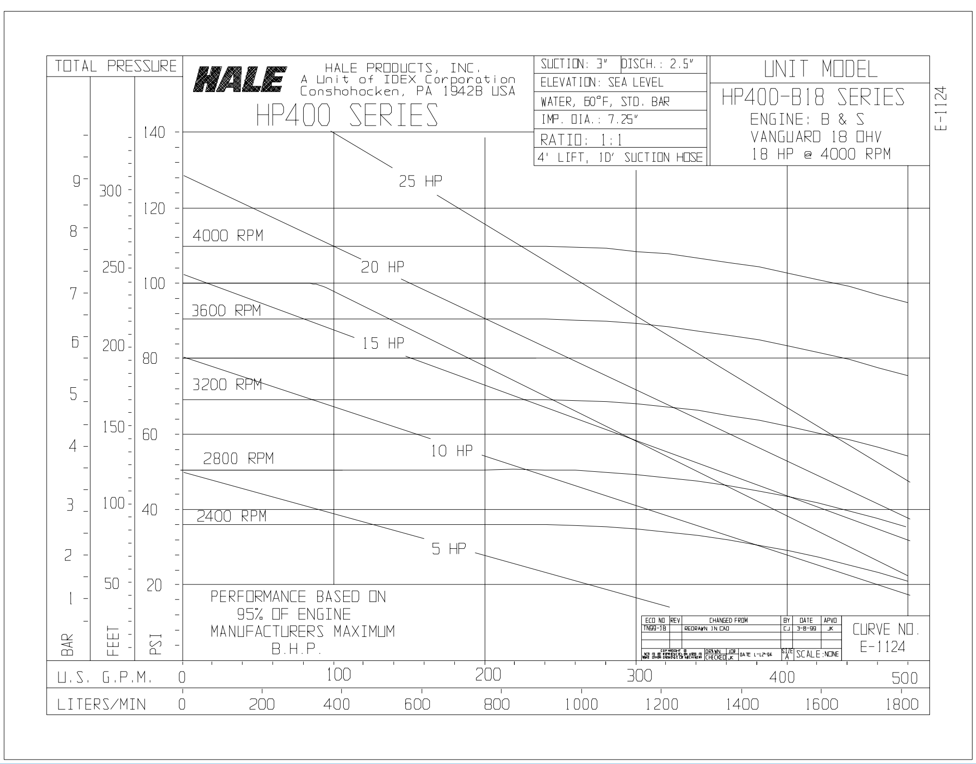
Throttle level
Priming control
Master On/Off Switch
Start Push-Button
Choke Control
Low Oil Pressure Warning Light
Discharge Gauge: 2-1/2 inches (63.5 mm) Dia. Glycerine filled, 0 to 400 PSI (0 to 28 BAR)

AVAILABLE OPTIONS

- Suction Adapters
- Discharge Adapters
- TRV-120-P Thermal Relief Valve for portable pumps
- Protective pump coating for seawater applications

ENGINE (Battery Included)

Make: Briggs and Stratton Vanguard™
Model: 350400 Series
Type: Horizontal shaft, air cooled, V-twin OHV
Horsepower: 18 BHP (13.4. kW) at 4000 RPM
Torque: 30 foot pound (40.7 N-M). Maximum stroke at 2600 RPM
Bore x Stroke: 2.83 x 2-3/4 inches (72 x 77 mm)
Displacement: 34-3/4 cubic inches (570 cc)
Oil Capacity: 3.0 pint (1.4 liter)
Fuel Tank: Steel
Fuel Capacity: 3 gallons (12 liters) 2 hours running time
Electrical: 16 AMP alternator
Emissions: Meets 1994 California Air Resources Board Standards.



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HPX75-B18

MaxStream Portable Pump

PORTABLE PUMPS

Features and Benefits

"X" Version — Configured for installation by truck builders

Exclusive Band Clamp Design – Quick and easy access for maintenance and repairs

Full Instrumentation — Instrument panel shipped loose for remote mounting

Superior Performance—High pump efficiency.

Briggs & Stratton Vanguard Engine—Quiet and powerful.

PERFORMANCE RATINGS
135 GPM @ 50 PSI
110 GPM @ 150 PSI
50 GPM @ 250 PSI
25 GPM @ 300 PSI

The HPX75-B18 MaxStream series pump is the newest, most exciting development in slip on pumps in years. Innovative features have been engineered to provide unparalleled performance and ease of operation.

The MaxStream model configuration is an ideal product for OEM installation. The pumping unit is attached to a steel skid plate base that can be easily mounted into any vehicle. The rail base includes all required hardware and vibration isolators. A remote instrument panel with mounted single discharge gauge and engine controls is included as standard. The suction connection has a two inch female NPT and a inch and a half NPT discharge.

Priming is located at the eye of the impeller for faster priming and increased lifts.

Power is provided by the respected Briggs and Stratton Vanguard engine. The Vanguard power comes from a reliable state-of-the-art, air cooled, 18 BHP, V-twin, Overhead Valve (OHV) engine. The overhead valve design delivers more power than conventionally designed side-valve engines. It has an electric start with recoil backup to ensure starting under all conditions. All these exciting features come in a convenient compact design.

The HP MaxStream series pump also features Hale's exclusive band clamp design for quick and easy access for maintenance and repair. A bronze impeller and replaceable bronze wear rings are housed in a high strength, lightweight aluminum alloy pump housing. The unit features a self-adjusting, self-lubricating mechanical pump seal.

Every detail and feature of the HP MaxStream series has been carefully designed and built for years of operation

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HALE

PORTABLE PUMPS

HPX75-B18

MaxStream Portable Pump

EQUIPMENT SPECIFICATIONS

Type: Attack pump
Suction Connection: 2 inch NPT Female
Discharge Connection: 1-1/2 inch NPT Female
Body and Volute: Aluminum
Impeller: 4-7/8 inches (123.83 mm) silicon bronze
Pump Shaft: Engine shaft with bronze sleeve
Priming: Exhaust Venturi; 20 inches (508 mm) HG
Maximum Flow: 135 GPM (510 LPM) @ 50 PSI (3.5 BAR)
Maximum Pressure: 340PSI (23.5 BAR)
Weight: 157 pounds (71 kg)
Length: 21 inches (533 mm)
Width: 18 inches (457 mm)
Height: 20 inches (508 mm)

INSTRUMENTATION

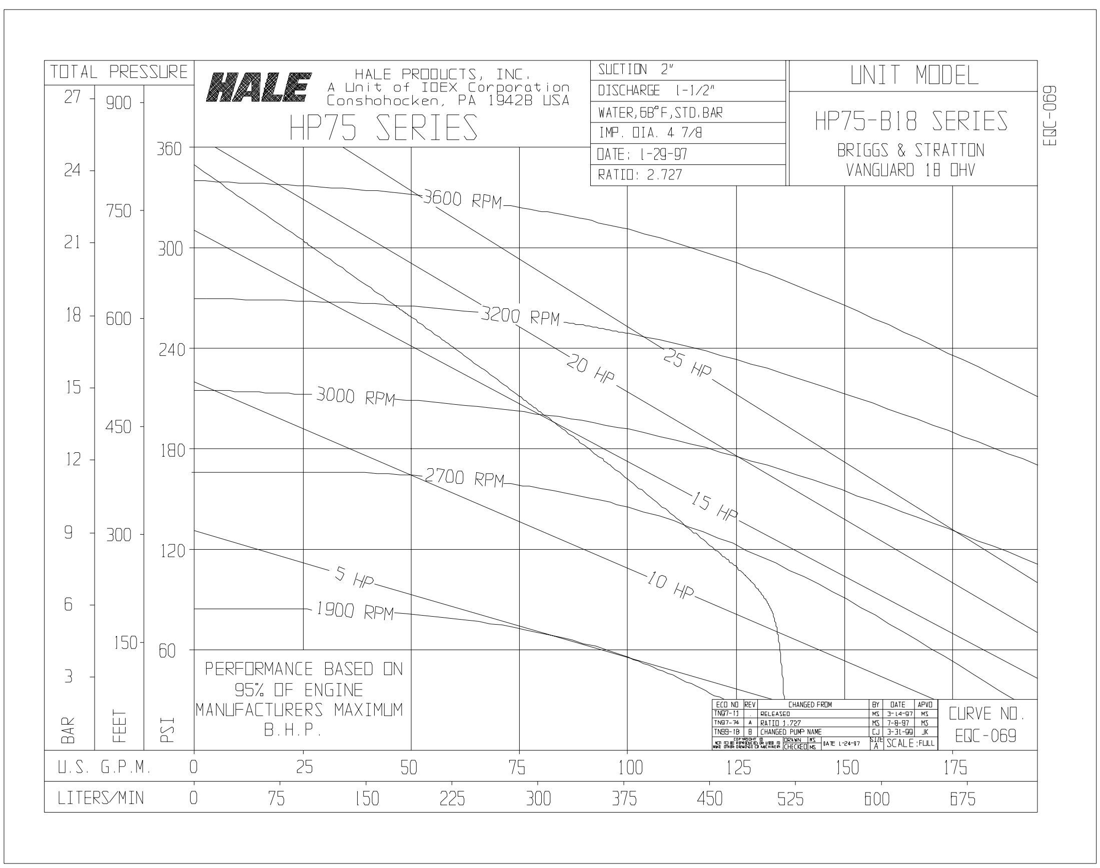
Throttle level
Priming controls
Master On/Off Switch
Start Push-Button
Choke Control
Low Oil Pressure Warning Light
Discharge Gauge: 2-1/2 inches (63.5 mm) Dia. Glycerine filled, 0 to 400 PSI (0 to 28 BAR).

AVAILABLE OPTIONS

Suction Adapters
Discharge Adapters
Hourmeter
New exhaust elbow kit for "X" unit
New remote instrument panel
mounting bracket
Protective pump coating for seawater applications
Deluxe instrument panel with two gauges
Base fuel tank
Exhaust blanket
Thermal Relief Valve

ENGINE

Make: Briggs and Stratton Vanguard™
Model: 350400 Series
Type: Horizontal shaft, air cooled, V-twin OHV
Horsepower: 18 BHP (13.4. kW) at 4000 RPM
Torque: 30 foot pound (40.7 N-M). Maximum stroke at 2600 RPM
Bore x Stroke: 2.83 x 2-3/4 inches (72 x 77 mm)
Displacement: 34-3/4 cubic inches (570 cc)
Oil Capacity: 3.0 pint (1.4 liter)
Optional Fuel Tank: Cross linked Polyethylene
Electrical: 16 AMP alternator
Emissions: Meets 1994 California Air Resources Board Standards



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HPX100-B18

MaxStream Portable Pump

PORTABLE PUMPS

Features and Benefits

"X" Version — Configured for installation by truck builders

Rotating Discharge Valve — Quick and easy hose layout

Full Instrumentation — Instrument panel shipped loose for remote mounting

Superior Performance—High pump efficiency

Briggs & Stratton Vanguard Engine—Quiet and powerful

The HPX100 MaxStream series pump is the newest, most exciting development in slip on pumps in years. Innovative features have been engineered to provide unparalleled performance and ease of operation.

The MaxStream model configuration is an ideal product for OEM installation. The pumping unit is attached to a steel skid plate base that can be easily mounted into any vehicle. The rail base includes all required hardware and vibration isolators. A remote 3 gallon gas tank and remote instrument panel are also included as standard. The suction connection has a three inch female NPT and a three inch female NPT discharge for maximum efficiency in OEM or field installation.

Power is provided by the respected Briggs and Stratton Vanguard engine. The

Vanguard power comes from a reliable state-of-the-art, air cooled, 18 BHP, V-twin, Overhead Valve (OHV) engine. The overhead valve design delivers more power than conventionally designed side-valve engines. It has an electric start with recoil backup to ensure starting under all conditions. All these exciting features come in a convenient compact design.

The HPX100 MaxStream offers a variety of options including a marine grade quick connect electrical socket. This socket can be used to power the optional light mast for night operations. This convenient electrical socket also serves as the connection point for a trickle charger to ensure the battery remains charged and the pump is always ready for operation.

Every detail and feature of the HP MaxStream series has been carefully designed and built for years of operation.

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PORTABLE PUMPS

HPX100-B18

MaxStream Portable Pump

EQUIPMENT SPECIFICATIONS

Type: Attack pump
Suction Connection: 2 inch NPT Female
Discharge Connection: 1-1/2 inch NPT Female
Body and Volute: Aluminum.
Impeller: 4.875 inches (123.83 mm) silicon bronze
Pump Shaft: Engine shaft with bronze sleeve
Priming: Exhaust Venturi; 20 inches (508 mm) HG
Maximum Flow: 150 GPM (568 LPM) @ 50 PSI (3.5 BAR)
Maximum Pressure: 290 PSI (20 BAR)
Weight: 157 pounds (71 kg)
Length: 21 inches (533 mm)
Width: 18 inches (457 mm)
Height: 20 inches (508 mm)

INSTRUMENTATION

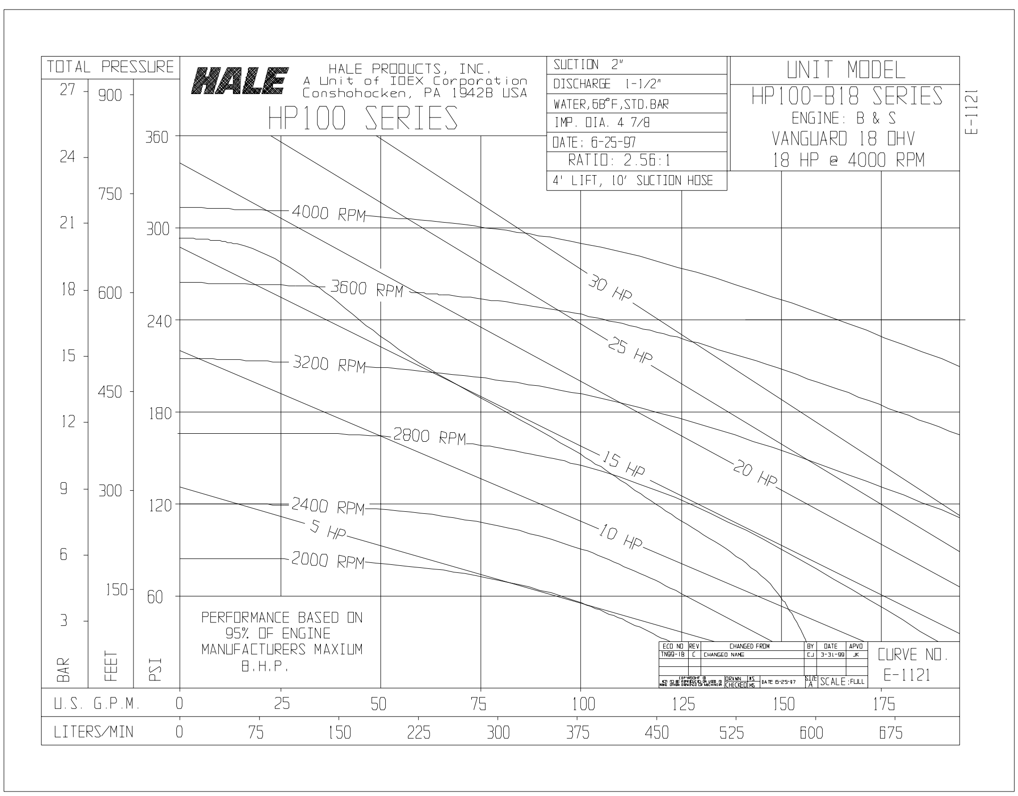
Throttle level
Priming controls
Master On/Off Switch
Start Push-Button
Choke Control
Low Oil Pressure Warning Light
Discharge Gauge: 2-1/2 inches (63.5 mm) Dia. Glycerine filled, 0 to 400 PSI (0 to 28 BAR)

AVAILABLE OPTIONS

Suction Adapters
Discharge Adapters
Hourmeter
New exhaust elbow kit for "X" unit
New remote instrument panel mounting bracket
Protective pump coating for seawater applications
Deluxe instrument panel with two gauges
Base fuel tank
Exhaust blanket
Thermal Relief Valve

ENGINE

Make: Briggs and Stratton Vanguard™
Model: 350400 Series
Type: Horizontal shaft, air cooled, V-twin OHV
Horsepower: 18 BHP (13.4. kW) at 4000 RPM
Torque: 30 foot pound (40.7 N-M). Maximum stroke at 2600 RPM
Bore x Stroke: 2.83 x 2-3/4 inches (72 x 77 mm)
Displacement: 34-3/4 cubic inches (570 cc)
Oil Capacity: 3.0 pint (1.4 liter)
Optional Fuel Tank: Cross linked Polyethylene
Fuel Capacity: 3 gallons (12 liters) 2 hours running time
Electrical: 16 AMP alternator
Emissions: Meets 1994 California Air Resources Board Standards



HPX200-B18

MaxStream Portable Pump

PORTABLE PUMPS

Features and Benefits

"X" Version — Configured for installation by truck builders

Exclusive Band Clamp Design – Quick and easy access for maintenance and repairs

Full Instrumentation — Instrument panel shipped loose for remote mounting

Superior Performance—High pump efficiency.

Briggs & Stratton Vanguard Engine— Quiet and powerful.

PERFORMANCE RATINGS
245 GPM @ 25 PSI
190 GPM @ 75 PSI
110 GPM @ 125 PSI
60 GPM @ 150 PSI

The HPX200-B18 MaxStream series pump is the newest, most exciting development in slip on pumps in years. Innovative features have been engineered to provide unparalleled performance and ease of operation.

The MaxStream model configuration is an ideal product for OEM installation. The pumping unit is attached to a steel skid plate base that can be easily mounted into any vehicle. The rail base includes all required hardware and vibration isolators. A remote instrument panel with mounted single discharge gauge and engine controls is included as standard. The suction connection has a three inch female NPT/4 inch Victaulic and a two and a half inch female discharge.

Priming is located at the eye of the impeller for faster priming and increased lifts.

Power is provided by the respected Briggs and Stratton Vanguard engine. The Vanguard power comes from a reliable state-of-the-art, air cooled, 18 BHP, V-twin, Overhead Valve (OHV) engine. The overhead valve design delivers more power than conventionally designed side-valve engines. It has an electric start with recoil backup to ensure starting under all conditions. All these exciting features come in a convenient compact design.

The HP MaxStream series pump also features Hale's exclusive band clamp design for quick and easy access for maintenance and repair. A bronze impeller and replaceable bronze wear rings are housed in a high strength, lightweight aluminum alloy pump housing. The unit features a self-adjusting, self-lubricating mechanical pump seal.

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PORTABLE PUMPS

HPX200-B18

MaxStream Portable Pump

EQUIPMENT SPECIFICATIONS

Type: Combination pump
Suction Connection: 3 inch NPT Female, 4 inch Victaulic.
Discharge Connection: 2-1/2 inch NPT Female
Body and Volute: Aluminum
Impeller: 8-3/4 inches (222.25 mm) silicon bronze
Pump Shaft: Engine shaft with bronze sleeve
Priming: Exhaust Venturi; 20 inches (508 mm) HG
Maximum Flow: 225 GPM (852 LPM) @ 50 PSI (3.5 BAR)
Maximum Pressure: 165 PSI (11 BAR)
Weight: 145 pounds (66 kg)
Length: 20-1/4 inches (514mm)
Width: 18 inches (457 mm)
Height: 20 inches (508 mm)

INSTRUMENTATION

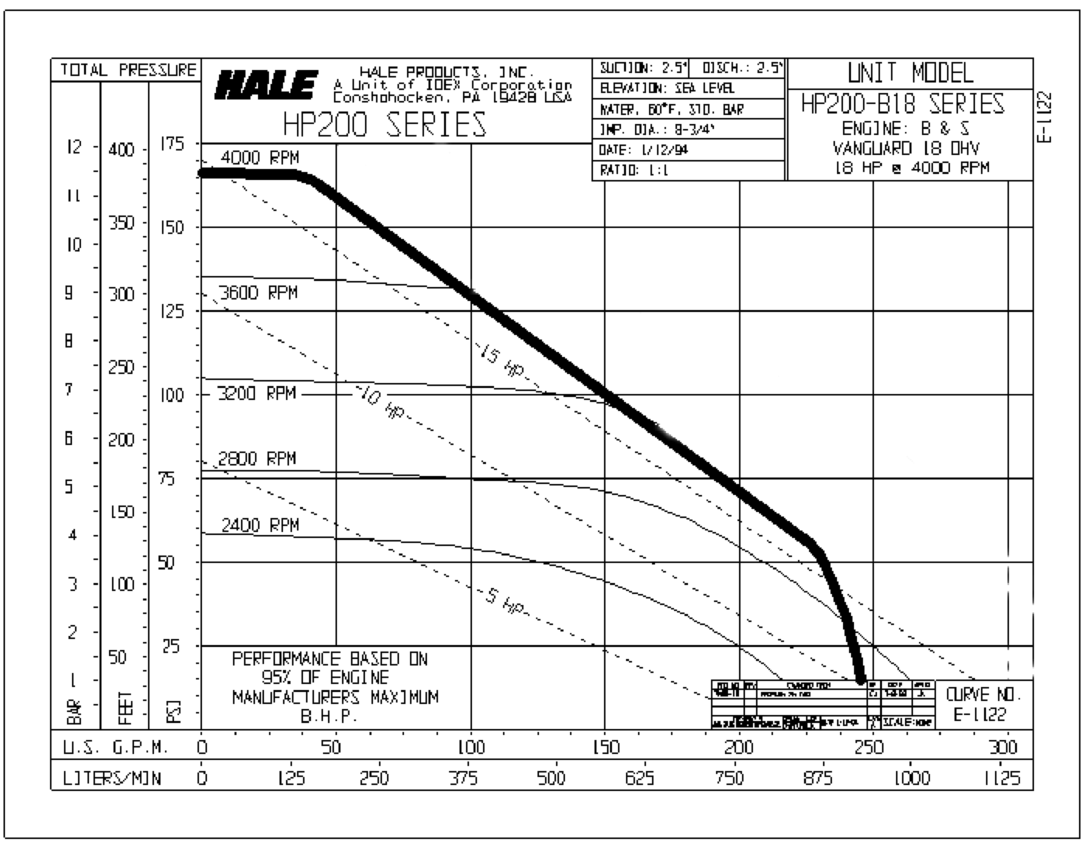
Throttle level
Priming controls
Master On/Off Switch
Start Push-Button
Choke Control
Low Oil Pressure Warning Light
Discharge Gauge: 2-1/2 inches (63.5 mm) Dia. Glycerine filled, 0 to 400 PSI (0 to 28 BAR)

AVAILABLE OPTIONS

Suction Adapters
Discharge Adapters
Hourmeter
New exhaust elbow kit for "X" unit
New remote instrument panel mounting bracket
Protective pump coating for seawater applications
Deluxe instrument panel with two gauges
Base fuel tank
Exhaust blanket
Thermal Relief Valve

ENGINE

Make: Briggs and Stratton Vanguard™
Model: 350400 Series
Type: Horizontal shaft, air cooled, V-twin OHV
Horsepower: 18 BHP (13.4. kW) at 4000 RPM
Torque: 30 foot pound (40.7 N-M). Maximum stroke at 2600 RPM
Bore x Stroke: 2.83 x 2-3/4 inches (72 x 77 mm)
Displacement: 34-3/4 cubic inches (570 cc)
Oil Capacity: 3.0 pint (1.4 liter)
Optional Fuel Tank: Cross linked Polyethylene
Electrical: 16 AMP alternator
Emissions: Meets 1994 California Air Resources Board Standards



HPX300-B18

MaxStream Portable Pump

PORTABLE PUMPS

Features and Benefits

"X" Version — Configured for installation by truck builders

Exclusive Band Clamp Design – Quick and easy access for maintenance and repairs

Full Instrumentation — Instrument panel shipped loose for remote mounting

Superior Performance—High pump efficiency.

Briggs & Stratton Vanguard Engine—Quiet and powerful.

PERFORMANCE RATINGS
390 GPM @ 25 PSI
310GPM @ 50 PSI
250 GPM @ 75 PSI
150 GPM @ 100 PSI

The HPX300-B18 MaxStream series pump is the newest, most exciting development in slip on pumps in years. Innovative features have been engineered to provide unparalleled performance and ease of operation.

The MaxStream model configuration is an ideal product for OEM installation. The pumping unit is attached to a steel skid plate base that can be easily mounted into any vehicle. The rail base includes all required hardware and vibration isolators. A remote instrument panel with mounted single discharge gauge and engine controls is included as standard. The suction connection has a three inch female NPT/4 inch Victaulic and a three inch NPT female discharge.

Priming is located at the eye of the impeller for faster priming and increased lifts.

Power is provided by the respected Briggs and Stratton Vanguard engine. The Vanguard power comes from a reliable state-of-the-art, air cooled, 18 BHP, V-twin, Overhead Valve (OHV) engine. The overhead valve design delivers more power than conventionally designed side-valve engines. It has an electric start with recoil backup to ensure starting under all conditions. All these exciting features come in a convenient compact design.

The HP MaxStream series pump also features Hale's exclusive band clamp design for quick and easy access for maintenance and repair. A bronze impeller and replaceable bronze wear rings are housed in a high strength, lightweight aluminum alloy pump housing. The unit features a self-adjusting, self-lubricating mechanical pump seal.

Every detail and feature of the HP MaxStream series has been carefully designed and built for years of operation.

Hale Products, Inc. A Unit of IDEX Corp. 700 Spring Mill Avenue Conshohocken, PA 19428 USA
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PORTABLE PUMPS

HPX300-B18

MaxStream Portable Pump

EQUIPMENT SPECIFICATIONS

Type: Combination pump
Suction Connection: 3 inch NPT Female, 4 inch Victaulic
Discharge Connection: 3 inch NPT Female
Body and Volute: Aluminum.
Impeller: 8-3/4 inches (222.25 mm) silicon bronze
Pump Shaft: Engine shaft with bronze sleeve
Priming: Exhaust Venturi; 20 inches (508 mm) HG
Maximum Flow: 400 GPM (1514 LPM) @ 20 PSI (1.5 BAR)
Maximum Pressure: 120 PSI (8 BAR)
Weight: 145 pounds (66 kg)
Length: 20-1/4 inches (514mm)
Width: 18 inches (457 mm)
Height: 20 inches (508 mm)

INSTRUMENTATION

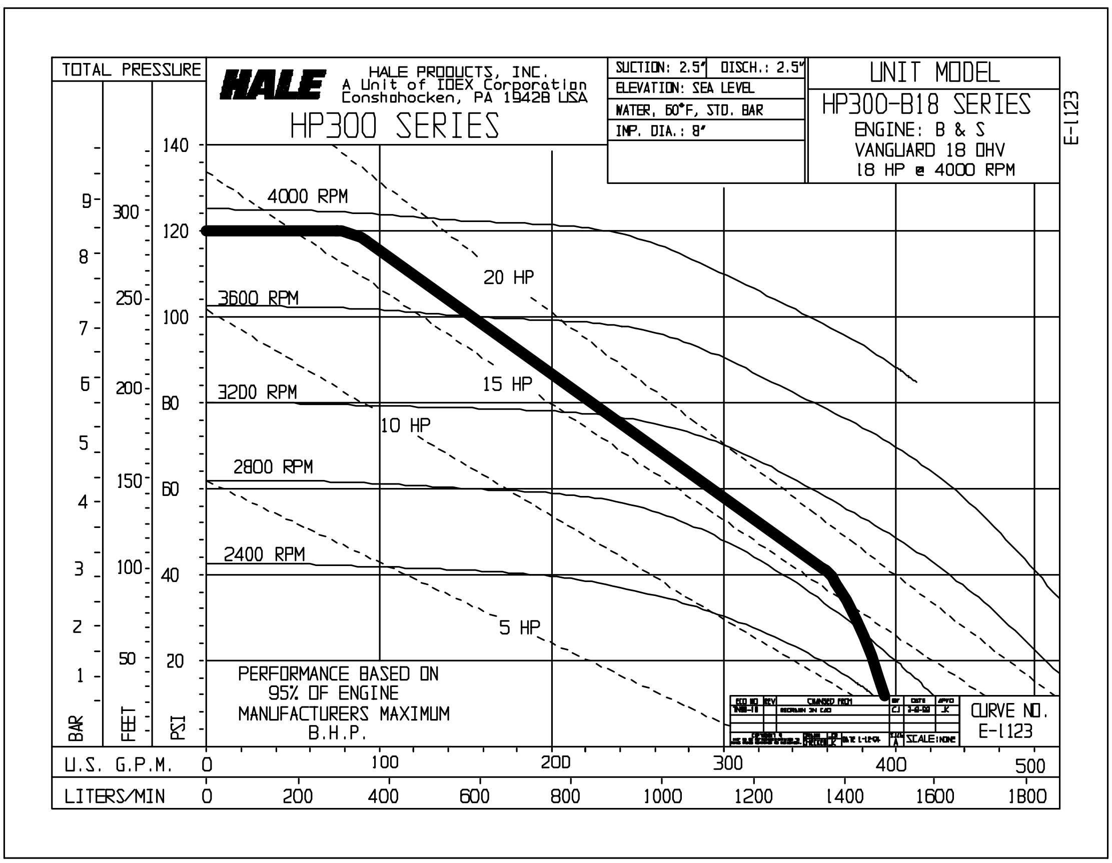
Throttle level
Priming controls
Master On/Off Switch
Start Push-Button
Choke Control
Low Oil Pressure Warning Light
Discharge Gauge: 2-1/2 inches (63.5 mm) Dia. Glycerine filled, 0 to 400 PSI (0 to 28 BAR)

AVAILABLE OPTIONS

Suction Adapters
Discharge Adapters
Hourmeter
New exhaust elbow kit for "X" unit
New remote instrument panel mounting bracket
Protective pump coating for seawater applications
Deluxe instrument panel with two gauges
Base fuel tank
Exhaust blanket
Thermal Relief Valve

ENGINE

Make: Briggs and Stratton Vanguard™
Model: 350400 Series.
Type: Horizontal shaft, air cooled, V-twin OHV
Horsepower: 18 BHP (13.4. kW) at 4000 RPM
Torque: 30 foot pound (40.7 N-M). Maximum stroke at 2600 RPM
Bore x Stroke: 2.83 x 2-3/4 inches (72 x 77 mm)
Displacement: 34-3/4 cubic inches (570 cc)
Oil Capacity: 3.0 pint (1.4 liter).
Optional Fuel Tank: Cross linked Polyethylene
Electrical: 16 AMP alternator
Emissions: Meets 1994 California Air Resources Board Standards



Note: Hale Products Inc. cannot assume responsibility for product failure resulting from improper maintenance or operation. Hale is responsible only to the limits stated in the product warranty. Product specifications contained in this material are subject to change without notice.

HPX400-B18

MaxStream Portable Pump

PORTABLE PUMPS

Features and Benefits

"X" Version — Configured for installation by truck builders

Exclusive Band Clamp Design – Quick and easy access for maintenance and repairs

Full Instrumentation — Instrument panel shipped loose for remote mounting

Superior Performance—High pump efficiency.

Briggs & Stratton Vanguard Engine—Quiet and powerful.

PERFORMANCE RATINGS
500 GPM @ 25 PSI
320 GPM @ 50 PSI
210 GPM @ 75 PSI
95 GPM @ 100 PSI

The HPX400-B18 MaxStream series pump is the newest, most exciting development in slip on pumps in years. Innovative features have been engineered to provide unparalleled performance and ease of operation.

The MaxStream model configuration is an ideal product for OEM installation. The pumping unit is attached to a steel skid plate base that can be easily mounted into any vehicle. The rail base includes all required hardware and vibration isolators. A remote instrument panel with mounted single discharge gauge and engine controls is included as standard. The suction connection has a three inch female NPT/4 inch Victaulic and a three inch NPT female discharge.

Priming is located at the eye of the impeller for faster priming and increased lifts.

Power is provided by the respected Briggs and Stratton Vanguard engine. The Vanguard power comes from a reliable state-of-the-art, air cooled, 18 BHP, V-twin, Overhead Valve (OHV) engine. The overhead valve design delivers more power than conventionally designed side-valve engines. It has an electric start with recoil backup to ensure starting under all conditions. All these exciting features come in a convenient compact design.

The HP MaxStream series pump also features Hale's exclusive band clamp design for quick and easy access for maintenance and repair. A bronze impeller and replaceable bronze wear rings are housed in a high strength, lightweight aluminum alloy pump housing. The unit features a self-adjusting, self-lubricating mechanical pump seal.

Every detail and feature of the HP MaxStream series has been carefully designed and built for years of operation

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HPX400-B18

MaxStream Portable Pump

EQUIPMENT SPECIFICATIONS

Type: Combination pump
Suction Connection: 3 inch NPT Female, 4 inch Victaulic
Discharge Connection: 3 inch NPT Female
Body and Volute: Aluminum
Impeller: 8-3/4 inches (222.25 mm) silicon bronze
Pump Shaft: Engine shaft with bronze sleeve
Priming: Exhaust Venturi; 20 inches (508 mm) HG
Maximum Flow: 500 GPM (1893 LPM) @ 20 PSI (1.5 BAR)
Maximum Pressure: 100 PSI (7 BAR)
Weight: 145 pounds (66 kg)
Length: 20-1/4 inches (514mm)
Width: 18 inches (457 mm)
Height: 20 inches (508 mm)

INSTRUMENTATION

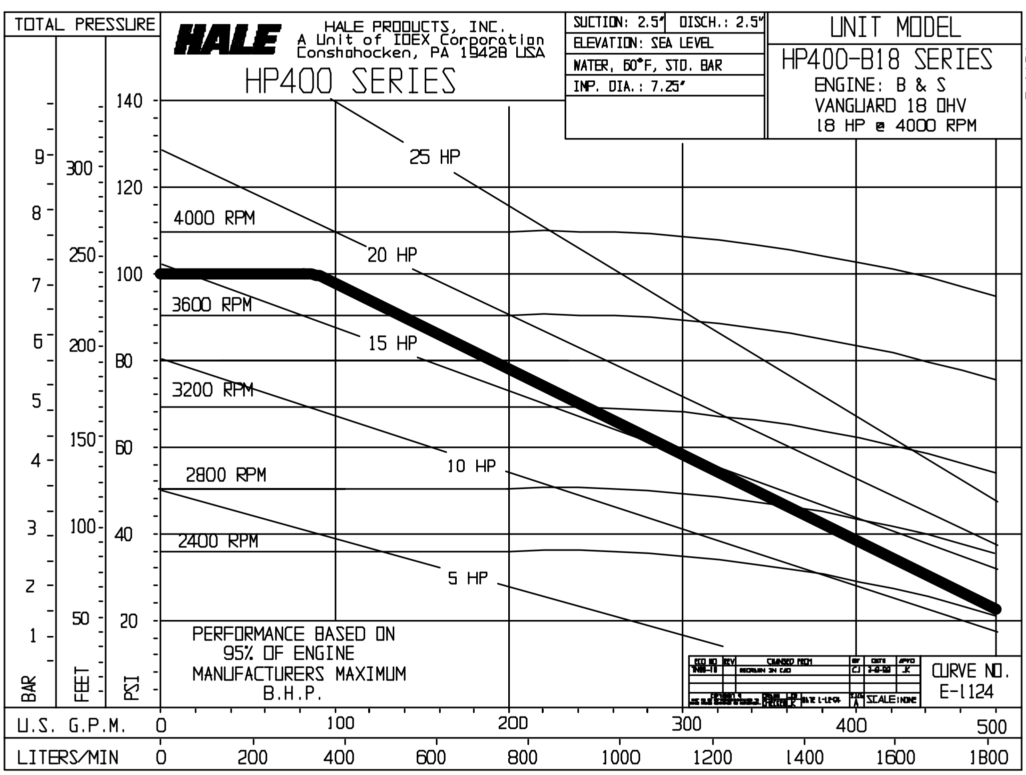
Throttle level
Priming controls
Master On/Off Switch
Start Push-Button
Choke Control
Low Oil Pressure Warning Light
Discharge Gauge: 2-1/2 inches (63.5 mm) Dia. Glycerine filled, 0 to 400 PSI(0 to 28 BAR)

AVAILABLE OPTIONS

Suction Adapters
Discharge Adapters
Hourmeter
New exhaust elbow kit for "X" unit
New remote instrument panel mounting bracket
Protective pump coating for seawater applications
Deluxe instrument panel with two gauges
Base fuel tank
Exhaust blanket
Thermal Relief Valve

ENGINE

Make: Briggs and Stratton Vanguard™
Model: 350400 Series.
Type: Horizontal shaft, air cooled, V-twin OHV
Horsepower: 18 BHP (13.4. kW) at 4000 RPM
Torque: 30 foot pound (40.7 N-M). Maximum stroke at 2600 RPM
Bore x Stroke: 2.83 x 2-3/4 inches (72 x 77 mm)
Displacement: 34-3/4 cubic inches (570 cc)
Oil Capacity: 3.0 pint (1.4 liter)
Optional Fuel Tank: Cross linked Polyethylene
Electrical: 16 AMP alternator
Emissions: Meets 1994 California Air Resources Board Standards



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HPX75-YD10 & HPT75-YD10

MaxStream Series

PORTABLE PUMPS

Features and Benefits

Diesel Compatibility
Refueling convenience with today's apparatus.

Exclusive Band Clamp Design Quick and easy access for maintenance and repairs

Lightweight
Only 149 pounds (68 kg)

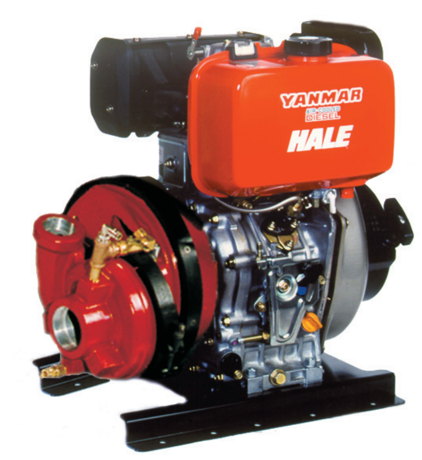
Our Smallest Diesel Package

Hale's diesel powered pump series offers the convenience of fuel compatibility with a diesel powered chassis. It combines all the benefits of a diesel engine — including safety, reliability, long life and low maintenance — with power and performance comparable to a gasoline driven unit.

Hale offers this series of diesel pumps to satisfy a variety of field situations and requirements. The HPX75-YD10 and HPT75-YD10 have volumes up to 110 GPM and pressures up to 190 PSI.

The HPX75-YD10 Diesel Slip-On comes complete with a 12-volt electric start ignition system. The fuel connections make it easy to use the vehicle's diesel tank for increased run time. The suction connection features a 2-inch NPT female thread for maximum efficiency in OEM installation and the discharge is a 1-1/2 inch NPT female connection.

The HPX75-YD10 is an ideal product for forestry or high pressure applications. It is provided with a Hale 12 VDC Environmentally Safe (ESP) Primer for fast priming and higher lift capabilities. The pump is equipped for remotely connected throttle and stop controls.



PERFORMANCE RATINGS
110 GPM @ 10 PSI
70 GPM @ 100 PSI
45 GPM @ 150 PSI
25 GPM @ 175 PSI

The HPT75-YD10 diesel pump comes complete with an exhaust gas priming system. The pump is equipped with carrying handles, mounted battery and gauge for portable use.

Power is provided by a heavy-duty Yanmar L100EE diesel engine and is supported by a worldwide service center network.

A bronze impeller, replaceable bronze clearance rings, and a self-adjusting, self-lubricating mechanical seal provide long life and low maintenance operation. The HPX75-YD10 and HPT75-YD10 have a volute and gearbox constructed of a high-strength, lightweight alloy.

Every detail and feature of the HP series has been carefully designed and built for years of operation

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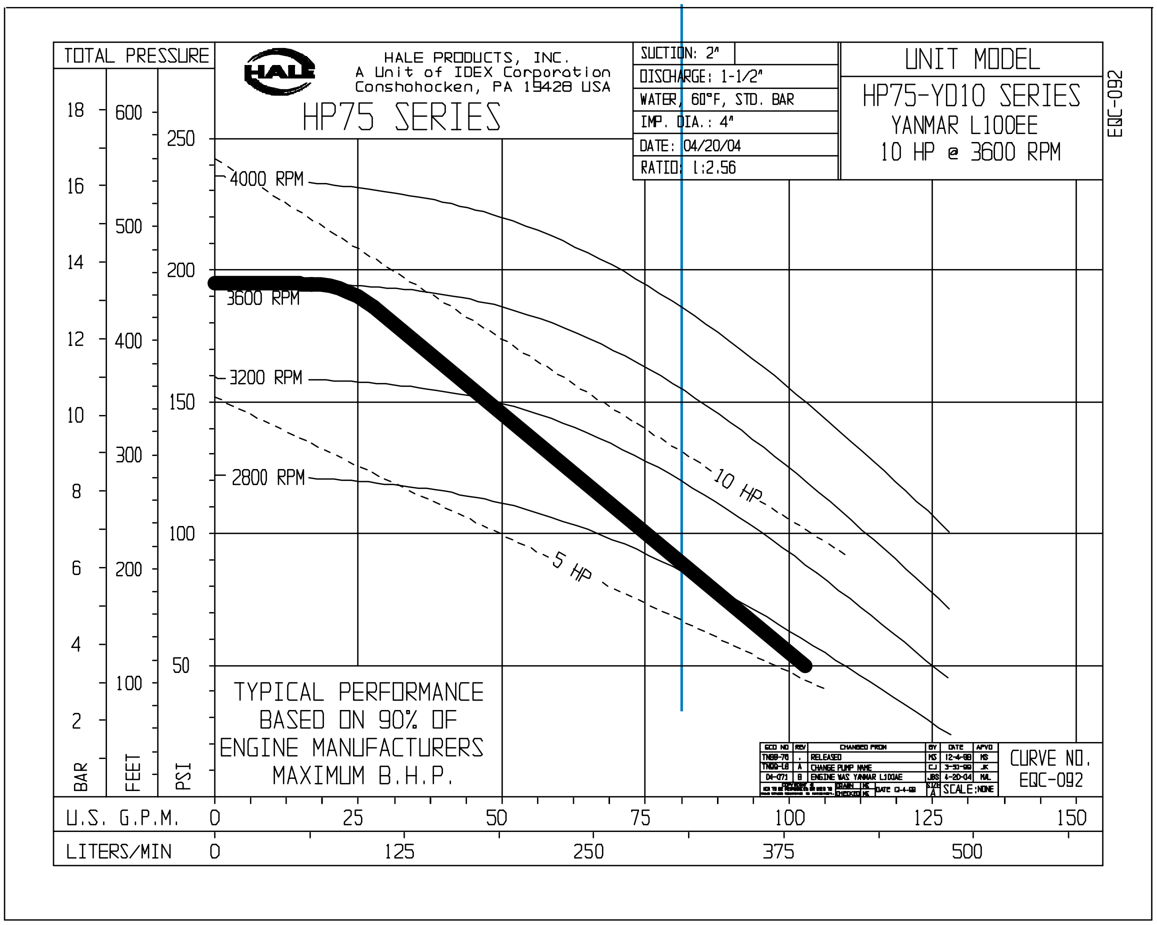
HPX75-YD10 & HPT75-YD10

MaxStream Series

PORTABLE PUMPS



PUMP SPECIFICATIONS

Pump:

Body and head: Lightweight, high strength, corrosion resistant, aluminum alloy with a speed increasing gearbox and smooth waterways for maximum performance.
Suction: 2 inch NPT Female
Discharge: 1-1/2 inch NPT female.
Impeller: Bronze enclosed type, fully machined and balanced. Bronze impeller has high strength and resists corrosion. Smooth waterways increase efficiency.
Clearance Rings: Hard bronze renewable clearance rings allow for long life.
Shaft Seal: Mechanical type for greater dependability. Easy and economical to maintain. Self-lubricating, self-adjusting mechanical seal for low maintenance and dependability.
Drain Cock: Brass
Priming: Complete with 12-volt DC ESP primer, shipped loose
Weight: 149 pounds (68 kg)
Length: 22.31 inches (567 mm)
Width: 18.5 inches (470 mm)
Height: 21.57 inches (548 mm)

ENGINE

Make: Yanmar L100EE .418 Liter Diesel
Type: 1 cylinder, 4-stroke naturally aspirated diesel engine
Horsepower: 10 HP @3600 RPM
Injection: Direct
Cooling: Air cooled
Lubrication: Forced lubrication via trochoid pump
Starting: Electric
Control: Manual
Air Filter: Dry type naturally aspirated

HPX75-YD10 Standard Features

Electric start
15 AMP Alternator
Mounting feet
Auto compression release
12V ESP Primer
Manual recoil backup
Mounted fuel tank
Single gauge pane, remote

HPT75-YD10 Standard Features

Electric start and battery
Carrying handles
Auto compression release
Exhaust gas primer
Manual recoil backup
Mounted fuel tank
Discharge gauge

HPX200-YD10 & HPT200-YD10

Diesel Slip-On Pumps

PORTABLE PUMPS

Features and Benefits

Diesel Reliability
Dependable, low maintenance design

Exclusive Band Clamp Design Quick and easy access for maintenance and repairs

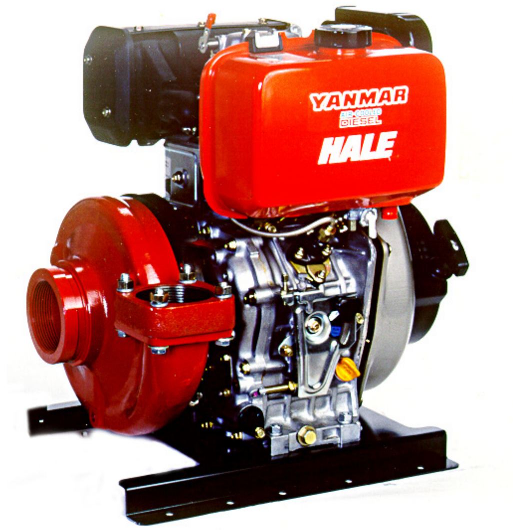
Diesel Compatibility
Refueling convenience with today's apparatus

Hale's diesel powered pump series offers the convenience of fuel compatibility with a diesel powered chassis. It combines all the benefits of a diesel engine — including safety, reliability, long life and low maintenance — with power and performance comparable to a gasoline driven unit.

Hale offers this series of diesel pumps to satisfy a variety of field situations and requirements. The HPX200-YD10 and HPT200-YD10 have volumes up to 170 GPM and pressures up to 115 PSI.

The HPX200-YD10 Diesel Slip-On pump comes complete with a 12-volt electric start ignition system. The fuel connections make it easy to use the vehicle's diesel tank for increased run time. The suction connection features a 3-inch NPT female thread for maximum efficiency in OEM installation and the discharge is a 2-1/2 inch NPT female connection.

The HPX200-YD10 is an ideal product for forestry or high pressure applications. It is provided with a Hale 12 VDC Environmentally Safe Primer (ESP) for fast priming and higher lift capabilities. The pump is equipped for remotely connected throttle and stop controls.



PERFORMANCE RATINGS
150 GPM @ 25 PSI
110 GPM @ 50 PSI
25 GPM @ 100 PSI

The HPT200-YD10 diesel portable comes complete with an exhaust gas priming system. The pump is equipped with carrying handles, mounted battery and gauge for portable use.

Power is provided by a heavy-duty Yanmar L100EE diesel engine and is supported by a worldwide service center network.

A bronze impeller, replaceable bronze clearance rings, and a self-adjusting, self-lubricating mechanical seal provide long life and low maintenance operation. The HPX200-YD10 and HPT200-YD10 have a volute and gearbox constructed of a high-strength, lightweight alloy.

Every detail and feature of the HP series has been carefully designed and built for years of operation.

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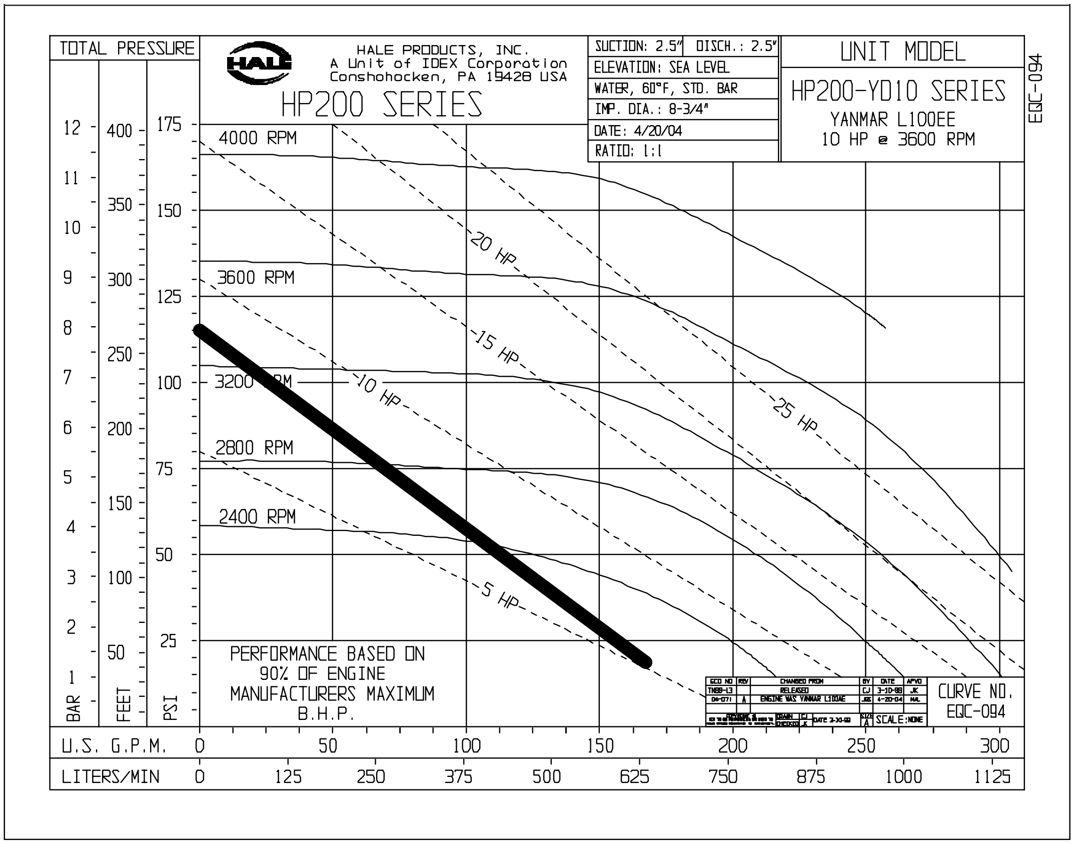
HPX200-YD10 & HPT200-YD10

Diesel Slip-On Pumps

PORTABLE PUMPS



PUMP SPECIFICATIONS

Pump:

Body and head: Lightweight, high strength, corrosion resistant, aluminum alloy with a speed increasing gearbox and smooth waterways for maximum performance

Impeller: Bronze enclosed type, fully machined and balanced. Bronze impeller has high strength and resists corrosion. Smooth waterways increase efficiency

Clearance Rings: Hard bronze renewable clearance rings allow for long life

Shaft: Impeller is mounted directly to engine crankshaft

Shaft Seal: Mechanical type for greater dependability. Easy and economical to maintain. Self-lubricating, self-adjusting mechanical seal for low maintenance and dependability

Drain Cock: Brass

Priming: Complete with 12-volt DC ESP primer, shipped loose

Weight: 130 pounds (59 kg)

Length: 20.84 inches (529 mm)

Width: 18.97 inches (482 mm)

Height: 21.57 inches (548 mm)

ENGINE

Make: Yanmar L100EE .418 Liter Diesel

Cycle: Four cycle

Horsepower: 10 HP @3600 RPM

Injection: Direct

Cooling: Air cooled

Lubrication: Forced lubrication via trachoid pump

Starting: Electric

Control: Manual

Air Filter: Dry type naturally aspirated

HPX200-YD10
Standard Features

Electric start
15 AMP alternator
Mounting feet
Auto compression release
12V ESP Primer
Manual recoil backup
Mounted fuel tank
Single gauge panel, remote

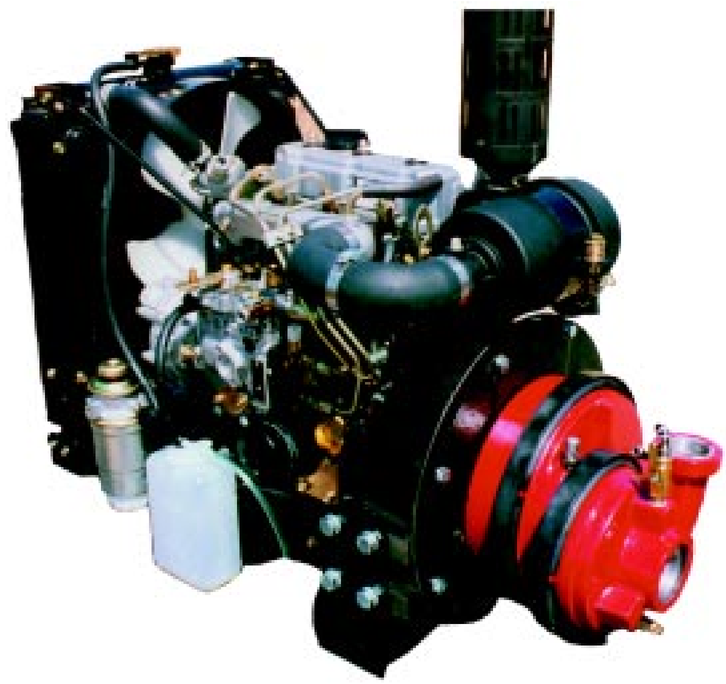
HPT200-YD10
Standard Features

Electric start and battery
Carrying handles
Auto compression release
Exhaust gas primer
Manual recoil backup
Mounted fuel tank
Discharge gauge

MaxStream Series
Diesel Slip-On Pump
HPX100-BD26

Features and Benefits

- ***Diesel Compatibility —*** Refueling convenience with today's apparatus
- ***High Pressure Model —*** Flows to 180 GPM
- ***Exclusive Band Clamp Design —*** Quick and easy access for maintenance and repairs. Includes speed increasing gearbox.
- ***Configured for easy installation by truck builders***
- ***Ideal for pump and roll applications***



PERFORMANCE RATINGS

180 GPM @ 10 PSI	115 GPM @ 200 PSI
155 GPM @ 100 PSI	55 GPM @ 300 PSI

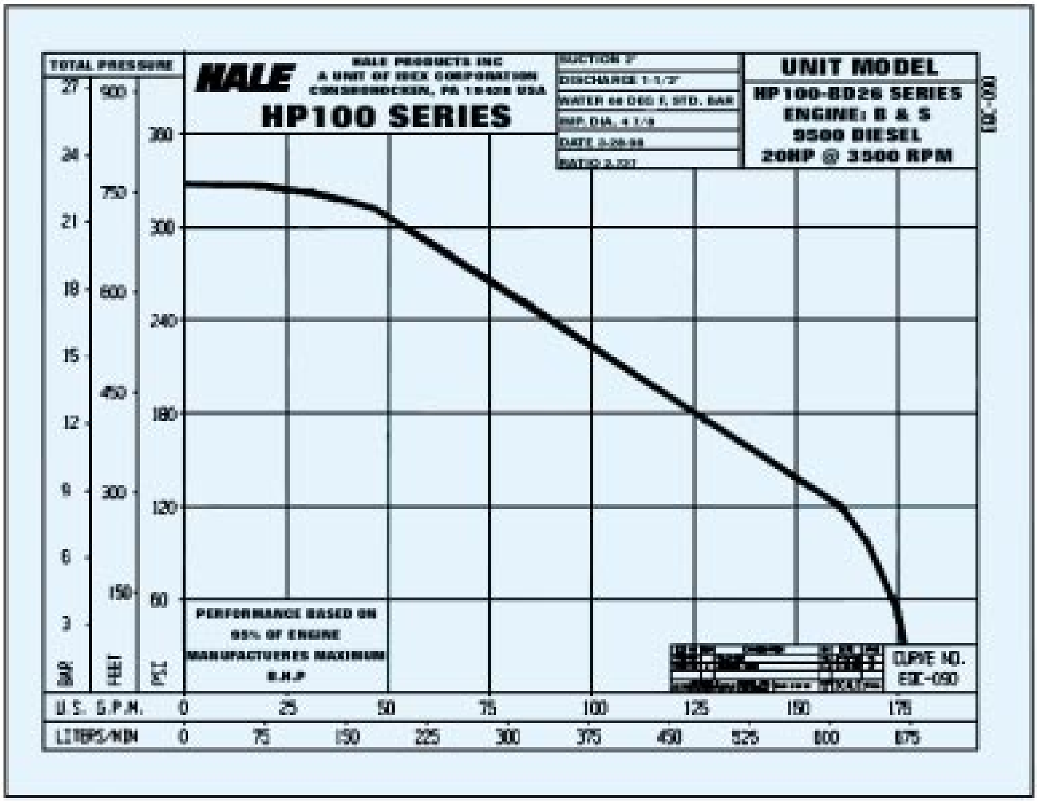
Hale's line of diesel powered slip-on pumps offer the convenience of fuel compatibility with a diesel powered chassis. They combine all the benefits of a diesel engine — including safety, reliability, long life and low maintenance — with power and performance comparable to a gasoline driven unit.

Hale offers a complete line of diesel pumps to satisfy a variety of field situations and requirements.

The MaxStream Diesel Slip-On series pumps come complete with a 12-volt electric start ignition system. The fuel connections make it easy to use the vehicles diesel tank for increased run time. The suction connection for the HPX100-BD26 is a 2-inch female thread for maximum efficiency in OEM installation and the discharge is a 1-1/2 inch NPT female connection.

The HPX100-BD26 is an ideal product for OEM installation. The pump is equipped for remotely connected throttle and stop controls. Power is provided by a heavy duty Briggs and Stratton DM950D Diesel engine and is supported by a worldwide service center network.

A bronze impeller, replaceable bronze clearance rings and a self-adjusting, self-lubricating mechanical seal provide long life and low maintenance operation. The HPX100-BD26 has a volute constructed of a high strength, light weight aluminum alloy.



Impeller Diameter: 4-7/8 inches.
Suction: 2 inch FNPT
Discharge: 1-1/2 inch FNPT
Length: 32.3 inches (859 mm)
Width: 16.5 inches (419 mm)
Height: 29.55 inches (751 mm)
Weight: 315 lbs (143 kg)

Technical Specifications

Body and Head: Lightweight, high strength, corrosion resistant, aluminum alloy with smooth waterways for maximum performance.
Impeller: Bronze enclosed type, fully machined and balanced, Bronze impeller has high strength and will not rust or corrode. Smooth waterways increase efficiency.
Clearance Rings: Hard bronze renewable clearance rings allow for long life.
Shaft Seal: Self-lubricating, self-adjusting mechanical seal for low maintenance and dependability. Easy and economical to maintain.
Drain Cock: Brass
Priming: Complete with 12-volt DC ESP primer, shipped loose

ENGINE

Make: Briggs and Stratton DM950D Diesel
Cycle: Four Cycle
Horsepower: 26 HP @ 3600 RPM
Injection: Direct
Cooling: Radiator, water cooled
Lubrication: Forced by gear pump
Starting: Electric
Cylinder: Cast iron
Crankshaft: Forged steel
Speed Governor: Automatic centrifugal
Cylinder head: Cast iron
Control: Manual
Air Filter: Dry type with cyclone pre-cleaner

Standard Features

- Electric start
- Mounting feet
- Auto compression release
- 12V ESP Primer
- Single gauge instrument panel
- 12 Volt, 40 AMP alternator

MADE IN THE USA

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Equipment Group
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TEL: 610/825-6300
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MaxStream Series
Diesel Slip-On Pump
HPX200-BD26

Features and Benefits

- ***Diesel Compatibility —*** Refueling convenience with today's apparatus
- ***High Capacity Model —*** Flows to 285 GPM
- ***Exclusive Band Clamp Design —*** Quick and easy access for maintenance and repairs
- ***Configured for easy installation by truck builders***
- ***Ideal for pump and roll applications***

PERFORMANCE RATINGS	
280 GPM @ 10 PSI	200 GPM @ 100 PSI
270 GPM @ 50 PSI	160 GPM @ 125 PSI

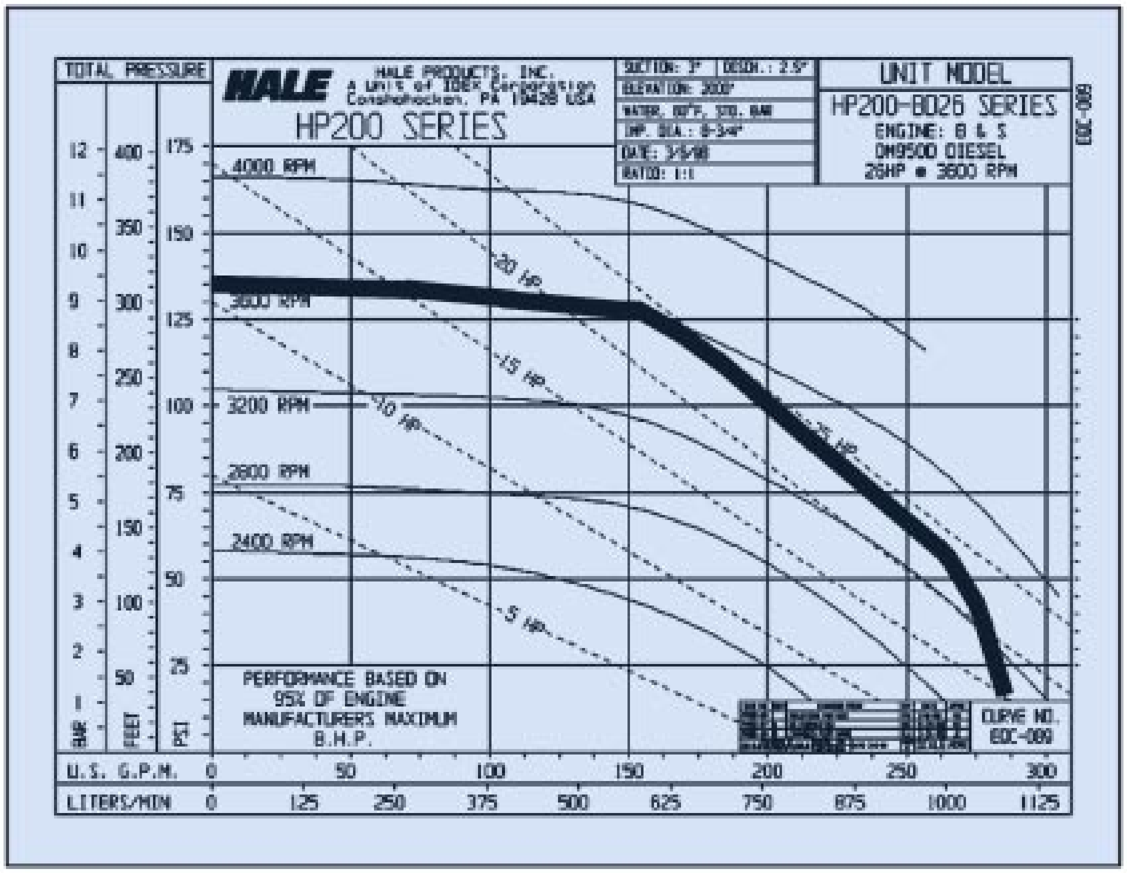
Hale's line of diesel powered slip-on pumps offer the convenience of fuel compatibility with a diesel powered chassis. They combine all the benefits of a diesel engine — including safety, reliability, long life and low maintenance — with power and performance comparable to a gasoline driven unit.

Hale offers a complete line of diesel pumps to satisfy a variety of field situations and requirements.

The MaxStream Diesel Slip-On series pumps come complete with a 12-volt electric start ignition system. The fuel connections make it easy to use the vehicles diesel tank for increased run time. The suction connection for the HPX200-BD26 is a 3-inch female NPT/4-inch Victaulic. Discharge is a removable 2-1/2 inch NPT female flange.

The HPX200-BD26 is an ideal product for OEM installation. The pump is equipped for remotely connected throttle and stop controls. Power is provided by a heavy duty Briggs and Stratton DM950D Diesel engine and is supported by a worldwide service center network.

A bronze impeller, replaceable bronze clearance rings and a self-adjusting, self-lubricating mechanical seal provide long life and low maintenance operation. The HPX200-BD26 has a volute constructed of a high strength, light weight aluminum alloy.



Impeller Diameter: 8-3/4 inches
Suction: 3 inch FNPT/4 inch Victaulic
Discharge: 2-1/2 inch FNPT
Length: 32 inches (813 mm)
Width: 24 inches (610 mm)
Height: 31 inches (787 mm)
Weight: 340 pounds (154 KG).

Technical Specifications

Body and Head: Lightweight, high strength, corrosion resistant, aluminum alloy with smooth waterways for maximum performance.
Impeller: Bronze enclosed type, fully machined and balanced, Bronze impeller has high strength and will not rust or corrode. Smooth waterways increase efficiency.
Shaft: Impeller is mounted directly to engine crankshaft
Shaft Seal: Self-lubricating, self-adjusting mechanical seal for low maintenance and dependability. Easy and economical to maintain
Drain Cock: Brass
Priming: Complete with 12-volt DC ESP primer

ENGINE

Make: Briggs and Stratton DM950D Diesel
Cycle: Four Cycle
Horsepower: 26 HP @ 3600 RPM
Injection: Direct
Cooling: Radiator, water cooled
Lubrication: Forced by gear pump
Starting: Electric
Cylinder: Cast iron
Crankshaft: Forged Steel
Speed Governor: Automatic centrifugal
Cylinder head: Cast iron
Control: Manual
Air Filter: Dry type with cyclone pre-cleaner

Standard Features

- Electric start
- Mounting feet
- Auto compression release
- 12V ESP Primer
- Single gauge instrument panel
- 12 Volt 40 amp alternator

MADE IN THE USA

HALE
IDEX CORPORATION

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HPX300-BD26

Diesel Slip-On Pump

Features and Benefits

- ***Diesel Compatibility*** – Refueling convenience with today's apparatus
- ***High Capacity Model*** – Flows to 400 GPM
- ***Exclusive Band Clamp Design*** – Quick and easy access for maintenance and repairs
- ***Configured for easy installation by truck builders***
- ***Ideal for all supply applications***

Hale's line of diesel powered slip-on pumps offer the convenience of fuel compatibility with a diesel powered chassis. They combine all the benefits of a diesel engine – including safety, reliability, long life and low maintenance – with power and performance comparable to a gasoline driven unit.

Hale offers a complete line of diesel pumps to satisfy a variety of field situations and requirements.

The MaxStream Diesel Slip-On series pumps come complete with a 12-volt electric start ignition system. The fuel connections make it easy to use the vehicles diesel tank for increased run time. The suction connection for the HPX300-BD26 is a 3-inch female NPT/4-inch Victaulic. Discharge is a 3-inch NPT female flange.

The HPX300-BD26 is an ideal product for OEM installation. The pump is equipped for remotely connected throttle and stop controls. Power is provided by a heavy duty Briggs and Stratton DM950D Diesel engine and is supported by a worldwide service center network.

A bronze impeller, replaceable bronze clearance rings and a self-adjusting, self-lubricating mechanical seal provide long life and low maintenance operation. The HPX300-BD26 has a volute constructed of a high strength, light weight aluminum alloy.

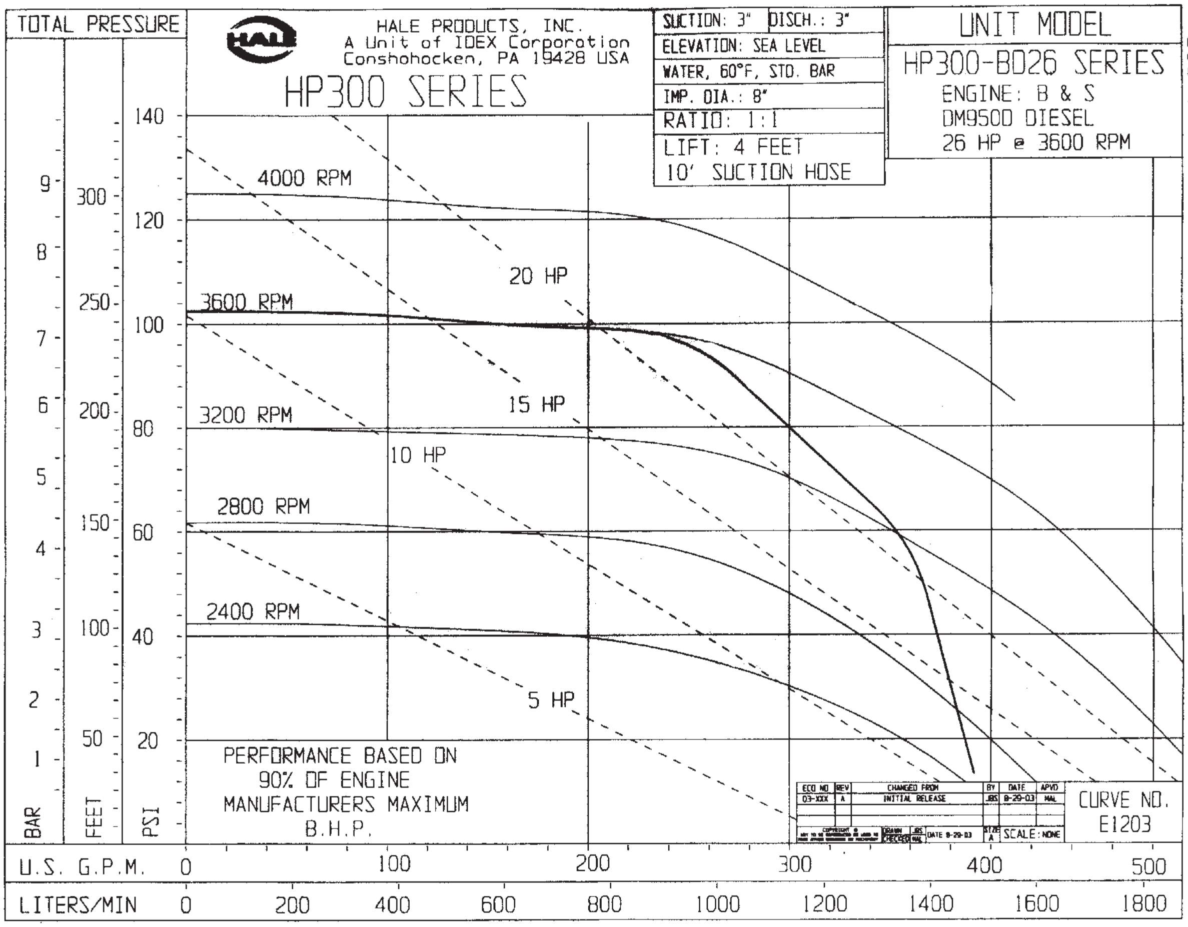
PERFORMANCE RATINGS

360 GPM @ 50PSI
320 GPM @ 75 PSI
120 GPM @ 100 PSI

PORTABLE PUMPS

HPX300-BD26

Diesel Slip-On Pump



Impeller Diameter: 8 inches
Suction: 3 inch FNPT/4 inch Victaulic
Discharge: 3-inch FNPT
Length: 30.8 inches (782 mm)
Width: 16.5 inches (419 mm)
Height: 29.55 inches (751 mm)
Weight: 165 pounds (75 KG)

Technical Specifications

Body and Head: Lightweight, high strength, corrosion resistant, aluminum alloy with smooth waterways for maximum performance.
Impeller: Bronze enclosed type, fully machined and balanced, Bronze impeller has high strength and will not rust or seize. Smooth waterways increase efficiency.
Shaft: Impeller is mounted directly to engine crankshaft
Shaft Seal: Mechanical type for greater dependability. Easy and economical to maintain. Self-lubricating, self-adjusting mechanical seal for low maintenance and dependability.
Drain Cock: Brass
Priming: Complete with 12-volt DC ESP primer

ENGINE
Make: Briggs and Stratton DM950D Diesel
Cycle: Four Cycle
Horsepower: 26 HP @ 3600 RPM
Injection: Direct
Cooling: Radiator, water cooled
Lubrication: Forced by gear pump
Starting: Electric
Cylinder: Pearlitic cast iron

Crankshaft: Cast iron
Speed Governor: Automatic centrifugal
Cylinder head: Aluminum permanent mold casting
Control: Manual
Air Filter: Dry type with cyclone pre-cleaner

Standard Features

- Electric start
- Mounting feet
- Auto compression release
- 12V ESP Primer
- Single gauge instrument panel
- 12 Volt alternator

Options

Dual gauge instrument panel

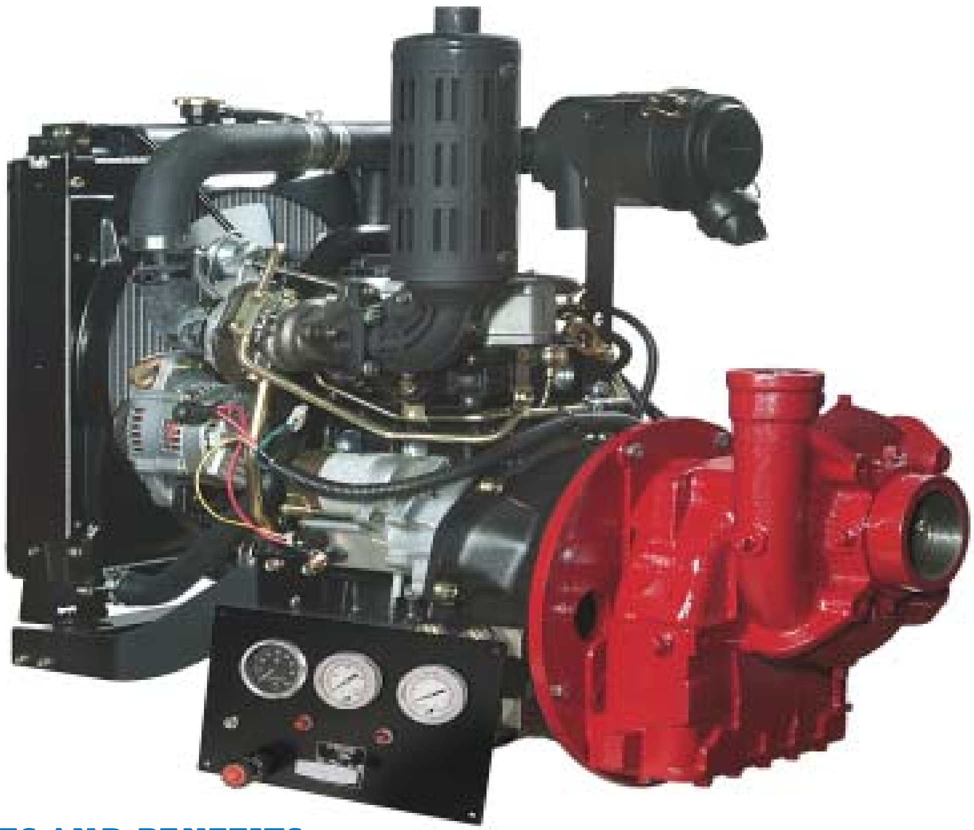
PORTABLE PUMPS

HALE Class 1

HPX350-BD34

Diesel Slip-On Pump

MAXSTREAM PUMPS



FEATURES AND BENEFITS

- ***Diesel Compatibility —*** Refueling convenience with today's apparatus
- ***High Capacity Model —*** Flows to 320 GPM
- ***Configured for easy installation by truck builders***
- ***Ideal for pump and roll applications***

Hale's line of diesel powered slip-on pumps offer the convenience of fuel compatibility with a diesel powered chassis. They combine all the benefits of a diesel engine — including safety, reliability, long life and low maintenance — with power and performance comparable to a gasoline driven unit.

Hale offers a complete line of diesel pumps to satisfy a variety of field situations and requirements.

The MaxStream Diesel Slip-On series pumps come complete with a 12-volt electric start ignition system. The fuel connections make it easy to use the vehicles diesel tank for increased run time. The suction connection for the HPX350-BD34 is a 3-inch female NPT. Discharge is a removable 2-inch NPT female flange.

The HPX350-BD34 is an ideal product for OEM installation. The pump is equipped for remotely connected throttle and stop controls. Power is provided by a heavy duty Briggs and Stratton DM950DT Diesel engine and is supported by a worldwide service center network.

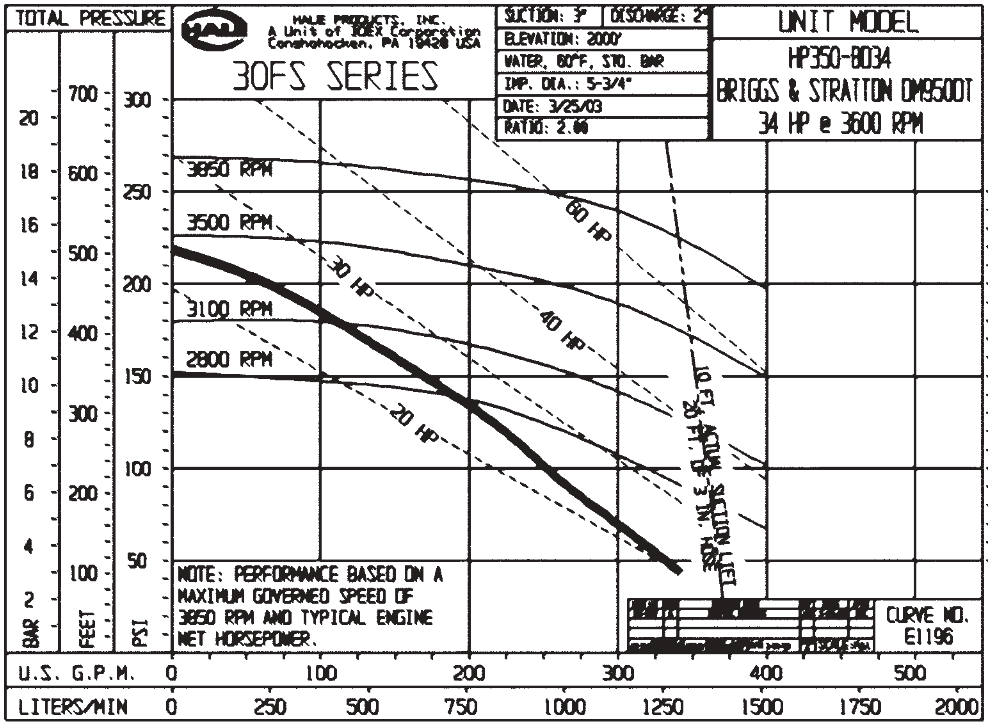
A bronze impeller, replaceable bronze clearance rings and a self-adjusting, self-lubricating mechanical seal provide long life and low maintenance operation. The HPX350-BD34 has a volute constructed of a high strength cast iron alloy.

Hale Products Inc. • *Fire Suppression Group* • *A Unit of IDEX Corporation* • *700 Spring Mill Avenue Conshohocken, PA 19428* • *Phone: (610) 825-6300* • *Fax: (610) 825-6440* • *www.haleproducts.com*
Class 1 • *Fire Suppression Group* • *A Unit of IDEX Corporation* • *607 NW 27th Avenue Ocala, FL 34475* • *Phone: (352) 629-5020* • *Fax: (352) 629-2902* • *www.class1.com*

HALE

HPX350-BD34

Diesel Slip-On Pump



PERFORMANCE RATINGS

350 GPM @ 50 PSI	150 GPM @ 150 PSI
250 GPM @ 100 PSI	50 GPM @ 200 PSI

Impeller Diameter: 5-3/4 inches
Suction: 3 inch FNPT
Discharge: 2 inch FNPT
Length: 35 inches (889 mm)
Width: 24 inches (610 mm)
Height: 32 inches (813 mm)
Dry Weight: 340 pounds (154 KG).

Technical Specifications

Body and Head: High strength cast iron with smooth waterways for maximum performance.
Impeller: Bronze enclosed type, fully machined and balanced, Bronze impeller has high strength and will not rust or corrode. Smooth waterways increase efficiency.
Shaft Seal: Self-lubricating, self-adjusting mechanical seal for low maintenance and dependability. Easy and economical to maintain
Drain Cock: Brass
Priming: Complete with 12-volt DC ESP primer

ENGINE

Make: Briggs and Stratton DM950DT Diesel
Cycle: Four Cycle
Horsepower: 34 HP @ 3600 RPM
Injection: Direct
Cooling: Radiator, water cooled
Lubrication: Forced by gear pump
Starting: Electric
Cylinder: Cast iron
Crankshaft: Forged Steel
Speed Governor: Automatic centrifugal
Cylinder head: Aluminum
Control: Manual
Air Filter: Dry type with cyclone pre-cleaner

Standard Features

- Electric start
- Mounting feet
- Auto compression release
- 12V ESP Primer
- 12 Volt 40 amp alternator
- Instrument panel:
  - Master Inlet Pressure Gauge
  - Master Discharge Pressure Gauge
  - Engine Tachometer Gauge
  - Red Lamp for Low Oil Pressure Warning
  - Yellow Lamp for High Coolant Temperature
  - Short Lever Turn Start Switch
  - Throttle Cable
  - Mounted PVG Priming Valve

MAXSTREAM PUMPS

HPX400-BD26

Diesel Slip-On Pump

Features and Benefits

- ***Diesel Compatibility*** – Refueling convenience with today's apparatus
- ***High Capacity Model*** – Flows to 500 GPM
- ***Exclusive Band Clamp Design*** – Quick and easy access for maintenance and repairs
- ***Configured for easy installation by truck builders***
- ***Ideal for all supply applications***

Hale's line of diesel powered slip-on pumps offer the convenience of fuel compatibility with a diesel powered chassis. They combine all the benefits of a diesel engine – including safety, reliability, long life and low maintenance – with power and performance comparable to a gasoline driven unit.

Hale offers a complete line of diesel pumps to satisfy a variety of field situations and requirements.

The MaxStream Diesel Slip-On series pumps come complete with a 12-volt electric start ignition system. The fuel connections make it easy to use the vehicles diesel tank for increased run time. The suction connection for the HPX400-BD26 is a 3-inch female NPT/4-inch Victaulic. Discharge is a 3-inch NPT female flange.

The HPX400-BD26 is an ideal product for OEM installation. The pump is equipped for remotely connected throttle and stop controls. Power is provided by a heavy duty Briggs and Stratton DM950D Diesel engine and is supported by a worldwide service center network.

PERFORMANCE RATINGS
500 GPM @ 30 PSI
350 GPM @ 70 PSI
400 GPM @ 50 PSI
200 GPM @ 90 PSI

A bronze impeller, replaceable bronze clearance rings and a self-adjusting, self-lubricating mechanical seal provide long life and low maintenance operation. The HPX400-BD26 has a volute constructed of a high strength, light weight aluminum alloy.

PORTABLE PUMPS

HALE
IDEX CORPORATION
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TEL: 610/825-6300 1-800/220-HALE FAX: 610/825-9615 www.haleproducts.com
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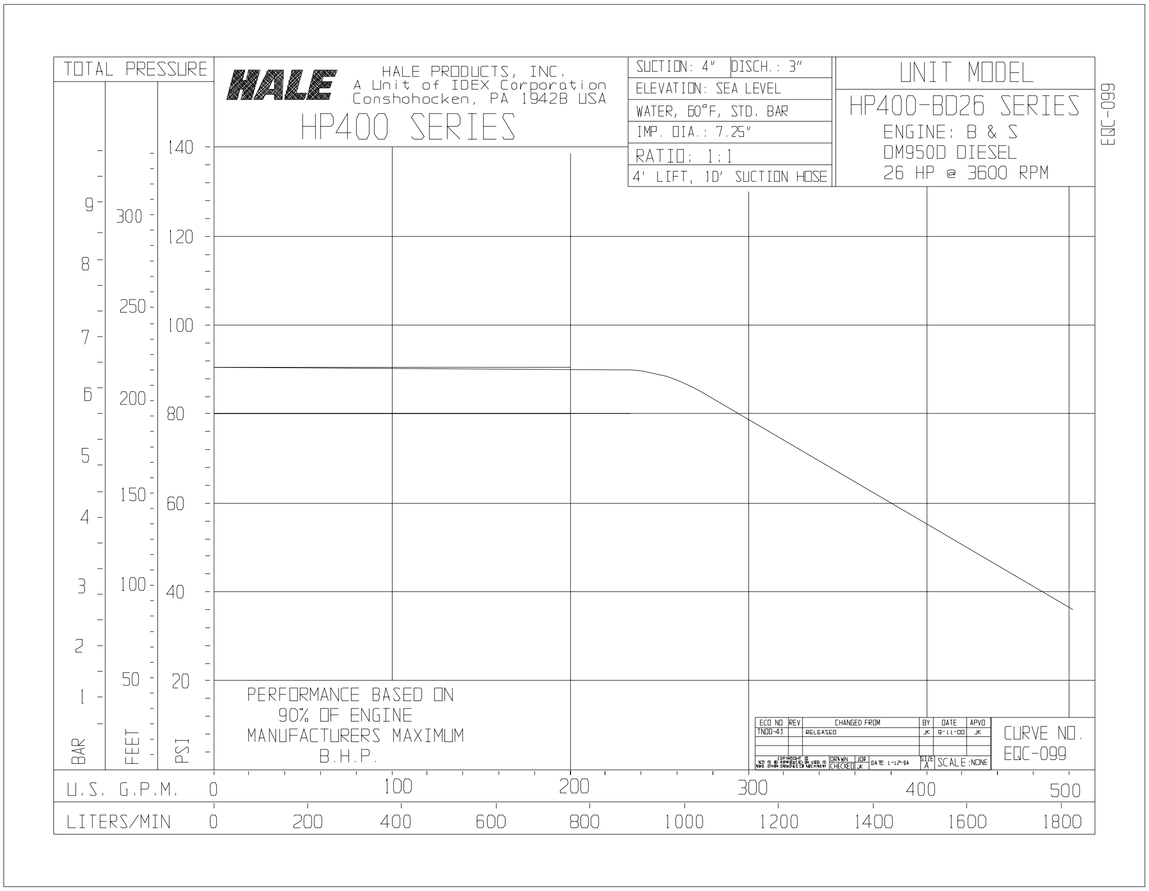
HALE

HPX400-BD26

Diesel Slip-On Pump

PORTABLE PUMPS



Impeller Diameter: 8-3/4 inches.
Suction: 3 inch FNPT/4 inch Victaulic
Discharge: 3-inch FNPT
Length: 30.8 inches (782 mm)
Width: 16.5 inches (419 mm)
Height: 29.55 inches (751 mm)
Weight: 165 pounds (75 KG).

Technical Specifications
Body and Head: Lightweight, high strength, corrosion resistant, aluminum alloy with smooth waterways for maximum performance.
Impeller: Bronze enclosed type, fully machined and balanced, Bronze impeller has high strength and will not rust or seize. Smooth waterways increase efficiency.
Shaft: Impeller is mounted directly to engine crankshaft
Shaft Seal: Mechanical type for greater dependability. Easy and economical to maintain. Self-lubricating, self-adjusting mechanical seal for low maintenance and dependability.
Drain Cock: Brass
Priming: Complete with 12-volt DC ESP primer

ENGINE
Make: Briggs and Stratton DM950D Diesel
Cycle: Four Cycle
Horsepower: 26 HP @ 3600 RPM
Injection: Direct
Cooling: Radiator, water cooled
Lubrication: Forced by gear pump
Starting: Electric
Cylinder: Pearlitic cast iron

Crankshaft: Cast iron
Speed Governor: Automatic centrifugal
Cylinder head: Aluminum permanent mold casting
Control: Manual
Air Filter: Dry type with cyclone pre-cleaner

Standard Features
ï Electric start
ï Mounting feet
ï Auto compression release
ï 12V ESP Primer
ï Single gauge instrument panel
ï 12 Volt alternator

Options
Dual gauge instrument panel

Bulletin #893. Rev 1 ●

HALE Class 1

Honda Engine Option

HP Series Portable Pumps

Hale has expanded its extensive portable pump line to include a Honda Engine Option. Rugged Honda engines are reliable and easy to start and are now an option on many HP series pumps. You can have your choice of Briggs and Stratton® or Honda® Engines when you order your Hale HP series portable pump.

FEATURES AND BENEFITS

- ***Configured for installation by truck builders or for use as a portable pump***
- ***Exclusive band clamp design — quick and easy access for maintenance and repairs***
- ***Full instrumentation options***
- ***Superior performance - high pump efficiency***
- ***Honda engine - quiet, powerful, easy start***

The new Honda engine option for the HP Series offers powerful performance. The Honda power comes from a reliable state-of-the-art, air-cooled, 20 BHP, V-twin, Overhead Valve (OHV) engine. The overhead valve design delivers more power than conventionally designed side-valve engines. It has an electric start with recoil backup to ensure starting under all conditions. All these exciting features come in a convenient compact design.

The HP series pump featues Hale's exclusive band clamp design for quick and easy access for maintenance and repair. A bronze impeller and replaceable bronze wear rings are housed in a high strength, lightweight, aluminum alloy pump housing. The unit features a self-adjusting, self-lubricating mechanical pump seal.

Every detail and feature of the HP series has been carefully designed and built for years of operation.

Configurations available

X Version - Configured for installation by a truck builder. Includes loose shipped gauge panel and controls.

XB Version - Configured for installation by a truck builder. Includes base fuel tank and loose shipped gauge panel and controls.

W Version - Configured as a portable pump with a wraparound frame, base fuel tank and gauge panel.

Pump Ends Available		Typical Max. PSI	Typical Max. GPM
100	High pressure pump end	290	160
200	Medium pressure and flow pump end	165	250
300	Capacity flow pump end	120	400

PORTABLE PUMPS

Hale Products Inc. ● *Fire Suppression Group* ● *A Unit of IDEX Corporation* ● *700 Spring Mill Avenue Conshohocken, PA 19428* ● *Phone: (610) 825-6300* ● *Fax: (610) 825-6440* ● *www.haleproducts.com*

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FP300DJ-O

Diesel Pumping Unit

DIESEL PUMPS

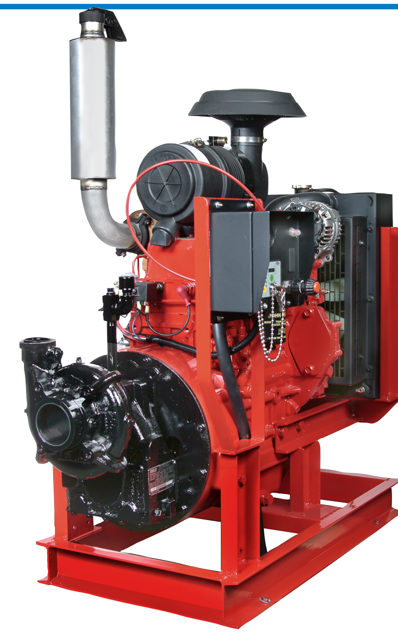
FEATURES AND BENEFITS

- **High Pressure** — Performance over 335 PSI
- **Volumes:** 200 GPM @ 250 PSI
  300 GPM @ 150 PSI
- **Exceeds Performance Ratings:** NFPA 1901-250, ISO-8, NWCG Type 3
- **Close Coupled Pump** — Bolted directly to the engine housing via speed increasing gearbox. Fewer parts required, alignment assured.
- **Efficiency** — Close tolerance matching of impeller and wear rings assures highest efficiency.
- **Dependable Performance** — Carefully engineered, ruggedly built and backed by over 85 years of pump manufacturing experience.
- **Matched Power** — Pump is matched to engine to provide maximum performance at minimal cost.
- **Easy Pump Maintenance** — No special tools required. All wearing parts are easy to replace.
- **Configuration** — Open mounted only for cross-chassis installation.

Technical Specifications

Pump

Type: Single stage centrifugal with speed increasing gearbox
Suction: 3-inch female NPT
Discharge: 2-inch female NPT
Volute and Head: Cast iron construction
Impeller: Hard, fine grain bronze, fully machined and hand-blanced with smooth internal waterways and mixed-flow vanes for maximum efficiency
Clearance Rings: Replaceable bronze
Shaft: Heat-treated, corrosion resistant, one-piece integrated shaft and gear
Shaft Seal: Long-life, maintenance free, self-adjusting mechanical seal



Testing: Hydrostatic and performance test conducted at Hale's facility
Priming: 12V ESP Environmentally Safe Oil-less Primer.

Engine

Model: John Deere 4024TF270
Type: In-line, 4-cycle, 4-cylinder
Cooling: Water cooled radiator
Rating: 60 gross HP at 2800 RPM
Fuel: Diesel
Electrical: 12 volt starter, 12 volt alternator
Air Filter: Dry element type

Configuration

(For Apparatus builder mounting)
Compact, open mounting for chassis installation
Full radiator engine cooling
Air cleaner, mounted
No fuel tank
Electric priming system (shipped loose)
Equipped for a Vernier throttle
Spark Arrest Muffler
Remote mountable gauge panel

Accessories

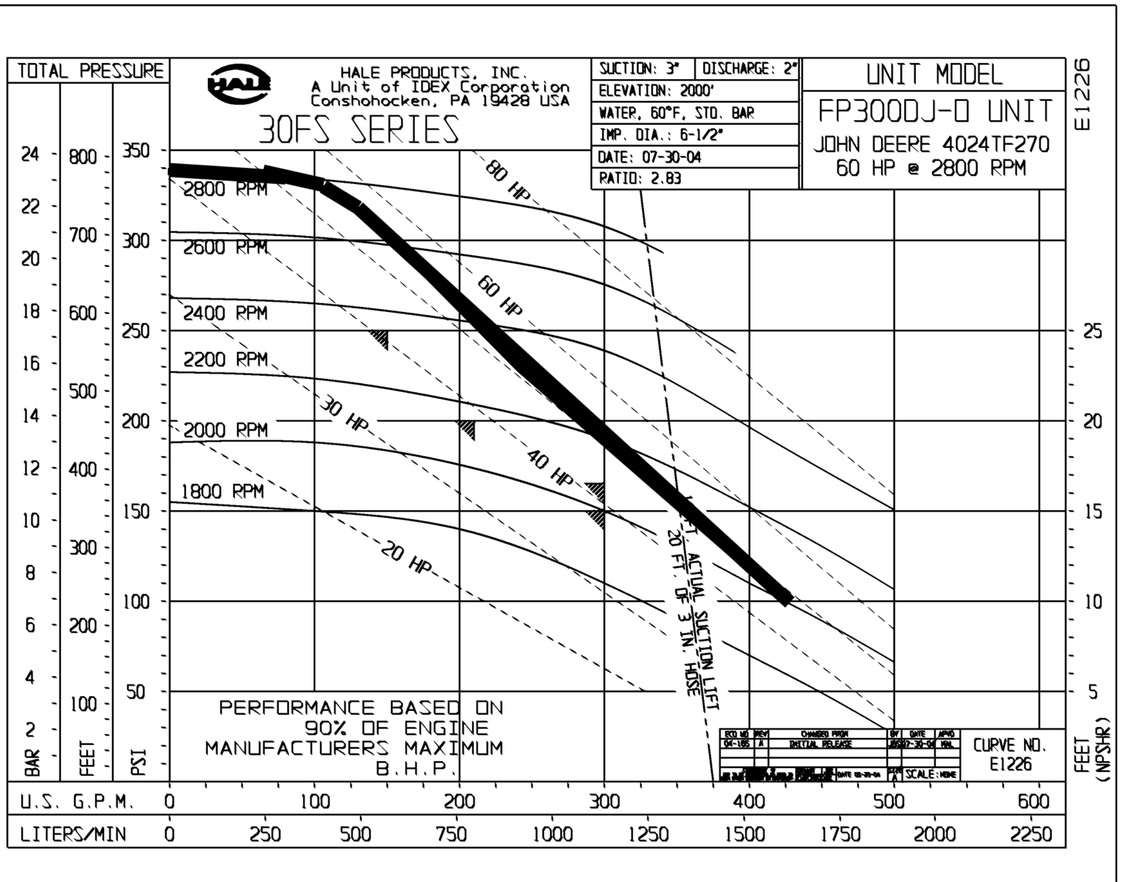
Thermal Relief Valve

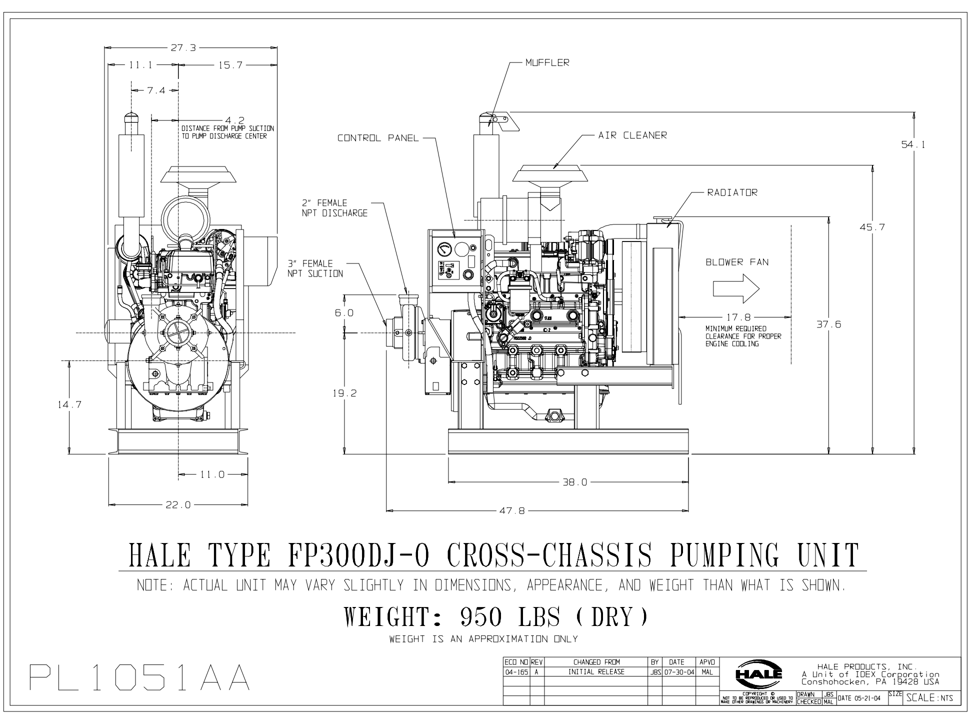
Weight and Dimensions

Weight: 950 pounds
Length: 47.8 inches
Width: 27.3 inches
Height: 45.7 inches (without muffler)
(Weights and dimensions are approximate)

DIESEL PUMPS

Note: This engine driven unit requires adequate ventilation for proper operation.





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HP550

“Minuteman” Portable Pump

The Hale HP550 portable pump is fully self-contained, high-performance unit designed to provide continuous performance of 250 GPM at 150 PSI from a ten-foot draft. When connected to a tank, the HP550 can provide over 500 GPM at 90 PSI.

FEATURES AND BENEFITS

- Wraparound protective stainless steel frame with swing-out handles
- Full instrumentation
- Closed circuit cooling system with heat exchanger
- Vertical shaft, four stroke Honda engine with battery
- Electronic engine overspeed protection
- Engine protection system initiated by high water temperature or low oil pressure automatically slows engine until problem is cleared, then returns to required speed. Problem area will be indicated by warning light.
- No external belts
- Rotationally molded 3.7 gallon fuel tank
- Remote fuel tank connection ability
- Exhaust gas ejection priming system
- Equipped with Thermal Relief Valve (TRV)
- Four inch N.S.T. Victaulic® male suction inlet connection
- Two each 2-1/2 inch N.S.T. male screw down valves with hose bleeders
- Priming up to 25 feet

PERFORMANCE RATINGS
500 GPM @ 90 PSI
250 GPM @ 150 PSI
100 GPM @ 200 PSI
10 GPM @ 240 PSI

TECHNICAL SPECIFICATIONS

Engine (Battery included)

Honda 3 cylinder vertical crankshaft, 4 stroke. Electronic ignition system. The engine rated power is 50 HP at 6000 RPM using 86 octane unleaded gas.

Pump

All aluminum horizontal pump case with horizontal 4-inch Victaulic suction and twin 2-1/2 inch N.S.T. male discharge valves with hose bleeders. Self-adjusting, no maintenance mechanical seal.

Lubrication

Pressure lubrication by trochoid pump. 2.5 quart capacity oil sump, integral oil cooler.

Fuel System

Capacity 3.7 gallon suitable for one hour running time. Combined filler cap and level gauge.

PORTABLE PUMPS

Hale® Products, Inc. ***A Unit of IDEX Corp.*** 700 Spring Mill Avenue Conshohocken, PA 19428 USA
TEL: 610/825-6300 1-800/220-HALE FAX: 610/825-9615 www.haleproducts.com
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HALE®

HP550

"Minuteman" Portable Pump

PORTABLE PUMPS

Lubrication
Pressure lubrication by trochoid pump. 2.5 quart capacity oil sump, integral oil cooler.

Fuel System
Capacity 3.7 gallon suitable for one hour running time. Combined filler cap and level gauge.

Electrical
10 AMP alternator (flywheel mounted). 12-Volt electric starter. 12-Volt/18A/hour maintenance free battery.

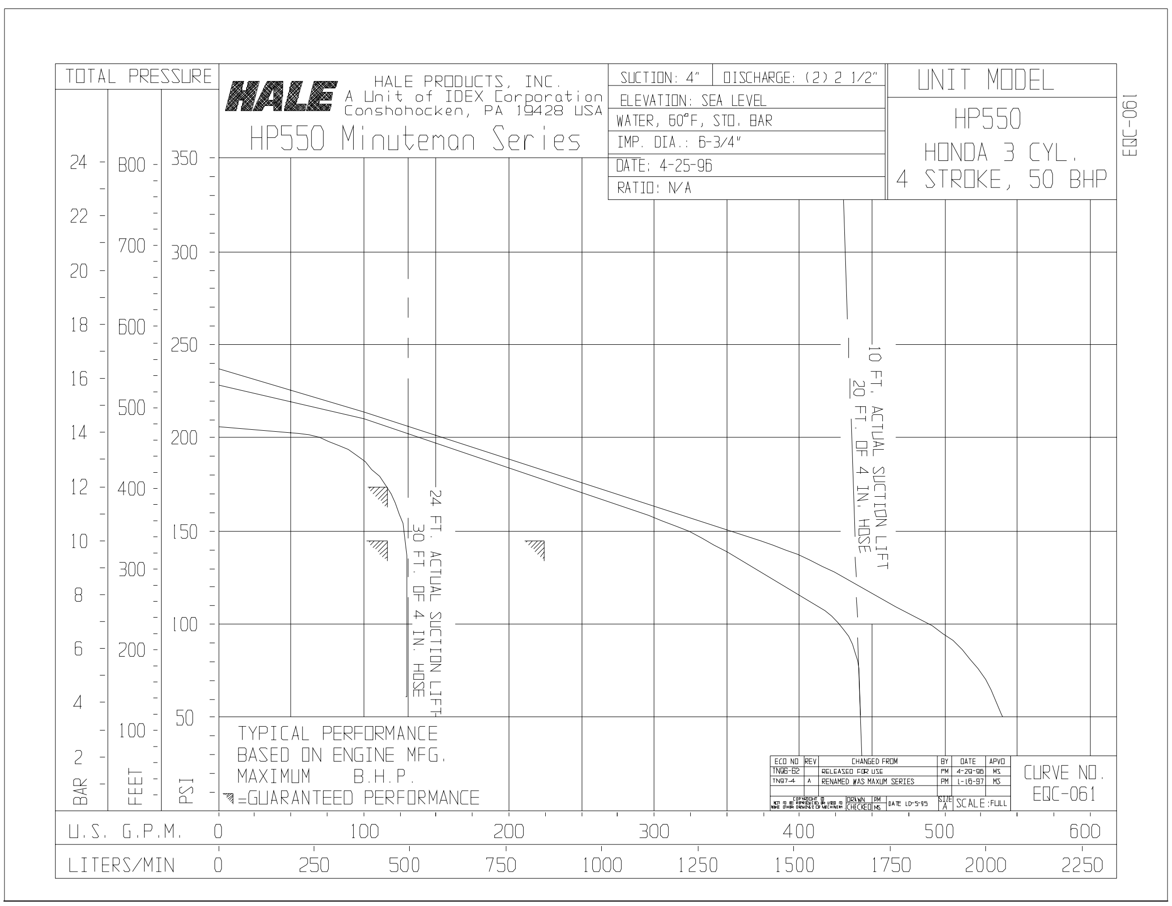
Cooling
System capacity - 1.6 gallons (6 liters)
System pressure - 14.5 PSI (1 BAR)
Direct driven positive displacement circulating pump. Shell and tube heat exchanger with pressure cap.

Dimensions
Length: 26.57 inch (675 mm)
Width: 19.53 inch (496 mm)
Height: 23.85 inch (606 mm)
Weight (dry): 209 pounds (95 Kg)
Weight (wet): 254 pounds (115 Kg)

Options
Separate fuel tank with quick release connector

HP550 with special apticote coating for seawater/marine applications
Part Number..... 545-4100-02-0

HP550 with bronze option
Part Number..... 545-4100-04-0



20FV-C8 and 20FP-C8
Fyr Flote Portable Floating Pumps

The Fyr Flote is a lightweight, portable centrifugal pump mounted on an unsinkable, high-strength polyethylene float with dual carrying handles and a splash suppression collar. A high-volume model (20FV-C8) and a high-pressure model (20FP-C8) meet most every pump need —in as little as four inches of water. Weighing just 49 pounds, the Fyr Flote stores easily in most truck compartments. It includes an automatic recoil starter, a spark arresting muffler, and an engine overspeed control switch.

Technical Specifications

Pump

Type: Centrifugal, bolted to engine.
Suction: Two inch, non-threaded, with easily removable oversized screen.
Discharge: One and half inch NST male.
Head: Lightweight, high strength, corrosion resistant aluminum alloy.
Volute: High strength aluminum alloy with machined waterways for maximum performance.
Impeller: Bronze enclosed type for maximum efficiency.
Clearance Rings: Patented floating bronze clearance ring for minimum clearance, to prevent rubbing, seizing, and alignment problems.
Pump Shaft: Engine's vertical shaft serves as pump shaft, protected against corrosion by a bronze sleeve.
Shaft Seal: Self-adjusting, self-lubricated using a special ceramic seat for wear and shock resistance.
Priming: Exclusive auto prime system works without a suction hose.

Engine

Make: U. S. Motor Power Inc.
Type: Single cylinder, two-cycle gasoline.
Horsepower: 8 HP at 7,000 RPM.
Cooling: Forced air.
Starting: Water-resistant, solid state ignition.
Air Filter: Wire mesh element protects against impurities.
Fuel Filter: 75 micron in-line fuel filter; a fuel strainer is built in to the fuel pump.

Options

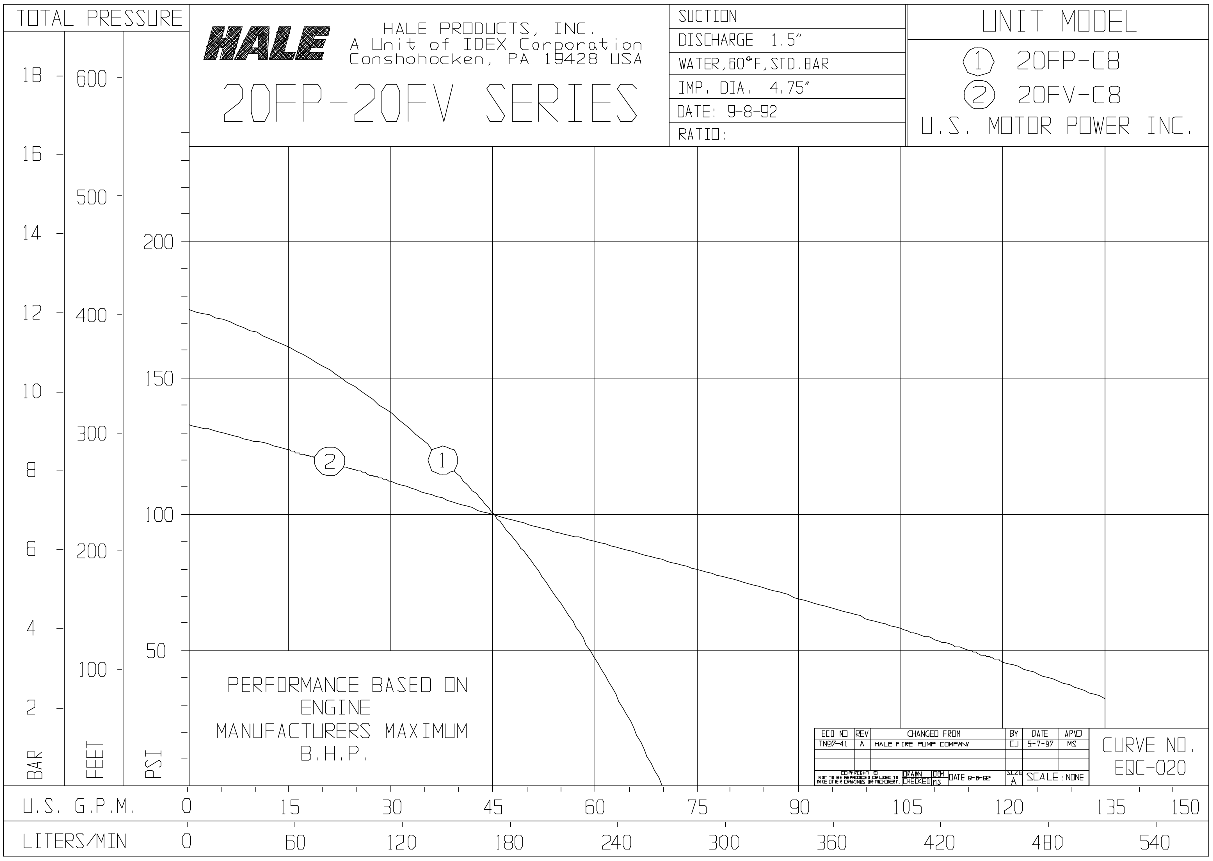
Stowaway Accessory Package
100 feet x 1-1/2 inch hose, adjustable nozzle, tune-up kit, and one quart N.M.M.A (BIA) approved 2-cycle engine oil in canvas bag.

Dimensions

Length: 28.25 inches (718 mm)
Width: 20 inches (508 mm)
Height: 16 inches (406 mm)
Weight: 49 pounds (22 kg)

Ordering Part Numbers

20FV-C8: 545-2121-00-0
20FP-C8: 545-2131-00-0



	High Volume 20FV-C8		High Pressure 20FP-C8	
	95% Max. BPH			
GPM (LPM)	PSI	BAR	PSI	BAR
10 (38)	125	8.6	170	11.7
50 (190)	95	6.6	90	6.2
140 (530)	25	1.7	---	---

HALE **IDEX**

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FAX: (65) 764-4020

Printed in U.S.A. Bulletin 695 , Rev. 1 3/98

Fyr Port

Portable Pump

PORTABLE PUMPS

Features and Benefits

- ***High pressure performance***
- ***Compact, very lightweight design***
- ***High horsepower/weight ratio***
- ***One man portability***

The Fyr Port series portable pumps are specially designed for applications involving high pressure.

Standard features include brass piston type hand primer, recoil starting, and an 8-horsepower two-cycle engine which offers high horsepower in a small package. Two different mounting options are available — skid (20FP-C8SK) or wraparound frame (20FP-C8FR). The complete pumping unit weighs in at a mere 50 pounds — ideal for one-man portability.

Technical Specifications

Pump

Type: Single stage centrifugal bolted directly to engine
Suction: 1-1/2” Female NST thread
Discharge: 1-1/2” Female NST thread
Volute and Head: High strength corrosion resistant aluminum alloy with machined waterways for maximum performance
Impeller: Hard fine grain bronze, fully machined and hand balanced with smooth internal waterways and mixed flow vanes for maximum efficiency.
Clearance Rings: “Floating” bronze for minimum clearance
Pump Shaft: Engine's horizontal shaft serves as pump shaft, protected against corrosion by a bronze sleeve

Shaft Seal: Long life, maintenance-free self-adjusting, self-lubricated using a special ceramic seat for wear and shock resistance
Priming: Compact, hand operated, piston type brass priming pump
Testing: Performance tested

Engine

Make: U. S. Motor Power Inc.
Type: Single cylinder, two-cycle air cooled
Horsepower: 8 HP at 7,000 RPM
Governing: Electrical overspeed protection
Lubrication: Oil/Gas mixture
Starting: Recoil type starting
Air Filter: Dry element type
Exhaust: Spark arresting

Dimensions

Length: 17.5 inches (445 mm)
Width: 16 inches (406 mm)
Height: 19.5 inches (495 mm)
Weight: 50 pounds (23 kg)

Options

Hose Package: Contains 100 feet of 1-1/2” fire hose, adjustable nozzle, tune-up kit, and 2-cycle oil in a canvas carrying bag.

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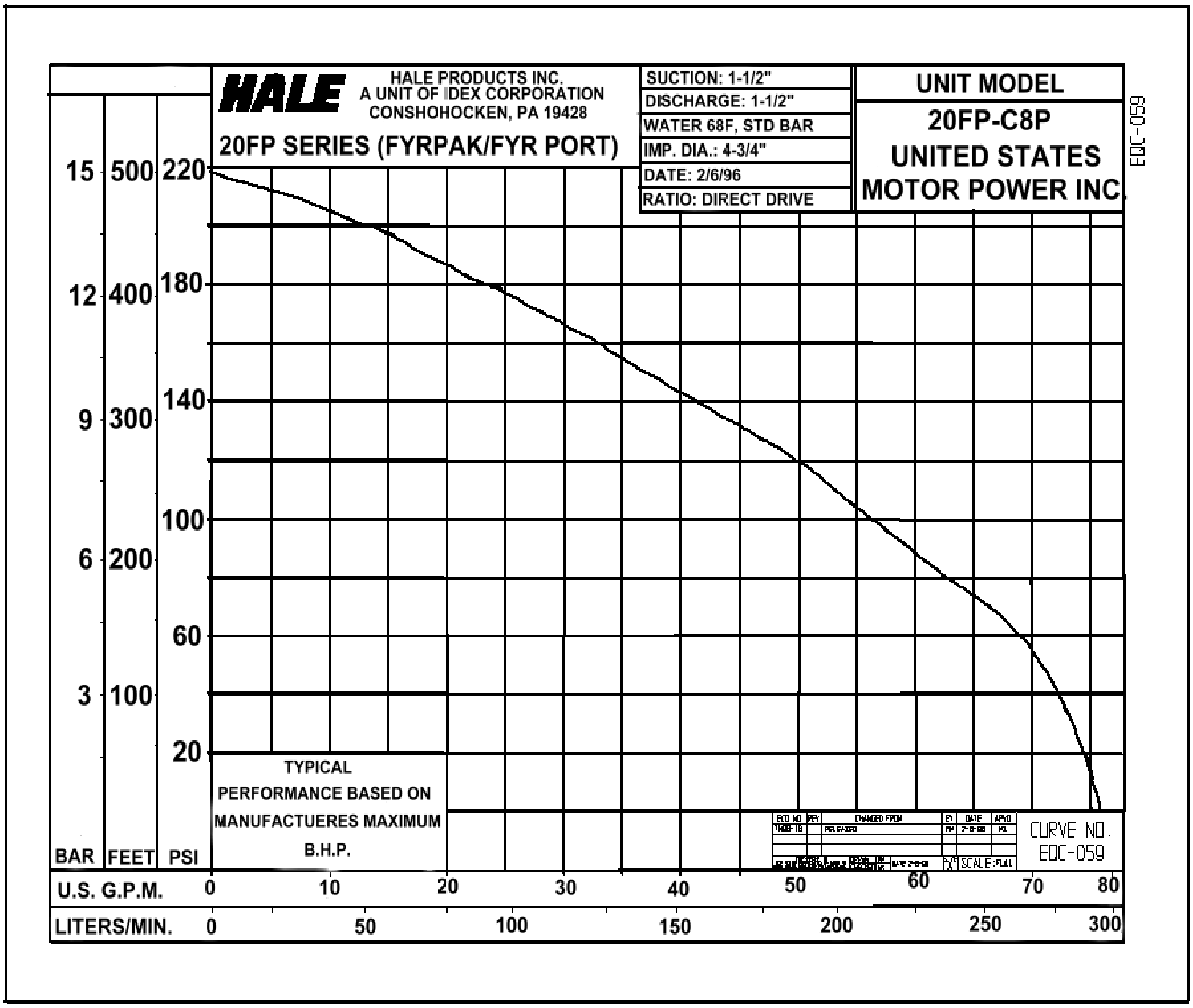
Fyr Port

Portable Pump



PORTABLE PUMPS

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Fyr Pak
Backpack Pump

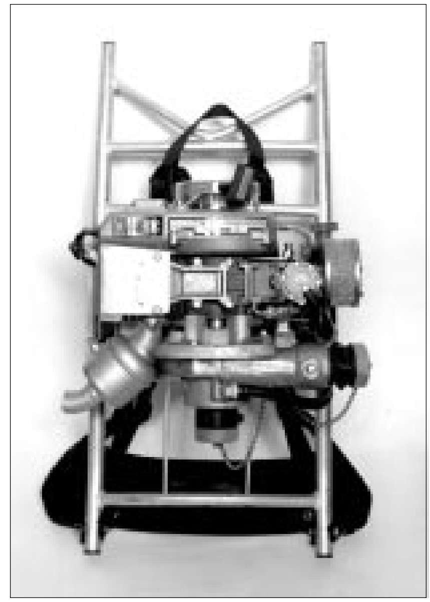
The Fyr Pak is a lightweight portable centrifugal pump mounted on a padded adjustable backpack frame. Weighting only 34 pounds, the Fyr Pak can pump water from draft, relay or hydrant. It can go where a fire engine can't reach. It will deliver discharge pressures up to 220 PSI (15.5 bar) and flows to 75 GPM (285 LPM) from draft. The unit includes an automatic recoil starter, a spark resisting muffler, an engine overspeed control switch, a priming pump, and a priming valve.

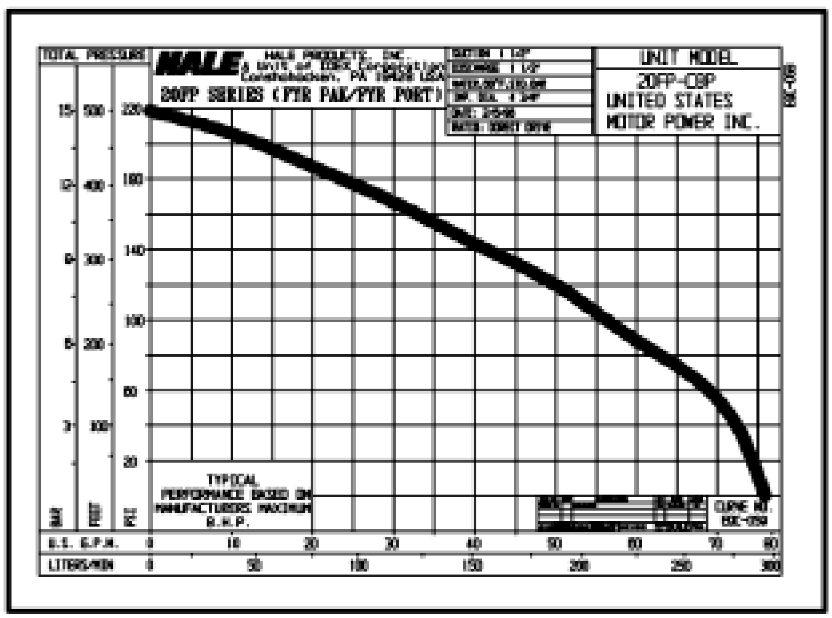
Technical Specifications

Pump

Model and Type: Centrifugal, bolted to engine
Suction: 1-1/2 inch Male NST
Discharge: 1-1/2 inch Male NST
Head: Lightweight, high strength, corrosion resistant aluminum alloy
Volute: High strength aluminum alloy with machined waterways for maximum performance.
Impeller: Bronze enclosed type for maximum efficiency
Clearance Rings: Patented floating bronze clearance ring for minimum clearance to prevent rubbing, seizing, and alignment problems.
Pump Shaft: Engine's horizontal shaft serves as pump shaft, protected against corrosion by a bronze sleeve.
Shaft Seal: Self-adjusting, self-lubricated using a special ceramic seat for wear and shock resistance.
Priming: Compact hand operated position type brass priming pump provided

Engine
Make: U.S. Motor Power Inc.
Type: Single cylinder, two-cycle gasoline
Horsepower: 8 HP at 7,000 RPM
Cooling: Forced Air
Starting: Water-resistant, solid state ignition





Air Filter: Wire mesh element protects against impurities
Fuel Filter: 75 micron in-line fuel filter; an integral fuel strainer is built into the fuel pump.

OPTIONS

Stowaway Accessory Package:
100 feet x 1-1/2 inch hose, adjustable nozzle, tune-up kit, and one quart N.M.M.A. (BIA) approved 2-cycle engine oil in a canvas carrying bag.
(Part Number: 546-1060-01-0)
Maintenance hourmeter: LCD display
(Part Number: 200-0780-06-0)

Weight & Dimensions

Weight: 34 pounds (15.5 kg)
Length: 32 inches (813 mm)
Width: 16.5 inches (420 mm)
Height: 13 inches (330 mm)

Ordering Part Number

545-2140-00-0

Hale Products
Fire Suppression Equipment Group
A Unit of IDEX Corp.
700 Spring Mill Avenue
Conshohocken, PA 19428
TEL: 610/825-6300
FAX: 610/825-9615
www.haleproducts.com

Class 1
Fire Suppression Equipment Group
A Unit of IDEX Corp.
607 NW 27th Avenue
Ocala FL 34475
Tel: 352-629-5020
www.class1.com

MADE IN THE USA

Super Chief

Portable Floating Pump

PORTABLE PUMPS

Features and Benefits

- ***Float assembly folds in half for easy storage in truck compartments***
- ***Engine and pump assembly quickly detaches from float.***
- ***The entire lightweight package easily transports and allows carriage by two people***
- ***Pump output exceeds 420 GPM/1590 LPM***
- ***Ideal for drafting from ponds, streams or lakes, the unit operates in only three inches of water***

The new Super Chief has a unique design specially engineered for the fire service. The pump and engine assembly detach easily from the float. The float folds in half for convenient storage in most apparatus compartments.

The Super Chief is the pump to count on when you cannot count on hydrants. Easily used with alternative water sources such as streams, lakes, or pools, the Super Chief requires only three inches of water to draft.

The Super Chief delivers a flow of 420 GPM (1590 LPM) with one discharge port or a maximum pressure of 50 PSIG. Ideal for drafting from streams or ponds, the Super Chief can also throw a stream of water more than 90 feet for direct firefighting capabilities.

With a positive-type rewind starter and high tension magnetic ignition system, the Super Chief starts up when you need it. The 4-cycle, air-cooled Briggs & Stratton® gasoline engine is designed for reliable performance and runs for more than an hour at full throttle on one tank of gas.

The Super Chief is designed for easy maintenance. With corrosion resistant aluminum castings in the pump housing and impeller, the Super Chief can run dry for a maximum of 2 minutes without damage. The collapsible float assembly is almost unsinkable and extremely tough, made with a high density polyethylene shell filled with closed-cell polyurethane foam.

Super Chief

Portable Floating Pump

HALE®

PORTABLE PUMPS

Specifications

Size:

30 in x 30 in x 23 in.

760 mm x 760 mm x 585 mm

Shipping Weight:

131 lbs. (59.42 kg)

Net Weight: 118 lbs (53.5 kg)

Pump: 86 lbs (39.0 kg)

Float: 32 lbs (14.5 kg)

Part Numbers:

545-4091-07-0 Super Chief (NST Thread)

545-4091-08-0 Super Chief (ISO Thread)

Engine Capacitites:

Gas Tank: 3.1 quarts (2.8 Liters)

Oil: 1.5 Quarts (1.4 Liters)

Engine: Briggs & Stratton® Series Intek™ Series 11 HP, 3600 RPM @ no load. 21 cubic inch/344cc; single cylinder overhead valve (OHV) design. Advanced Anit-Vibration System (AVS™)

Pump Body: 0.5 inches (1.2 cm) cast aluminum alloy with built-in suction guard and skids.

Discharge: 2.5 NST male or ISO228/1-G21/2A parallel pipe; 3" (76 mm) hose diameter recommended for full output.

Float: High density polyethylene shell filled with closed-cell polyurethane foam.

Pump Performance:

Max. head pressure: 50 psi (3.4 Bar)

Max. head: 115 feet (35 meters)

Max. output: 425 GPM (1609 LPM)

 ●

MOBILE EQUIPMENT SALES CATALOG

Specifications

HALE

Class 1

PUMP SPECIFICATIONS

Chief III

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.

Performance
The pump shall weight no more than 127 pounds (dry) and produce a typical performance of 400 GPM @ 10 PSI, 225 GPM @ 25 PSI and 100 GPM @ 35 PSI

Pump
The pump body shall be made of alloy aluminum castings bolted to the engine. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type.

Suction
The pump suction shall include a bottom suction guard and skids.

Discharge
The discharge ports shall be 2-1/2” NH Hose Threaded connections.

Engine
The engine shall be a 4 cycle gasoline heavy-duty Briggs and Stratton Briggs 288700I/C air cooled design. Engine rating shall be 10.5 BHP. Engine shall be designed to meet 1994 CARB (California Air Resources Board) standards. Engine shall be equipped with a muffler and mounted fuel tank.

Float
The pump/engine shall be mounted on an unsinkable, high-strength polyethylene shell filled with a closed-cell polyurethane foam float which is removable from engine/pump assembly for easy handing and service. The pump/engine assembly shall include a wraparound handle.

20FV-C8 Fyr Flote

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.

Performance
The pump shall weight no more than 50 pounds (dry) and produce a typical performance of 135 GPM @ 25 PSI, 85 GPM @ 75 PSI and 15 GPM @ 125 PSI.

Pump
The pump body shall be made of alloy aluminum castings bolted to the engine. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type.

Suction
The pump suction shall be 2: with removable oversized screen

Discharge
The discharge ports shall be 1-1/2" NH Hose Thread connectors.

Engine
The engine shall be a 2 cycle gasoline U. S. Motor Power air cooled design. Engine rating shall be 8 BHP at 7000 rpm. Engine shall be designed to meet 1994 CARB (California Air Resources Board) standards. Engine shall be equipped with a muffler and mounted fuel tank.

Float
The pump/engine shall be mounted on an unsinkable, high-strength polyethylene float with dual carrying handles and a splash suppression collar.

Hale Products Inc. A Unit of IDEX Corporation, 700 Spring Mill Ave., Conshohocken, PA 19428
Phone: 610-825-6300, Fax: 610-825-6440, www.haleproducts.com

20FP-C8 Fyr Flote

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.

Performance
The pump shall weight no more than 50 pounds (dry) and provide a typical performance of 65 GPM @ 25 PSI, 45 GPM @ 100 PSI and 25 GPM @ 150 PSI.

Pump
The pump body shall be made of alloy aluminum castings bolted to the engine. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type.

Suction
The pump suction shall be 2: with removable oversized screen

Discharge
The discharge ports shall be 1-1/2” NH Hose Thread connectors.

Engine
The engine shall be a 2 cycle gasoline U. S. Motor Power air cooled design. Engine rating shall be 8 BHP at 7000 rpm. Engine shall be designed to meet 1994 CARB (California Air Resources Board) standards. Engine shall be equipped with a muffler and mounted fuel tank.

Float
The pump/engine shall be mounted on an unsinkable, high-strength polyethylene float with dual carrying handles and a splash suppression collar.

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PUMP SPECIFICATIONS

20FP-C8FR Fyr Port

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.

Performance
The pump/engine shall weight no more than 50 pounds (dry) and produce a typical performance of 65 GPM @ 25 PSI, 45 GPM @ 100 PSI, 25 GPM @ 150 PSI.

Pump
The pump body shall be made of alloy aluminum castings bolted to the engine. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type.

Suction
The pump suction shall be 1-1/2” NH Hose Thread connection.

Discharge
The discharge ports shall be 1-1/2” NH Hose Thread connector.

Engine
The engine shall be a 2 cycle gasoline U. S. Motor Power air cooled design. Engine rating shall be 8 BHP at 7000 rpm. Engine shall be designed to meet 1994 CARB (California Air Resources Board) standards. Engine shall be equipped with a muffler and mounted fuel tank.

Wraparound Frame
The pump/engine shall be isolation mounted into a wraparound frame. A hand operated primer shall be provided.

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PUMP SPECIFICATIONS

20FP-C8SK Fyr Port

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.

Performance
The pump/engine shall weight no more than 50 pounds (dry) and produce a typical performance of 65 GPM @ 25 PSI, 45 GPM @ 100 PSI, 25 GPM @ 50 PSI.

Pump
The pump body shall be made of alloy aluminum castings bolted to the engine. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type.

Suction
The pump suction shall be 1-1/2” NH Hose Thread connection.

Discharge
The discharge ports shall be 1-1/2” NH Hose Thread connector.

Engine
The engine shall be a 2 cycle gasoline U. S. Motor Power air cooled design. Engine rating shall be 8 BHP at 7000 rpm. Engine shall be designed to meet 1994 CARB (California Air Resources Board) standards. Engine shall be equipped with a muffler and mounted fuel tank.

Skid Mount
The pump/engine shall be isolation mounted on a frame for apparatus mounting. A hand operated primer shall be provided.

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PUMP SPECIFICATIONS

20FP-C8P Fyr Pak

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.

Performance
The pump/engine shall weight no more than 35 pounds (dry) and produce a typical performance of 65 GPM @ 25 PSI, 45 GPM @ 100 PSI, 25 GPM @ 150 PSI.

Pump
The pump body shall be made of alloy aluminum castings bolted to the engine. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type.

Suction
The pump suction shall be 1-1/2" NH Hose Thread connection.

Discharge
The discharge ports shall be 1-1/2" NH Hose Thread connector.

Engine
The engine shall be a 2 cycle gasoline U. S. Motor Power air cooled design. Engine rating shall be 8 BHP at 7000 rpm. Engine shall be designed to meet 1994 CARB (California Air Resources Board) standards. Engine shall be equipped with a muffler and remote fuel tank.

Backpack
The pump/engine shall be isolation mounted on a padded, adjustable backpack frame. A hand operated primer shall be provided.

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PUMP SPECIFICATIONS

HP75-B18 Portable Pump

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.

Performance
The pump/engine shall perform to the standards of ISO 9 and NFPA 1906 high pressure 20 GPM rating and medium pressure rating of 90 GPM. Typical pump performance from 5 foot draft at sea level shall be: 15 GPM @ 325 PSI, 105 GPM @ 150 PSI, and 130 GPM @ 50 PSI.

Pump
The pump body shall be made of alloy aluminum castings coupled together with a stainless steel band clamp with an O-ring seal which allows quick pump volute removal for servicing. The pump end shall be factory hydrostatically tested to 400 PSI for 10 minutes. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The impeller shall be 4.875 inches in diameter and designed with a sleeve back end to prevent water from coming in contact with the engine shaft. To obtain the required pressures, a built-in oil bath lubricated gearbox shall be provided between the pump end and engine. The gearbox shall be coupled together with a stainless steel band clamp. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type. The pump body shall be equipped with a petcock drain valve.

Priming
The pump shall be equipped with an exhaust venture primer of brass and stainless steel construction. The primer shall be capable of 20 inches of mercury vacuum. The primer shall be actuated with a spring return, single control lever located at the operator's panel. The primer to pump line shall be equipped with an automatic check valve for priming form an open body of water and a manual shut-off for pumping from a pressurized water source.

Suction/Discharge
The suction and discharge ports shall be female pipe thread, designed and located to accept applicable hose thread adapters. The discharge shall be equipped with a 175^{o} swivel, 10^{o} droop, gateable, screw down valve. This valve shall also be equipped with an automatic check valve for priming and a drain cock valve to relieve discharge hose pressure.

Engine
The engine shall be a 4 cycle gasoline Briggs and Stratton Vanguard series 350400 V Twin, overhead valve, air cooled design. Engine rating shall be 18 BHP at 4000 rpm with a torque of 30 lb-ft at 2600 rpm. Engine displacement shall be 570cc and shall be designed to meet 1994 CARB (California Air Resources Board) standards. A 12-volt electric system shall be provided with electric starter and a 16 amp alternator. Recoil backup engine starting shall be provided. Engine shall be equipped with a residential muffler with USDA approved spark arrestor and a removable heat isolation blanket.

Enclosure
The pump/engine shall be isolation mounted onto a cross linked polyethylene platform which also serves as a 3 gallon fuel tank. A steel wraparound frame over the engine shall be equipped with hinged and removable side and top enclosure panels which reduce noise levels and improve appearance and safety.

Instrumentation
The pump shall be supplied with a remote mounted control panel. This panel shall include a throttle lever, primer lever, master switch, starter button, choke control, a 2.5 inch liquid filled discharge gauge and an oil pressure warning light.

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PUMP SPECIFICATIONS

HP100-B18 Portable Pump

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.

Performance
The pump/engine shall perform to the standards of ISO 9 and NFPA 1906 medium pressure 30 GPM rating. Typical pump performance from 5 foot draft at sea level shall be: 15 GPM @ 280 PSI, 100 GPM @ 150 PSI, and 150 GPM @ 50 PSI

Pump
The pump body shall be made of alloy aluminum castings coupled together with a stainless steel band clamp with an O-ring seal which allows quick pump volute removal for servicing. The pump end shall be factory hydrostatically tested to 400 PSI for 10 minutes. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The impeller shall be 4.875 inches in diameter and designed with a sleeve back end to prevent water from coming in contact with the engine shaft. To obtain the required pressures, a built-in oil bath lubricated gearbox shall be provided between the pump end and engine. The gearbox shall be coupled together with a stainless steel band clamp. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type. The pump body shall be equipped with a petcock drain valve.

Priming
The pump shall be equipped with an exhaust venture primer of brass and stainless steel construction. The primer shall be capable of 20 inches of mercury vacuum. The primer shall be actuated with a spring return, single control lever located at the operator’s panel. The primer to pump line shall be equipped with an automatic check valve for priming form an open body of water and a manual shut-off for pumping from a pressurized water source.

Suction/Discharge
The suction and discharge ports shall be female pipe thread, designed and located to accept applicable hose thread adapters. The discharge shall be equipped with a 175^{o} swivel, 10^{o} droop, gateable, screw down valve. This valve shall also be equipped with an automatic check valve for priming and a drain cock valve to relieve discharge hose pressure.

Engine
The engine shall be a 4 cycle gasoline Briggs and Stratton Vanguard series 350400 V Twin, overhead valve, air cooled design. Engine rating shall be 18 BHP at 4000 rpm with a torque of 30 lb-ft at 2600 rpm. Engine displacement shall be 570cc and shall be designed to meet 1994 CARB (California Air Resources Board) standards. A 12-volt electric system shall be provided with electric starter and a 16 amp alternator. Recoil backup engine starting shall be provided. Engine shall be equipped with a residential muffler with USDA approved spark arrestor and a removable heat isolation blanket.

Enclosure
The pump/engine shall be isolation mounted onto a cross linked polyethylene platform which also serves as a 3 gallon fuel tank. A steel wraparound frame over the engine shall be equipped with hinged and removable side and top enclosure panels which reduce noise levels and improve appearance and safety.

Instrumentation
The pump shall be supplied with a remote mounted control panel. This panel shall include a throttle lever, primer lever, master switch, starter button, choke control, a 2.5 inch liquid filled discharge gauge and an oil pressure warning light.

PUMP SPECIFICATIONS

HP200-B18 Portable Pump

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.

Performance
The pump/engine shall perform to the standards of ISO 9 and NFPA 1906 low pressure pump rating. Typical pump performance from 5 foot draft at sea level shall be: 60 GPM @ 150 PSI, 150GPM @ 100 PSI, and 245 GPM @ 25 PSI.

Pump
The pump body shall be made of alloy aluminum castings coupled together with a stainless steel band clamp with an O-ring seal which allows quick pump volute removal for servicing. The pump end shall be factory hydrostatically tested to 250 PSI for 10 minutes. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The impeller shall be 8.75 inches in diameter and designed with a sleeve back end to prevent water from coming in contact with the engine shaft. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type. The pump body shall be equipped with a petcock drain valve.

Priming
The pump shall be equipped with an exhaust venture primer of brass and stainless steel construction. The primer shall be capable of 20 inches of mercury vacuum. The primer shall be actuated with a spring return, single control lever located at the operator's panel. The primer to pump line shall be equipped with an automatic check valve for priming form an open body of water and a manual shut-off for pumping from a pressurized water source.

Suction/Discharge
The suction and discharge ports shall be female pipe thread, designed and located to accept applicable hose thread adapters. The discharge shall be equipped with a 175^{o} swivel, 10^{o} droop, gateable, screw down valve. This valve shall also be equipped with an automatic check valve for priming and a drain cock valve to relieve discharge hose pressure.

Engine
The engine shall be a 4 cycle gasoline Briggs and Stratton Vanguard series 350400 V Twin, overhead valve, air cooled design. Engine rating shall be 18 BHP at 4000 rpm with a torque of 30 lb-ft at 2600 rpm. Engine displacement shall be 570cc and shall be designed to meet 1994 CARB (California Air Resources Board) standards. A 12-volt electric system shall be provided with electric starter and a 16 amp alternator. Recoil backup engine starting shall be provided. Engine shall be equipped with a residential muffler with USDA approved spark arrestor and a removable heat isolation blanket.

Enclosure
The pump/engine shall be isolation mounted onto a cross linked polyethylene platform which also serves as a 3 gallon fuel tank. A steel wraparound frame over the engine shall be equipped with hinged and removable side and top enclosure panels which reduce noise levels and improve appearance and safety.

Instrumentation
The pump shall be supplied with a remote mounted control panel. This panel shall include a throttle lever, primer lever, master switch, starter button, choke control, a 2.5 inch liquid filled discharge gauge and an oil pressure warning light.

Hale Products Inc. A Unit of IDEX Corporation, 700 Spring Mill Ave., Conshohocken, PA 19428
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PUMP SPECIFICATIONS

HP300-B18 Portable Pump

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.

Performance
The pump/engine shall perform to the standards of CEN 6/5 and NFPA 1906 low pressure pump rating. Typical pump performance from 5 foot draft at sea level shall be: 150 GPM @ 100 PSI, 250 GPM @ 75 PSI, and 380 GPM @ 25 PSI.

Pump
The pump body shall be made of alloy aluminum castings coupled together with a stainless steel band clamp with an O-ring seal which allows quick pump volute removal for servicing. The pump end shall be factory hydrostatically tested to 200 PSI for 10 minutes. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The impeller shall be 8.75 inches in diameter and designed with a sleeve back end to prevent water from coming in contact with the engine shaft. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type. The pump body shall be equipped with a petcock drain valve.

Priming
The pump shall be equipped with an exhaust venture primer of brass and stainless steel construction. The primer shall be capable of 20 inches of mercury vacuum. The primer shall be actuated with a spring return, single control lever located at the operator's panel. The primer to pump line shall be equipped with an automatic check valve for priming form an open body of water and a manual shut-off for pumping from a pressurized water source.

Suction/Discharge
The suction and discharge ports shall be female pipe thread, designed and located to accept applicable hose thread adapters. The discharge shall be equipped with a 175^{o} swivel, 10^{o} droop, gateable, screw down valve. This valve shall also be equipped with an automatic check valve for priming and a drain cock valve to relieve discharge hose pressure.

Engine
The engine shall be a 4 cycle gasoline Briggs and Stratton Vanguard series 350400 V Twin, overhead valve, air cooled design. Engine rating shall be 18 BHP at 4000 rpm with a torque of 30 lb-ft at 2600 rpm. Engine displacement shall be 570cc and shall be designed to meet 1994 CARB (California Air Resources Board) standards. A 12-volt electric system shall be provided with electric starter and a 16 amp alternator. Recoil backup engine starting shall be provided. Engine shall be equipped with a residential muffler with USDA approved spark arrestor and a removable heat isolation blanket.

Enclosure
The pump/engine shall be isolation mounted onto a cross linked polyethylene platform which also serves as a 3 gallon fuel tank. A steel wraparound frame over the engine shall be equipped with hinged and removable side and top enclosure panels which reduce noise levels and improve appearance and safety.

Instrumentation
The pump shall be supplied with a remote mounted control panel. This panel shall include a throttle lever, primer lever, master switch, starter button, choke control, a 2.5 inch liquid filled discharge gauge and an oil pressure warning light.

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PUMP SPECIFICATIONS

HP400-B18 Portable Pump

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.

Performance
Typical pump performance from 5 foot draft at sea level shall be: 90 GPM @ 100 PSI, 340 GPM @ 50 PSI, and 460 GPM @ 25 PSI.

Pump
The pump body shall be made of alloy aluminum castings coupled together with a stainless steel band clamp with an O-ring seal which allows quick pump volute removal for servicing. The pump end shall be factory hydrostatically tested to 200 PSI for 10 minutes. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The impeller shall be 7.25 inches in diameter and designed with a sleeve back end to prevent water from coming in contact with the engine shaft. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type. The pump body shall be equipped with a petcock drain valve.

Priming
The pump shall be equipped with an exhaust venture primer of brass and stainless steel construction. The primer shall be capable of 20 inches of mercury vacuum. The primer shall be actuated with a spring return, single control lever located at the operator's panel. The primer to pump line shall be equipped with an automatic check valve for priming form an open body of water and a manual shut-off for pumping from a pressurized water source.

Suction/Discharge
The suction and discharge ports shall be female pipe thread, designed and located to accept applicable hose thread adapters. The discharge shall be equipped with two (2) 175^{o} swivel, 10^{o} droop, gateable, screw down valves. This valve shall also be equipped with an automatic check valve for priming and a drain cock valve to relieve discharge hose pressure.

Engine
The engine shall be a 4 cycle gasoline Briggs and Stratton Vanguard series 350400 V Twin, overhead valve, air cooled design. Engine rating shall be 18 BHP at 4000 rpm with a torque of 30 lb-ft at 2600 rpm. Engine displacement shall be 570cc and shall be designed to meet 1994 CARB (California Air Resources Board) standards. A 12-volt electric system shall be provided with electric starter and a 16 amp alternator. Recoil backup engine starting shall be provided. Engine shall be equipped with a residential muffler with USDA approved spark arrestor and a removable heat isolation blanket.

Enclosure
The pump/engine shall be isolation mounted onto a cross linked polyethylene platform which also serves as a 3 gallon fuel tank. A steel wraparound frame over the engine shall be equipped with hinged and removable side and top enclosure panels which reduce noise levels and improve appearance and safety.

Instrumentation
The pump shall be supplied with a remote mounted control panel. This panel shall include a throttle lever, primer lever, master switch, starter button, choke control, a 2.5 inch liquid filled discharge gauge and an oil pressure warning light.

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PUMP SPECIFICATIONS

HP550 Portable Pump

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.

Performance
The pump/engine shall perform to the standards of ISO 8 & 9 and NFPA 1906 low pressure pump rating and CEN 10/10. Typical pump performance from 10 foot draft at sea level shall be: 490 GPM @ 100 PSI, 350 GPM @ 150 PSI, and 50 GPM @ 225 PSI.

Pump
The pump body shall be a single stage centrifugal pump which is directly mounted to the engine. The pump body and impeller shall be made of aluminum alloy with the impeller hard anodized. The pump shaft shall be manufactured in stainless steel. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type. The pump body shall be equipped with a petcock drain valve.

Priming
The pump shall be equipped with an exhaust venture primer. The primer shall be capable of priming the pump to a depth of 25 feet in 24 seconds through 30 feet of 4” suction hose. The primer shall be actuated with a spring return, single control lever located at the operator’s panel. The primer to pump line shall be equipped with an automatic check valve for priming form an open body of water.

Suction/Discharge
The suction and discharge ports shall be NH hose thread connections, 4” suction and 2-1/2” discharge. The discharge shall be equipped with a screw down valve. This valve shall also be equipped with an automatic check valve for priming and a pull out knob to relieve discharge hose pressure.

Engine
The engine shall be a 4 cycle gasoline Honda three cylinder, overhead valve, liquid cooled design. Engine rating shall be 50 BHP. Engine displacement shall be designed to meet 1994 CARB (California Air Resources Board) standards. A 12-volt electric system shall be provided with electric starter and an alternator. Engine shall be equipped with a residential muffler.

Engine Cooling System
The engine shall be equipped with a closed circuit cooling system utilizing a heat exchanger of sufficient capacity to maintain correct engine operating temperature even when operating in high ambient temperatures. The system shall be closed circuit, anti-freeze can be used to prevent freezing in cold climates.

Starting from cold and with maximum priming conditions the cooling system capacity shall allow at least six priming attempts without the engine overheating. The pump shall be fitted with a Thermal Relief Valve which discharges water automatically if water is not moving through the pump and exceeds 108 degrees F. This device shall automatically close when cool water is introduced into the pump volute.

Carrying Frame
The pump/engine shall be mounted in a stainless steel tubular wraparound frame with four (4) swing out lifting handles. A built in 6 gallon fuel tank and battery system shall be supplied.

Instrumentation
The pump shall be supplied with a control and gauge for easy viewing. This includes a throttle lever, primer lever, master switch, starter button, choke control, a 2.5 inch liquid filled discharge gauge and an oil pressure warning light.

PUMP SPECIFICATIONS

HPT75-B18 Portable Pump

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.

Performance
The pump/engine shall perform to the standards of ISO 9 and NFPA 1906 high pressure rating @ 20 GPM and medium pressure rating of 90 GPM. Typical pump performance from 5 foot draft at sea level shall be: 15 GPM @ 325 PSI, 105 GPM @ 150 PSI, and 130 GPM @ 50 PSI.

Pump
The pump body shall be made of alloy aluminum castings coupled together with a stainless steel band clamp with an O-ring seal which allows quick pump volute removal for servicing. The pump end shall be factory hydrostatically tested to 400 PSI for 10 minutes. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The impeller shall be 4.875 inches in diameter and designed with a sleeve back end to prevent water from coming in contact with the engine shaft. To obtain the required pressures, a built-in oil bath lubricated gearbox shall be provided between the pump end and engine. The gearbox shall be coupled together with a stainless steel band clamp. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type. The pump body shall be equipped with a petcock drain valve.

Priming
The pump shall be equipped with an exhaust venture primer of brass and stainless steel construction. The primer shall be capable of 20 inches of mercury vacuum. The primer shall be actuated with a spring return, single control lever located at the operator's panel. The primer to pump line shall be equipped with an automatic check valve for priming form an open body of water and a manual shut-off for pumping from a pressurized water source.

Suction/Discharge
The suction and discharge ports shall be female pipe thread, designed and located to accept applicable hose thread adapters. The discharge shall be equipped with a 175^{o} swivel, 10^{o} droop, gateable, screw down valve. This valve shall also be equipped with an automatic check valve for priming and a drain cock valve to relieve discharge hose pressure.

Engine
The engine shall be a 4 cycle gasoline Briggs and Stratton Vanguard series 350400 V Twin, overhead valve, air cooled design. Engine rating shall be 18 BHP at 4000 rpm with a torque of 30 lb-ft at 2600 rpm. Engine displacement shall be 570cc and shall be designed to meet 1994 CARB (California Air Resources Board) standards. A 12-volt electric system shall be provided with electric starter and a 16 amp alternator. Recoil backup engine starting shall be provided. Engine shall be equipped with a residential muffler with USDA approved spark arrestor and a removable heat isolation blanket.

Carrying Base
The pump/engine shall be mounted onto a steel platform base with mounted carrying handles. A 3-gallon remote fuel tank is provided.

Instrumentation
The pump shall be supplied with a control and gauge for easy viewing. This includes a throttle lever, primer lever, master switch, starter button, choke control, a 2.5 inch liquid filled discharge gauge and an oil pressure warning light.

Hale Products Inc. A Unit of IDEX Corporation, 700 Spring Mill Ave., Conshohocken, PA 19428
Phone: 610-825-6300, Fax: 610-825-6440, www.haleproducts.com

PUMP SPECIFICATIONS

HPT75-YD10 Portable Pump

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.

Performance
The pump/engine shall perform to the standards of ISO 9 and NFPA 1906 low pressure pump rating. Typical pump performance from 5 foot draft at sea level shall be: 60 GPM @ 150 PSI, 95 GPM @ 100 PSI, and 120 GPM @ 50 PSI.

Pump
The pump body shall be made of alloy aluminum castings coupled together with a stainless steel band clamp with an O-ring seal which allows quick pump volute removal for servicing. The pump end shall be factory hydrostatically tested to 400 PSI for 10 minutes. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The impeller shall be 4.875 inches in diameter and designed with a sleeve back end to prevent water from coming in contact with the engine shaft. To obtain the required pressures, a built-in oil bath lubricated gearbox shall be provided between the pump end and engine. The gearbox shall be coupled together with a stainless steel band clamp. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type. The pump body shall be equipped with a petcock drain valve.

Priming
The pump shall be equipped with an exhaust venture primer of brass and stainless steel construction. The primer shall be capable of 20 inches of mercury vacuum. The primer shall be actuated with a spring return, single control lever located at the operator's panel. The primer to pump line shall be equipped with an automatic check valve for priming form an open body of water and a manual shut-off for pumping from a pressurized water source.

Suction/Discharge
The suction and discharge ports shall be female pipe thread, designed and located to accept applicable hose thread adapters.

Engine
The engine shall be a 4 cycle diesel Yanmar series L100AE air cooled design. Engine rating shall be 10 BHP at 3600 rpm. A 12-volt electric system shall be provided with electric starter and alternator. Engine shall be equipped with a USDA approved spark arrestor.

Carrying Base
The pump/engine shall be isolation mounted onto a steel platform base with mounted carrying handles.

Instrumentation
The pump shall be supplied with a control panel. This panel shall include a throttle lever, primer lever, master switch, starter button, a 2.5 inch liquid filled discharge gauge.

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PUMP SPECIFICATIONS

HPT100-B18 Portable Pump

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.

Performance
The pump/engine shall perform to the standards of ISO 9 and NFPA 1906 medium pressure rating of 30 GPM. Typical pump performance from 5 foot draft at sea level shall be: 15 GPM @ 280 PSI, 100 GPM @ 150 PSI, and 150 GPM @ 50 PSI.

Pump
The pump body shall be made of alloy aluminum castings coupled together with a stainless steel band clamp with an O-ring seal which allows quick pump volute removal for servicing. The pump end shall be factory hydrostatically tested to 400 PSI for 10 minutes. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The impeller shall be 4.875 inches in diameter and designed with a sleeve back end to prevent water from coming in contact with the engine shaft. To obtain the required pressures, a built-in oil bath lubricated gearbox shall be provided between the pump end and engine. The gearbox shall be coupled together with a stainless steel band clamp. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type. The pump body shall be equipped with a petcock drain valve.

Priming
The pump shall be equipped with an exhaust venture primer of brass and stainless steel construction. The primer shall be capable of 20 inches of mercury vacuum. The primer shall be actuated with a spring return, single control lever located at the operator's panel. The primer to pump line shall be equipped with an automatic check valve for priming form an open body of water and a manual shut-off for pumping from a pressurized water source.

Suction/Discharge
The suction and discharge ports shall be female pipe thread, designed and located to accept applicable hose thread adapters. The discharge shall be equipped with a 175^{o} swivel, 10^{o} droop, gateable, screw down valve. This valve shall also be equipped with an automatic check valve for priming and a drain cock valve to relieve discharge hose pressure.

Engine
The engine shall be a 4 cycle gasoline Briggs and Stratton Vanguard series 350400 V Twin, overhead valve, air cooled design. Engine rating shall be 18 BHP at 4000 rpm with a torque of 30 lb-ft at 2600 rpm. Engine displacement shall be 570cc and shall be designed to meet 1994 CARB (California Air Resources Board) standards. A 12-volt electric system shall be provided with electric starter and a 16 amp alternator. Recoil backup engine starting shall be provided. Engine shall be equipped with a residential muffler with USDA approved spark arrestor and a removable heat isolation blanket.

Carrying Base
The pump/engine shall be mounted onto a steel platform base with mounted carrying handles. A 3-gallon remote fuel tank is provided.

Instrumentation
The pump shall be supplied with a control and gauge for easy viewing. This includes a throttle lever, primer lever, master switch, starter button, choke control, a 2.5 inch liquid filled discharge gauge and an oil pressure warning light.

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PUMP SPECIFICATIONS

HPT200-B18 Portable Pump

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.

Performance
The pump/engine shall perform to the standards of ISO 9 and NFPA 1906 low pressure pump rating. Typical pump performance from 5 foot draft at sea level shall be: 60 GPM @ 150 PSI, 150GPM @ 100 PSI, and 245 GPM @ 25 PSI.

Pump
The pump body shall be made of alloy aluminum castings coupled together with a stainless steel band clamp with an O-ring seal which allows quick pump volute removal for servicing. The pump end shall be factory hydrostatically tested to 250 PSI for 10 minutes. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The impeller shall be 8.75 inches in diameter and designed with a sleeve back end to prevent water from coming in contact with the engine shaft. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type. The pump body shall be equipped with a petcock drain valve.

Priming
The pump shall be equipped with an exhaust venture primer of brass and stainless steel construction. The primer shall be capable of 20 inches of mercury vacuum. The primer shall be actuated with a spring return, single control lever located at the operator's panel. The primer to pump line shall be equipped with an automatic check valve for priming form an open body of water and a manual shut-off for pumping from a pressurized water source.

Suction/Discharge
The suction and discharge ports shall be female pipe thread, designed and located to accept applicable hose thread adapters. The discharge shall be equipped with a 175^{o} swivel, 10^{o} droop, gateable, screw down valve. This valve shall also be equipped with an automatic check valve for priming and a drain cock valve to relieve discharge hose pressure.

Engine
The engine shall be a 4 cycle gasoline Briggs and Stratton Vanguard series 350400 V Twin, overhead valve, air cooled design. Engine rating shall be 18 BHP at 4000 rpm with a torque of 30 lb-ft at 2600 rpm. Engine displacement shall be 570cc and shall be designed to meet 1994 CARB (California Air Resources Board) standards. A 12-volt electric system shall be provided with electric starter and a 16 amp alternator. Recoil backup engine starting shall be provided. Engine shall be equipped with a residential muffler with USDA approved spark arrestor and a removable heat isolation blanket.

Carrying Base
The pump/engine shall be mounted onto a steel platform base with mounted carrying handles. A 3-gallon remote fuel tank is provided.

Instrumentation
The pump shall be supplied with a control and gauge for easy viewing. This includes a throttle lever, primer lever, master switch, starter button, choke control, a 2.5 inch liquid filled discharge gauge and an oil pressure warning light.

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PUMP SPECIFICATIONS

HPT200-YD10 Portable Pump

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.

Performance
The pump/engine shall perform to the standards of ISO 9 and NFPA 1906 low pressure pump rating. Typical pump performance from 5 foot draft at sea level shall be: 40 GPM @ 100 PSI, 140GPM @ 50 PSI, and 185 GPM @ 25 PSI.

Pump
The pump body shall be made of alloy aluminum castings coupled together with a stainless steel band clamp with an O-ring seal which allows quick pump volute removal for servicing. The pump end shall be factory hydrostatically tested to 250 PSI for 10 minutes. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The impeller shall be 8.75 inches in diameter and designed with a sleeve back end to prevent water from coming in contact with the engine shaft. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type. The pump body shall be equipped with a petcock drain valve.

Priming
The pump shall be equipped with an exhaust venture primer of brass and stainless steel construction. The primer shall be capable of 20 inches of mercury vacuum. The primer shall be actuated with a spring return, single control lever located at the operator's panel. The primer to pump line shall be equipped with an automatic check valve for priming form an open body of water and a manual shut-off for pumping from a pressurized water source.

Suction/Discharge
The suction and discharge ports shall be female pipe thread, designed and located to accept applicable hose thread adapters.

Engine
The engine shall be a 4 cycle diesel Yanmar series L100AE air cooled design. Engine rating shall be 10 BHP at 3600 rpm. A 12-volt electric system shall be provided with electric starter and alternator. Engine shall be equipped with a USDA approved spark arrestor.

Carrying Base
The pump/engine shall be isolation mounted onto a steel platform base with mounted carrying handles

Instrumentation
The pump shall be supplied with a control panel. This panel shall include a throttle lever, primer lever, master switch, starter button, a 2.5 inch liquid filled discharge gauge.

PUMP SPECIFICATIONS

HPT300-B18 Portable Pump

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.

Performance
The pump/engine shall perform to the standards of CEN 6/5 and NFPA 1906 low pressure pump rating. Typical pump performance from 5 foot draft at sea level shall be: 150 GPM @ 100 PSI, 250 GPM @ 75 PSI, and 380 GPM @ 25 PSI.

Pump
The pump body shall be made of alloy aluminum castings coupled together with a stainless steel band clamp with an O-ring seal which allows quick pump volute removal for servicing. The pump end shall be factory hydrostatically tested to 200 PSI for 10 minutes. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The impeller shall be 8.75 inches in diameter and designed with a sleeve back end to prevent water from coming in contact with the engine shaft. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type. The pump body shall be equipped with a petcock drain valve.

Priming
The pump shall be equipped with an exhaust venture primer of brass and stainless steel construction. The primer shall be capable of 20 inches of mercury vacuum. The primer shall be actuated with a spring return, single control lever located at the operator's panel. The primer to pump line shall be equipped with an automatic check valve for priming form an open body of water and a manual shut-off for pumping from a pressurized water source.

Suction/Discharge
The suction and discharge ports shall be female pipe thread, designed and located to accept applicable hose thread adapters. The discharge shall be equipped with a 175^{o} swivel, 10^{o} droop, gateable, screw down valve. This valve shall also be equipped with an automatic check valve for priming and a drain cock valve to relieve discharge hose pressure.

Engine
The engine shall be a 4 cycle gasoline Briggs and Stratton Vanguard series 350400 V Twin, overhead valve, air cooled design. Engine rating shall be 18 BHP at 4000 rpm with a torque of 30 lb-ft at 2600 rpm. Engine displacement shall be 570cc and shall be designed to meet 1994 CARB (California Air Resources Board) standards. A 12-volt electric system shall be provided with electric starter and a 16 amp alternator. Recoil backup engine starting shall be provided. Engine shall be equipped with a residential muffler with USDA approved spark arrestor and a removable heat isolation blanket.

Carrying Base
The pump/engine shall be mounted onto a steel platform base with mounted carrying handles. A 3-gallon remote fuel tank is provided.

Instrumentation
The pump shall be supplied with a control and gauge for easy viewing. This includes a throttle lever, primer lever, master switch, starter button, choke control, a 2.5 inch liquid filled discharge gauge and an oil pressure warning light.

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PUMP SPECIFICATIONS

HPT400-B18 Portable Pump

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.

Performance
Typical pump performance from 5 foot draft at sea level shall be: 90 GPM @ 100 PSI, 340 GPM @ 50 PSI, and 460 GPM @ 25 PSI.

Pump
The pump body shall be made of alloy aluminum castings coupled together with a stainless steel band clamp with an O-ring seal which allows quick pump volute removal for servicing. The pump end shall be factory hydrostatically tested to 200 PSI for 10 minutes. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The impeller shall be 7.25 inches in diameter and designed with a sleeve back end to prevent water from coming in contact with the engine shaft. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type. The pump body shall be equipped with a petcock drain valve.

Priming
The pump shall be equipped with an exhaust venture primer of brass and stainless steel construction. The primer shall be capable of 20 inches of mercury vacuum. The primer shall be actuated with a spring return, single control lever located at the operator's panel. The primer to pump line shall be equipped with an automatic check valve for priming form an open body of water and a manual shut-off for pumping from a pressurized water source.

Suction/Discharge
The suction and discharge ports shall be female pipe thread, designed and located to accept applicable hose thread adapters. The discharge shall be equipped with two 175^{o} swivel, 10^{o} droop, gateable, screw down valves. This valve shall also be equipped with an automatic check valve for priming and a drain cock valve to relieve discharge hose pressure.

Engine
The engine shall be a 4 cycle gasoline Briggs and Stratton Vanguard series 350400 V Twin, overhead valve, air cooled design. Engine rating shall be 18 BHP at 4000 rpm with a torque of 30 lb-ft at 2600 rpm. Engine displacement shall be 570cc and shall be designed to meet 1994 CARB (California Air Resources Board) standards. A 12-volt electric system shall be provided with electric starter and a 16 amp alternator. Recoil backup engine starting shall be provided. Engine shall be equipped with a residential muffler with USDA approved spark arrestor and a removable heat isolation blanket.

Carrying Base
The pump/engine shall be mounted onto a steel platform base with mounted carrying handles. A 3-gallon remote fuel tank is provided.

Instrumentation
The pump shall be supplied with a control and gauge for easy viewing. This includes a throttle lever, primer lever, master switch, starter button, choke control, a 2.5 inch liquid filled discharge gauge and an oil pressure warning light.

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PUMP SPECIFICATIONS

HPW75-B18 Portable Pump

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.

Performance
The pump/engine shall perform to the standards of ISO 9 and NFPA 1906 high pressure rating @ 20 GPM and medium pressure rating @ 90 GPM. Typical pump performance from 5 foot draft at sea level shall be: 15 GPM @ 325 PSI, 105 GPM @ 150 PSI, and 130 GPM @ 50 PSI.

Pump
The pump body shall be made of alloy aluminum castings coupled together with a stainless steel band clamp with an O-ring seal which allows quick pump volute removal for servicing. The pump end shall be factory hydrostatically tested to 400 PSI for 10 minutes. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The impeller shall be 4.875 inches (123.83 mm) in diameter and designed with a sleeve back end to prevent water from coming in contact with the engine shaft. To obtain the required pressures, a built-in oil bath lubricated gearbox shall be provided between the pump end and engine. The gearbox shall be coupled together with a stainless steel band clamp. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type. The pump body shall be equipped with a petcock drain valve.

Priming
The pump shall be equipped with an exhaust venture primer of brass and stainless steel construction. The primer shall be capable of 20 inches of mercury vacuum. The primer shall be actuated with a spring return, single control lever located at the operator’s panel. The primer to pump line shall be equipped with an automatic check valve for priming form an open body of water and a manual shut-off for pumping from a pressurized water source.

Suction/Discharge
The suction discharge ports shall be female pipe thread, designed and located to accept applicable hose thread adapters. The discharge shall be equipped with a 175° swivel, 10° droop, gateable, screw down valve. This valve shall also be equipped with an automatic check valve for priming and a drain cock valve to relieve discharge hose pressure.

Engine
The engine shall be a 4-cycle gasoline Briggs and Stratton Vanguard series 350400 V-Twin, overhead valve, air cooled design. Engine rating shall be 18 BHP at 4000 rpm with a torque of 30 lb-ft at 2600 rpm. Engine displacement shall be 570cc and shall be designed to meet 1994 CARB (California Air Resources Board) standards. A 12-volt electric system shall be provided with electric starter and a 16 amp alternator. Recoil backup engine starting shall be provided. Engine shall be equipped with a residential muffler with USDA approved spark arrestor and a removable heat isolation blanket.

Mounting Platform/Base Fuel Tank/Wraparound Frame
The pump/engine shall be isolation mounted onto a cross linked polyethylene platform which also serves as a 3 gallon fuel tank. A tubular rollover protective frame shall be provided with swing-out lifting handles.

Instrumentation
The pump shall be supplied with a mounted control panel. This panel shall include a throttle lever, primer lever, master switch, starter button, choke control, a 2.5 inch liquid filled discharge gauge and an oil pressure warning light.

PUMP SPECIFICATIONS

HPW100-B18 Portable Pump

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.

Performance
The pump/engine shall perform to the standards of ISO 9 and NFPA 1906 medium pressure rating @ 30 GPM. Typical pump performance from 5 foot draft at sea level shall be: 15 GPM @ 280 PSI, 100 GPM @ 150 PSI, and 150 GPM @ 50 PSI

Pump
The pump body shall be made of alloy aluminum castings coupled together with a stainless steel band clamp with an O-ring seal which allows quick pump volute removal for servicing. The pump end shall be factory hydrostatically tested to 400 PSI for 10 minutes. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The impeller shall be 4.875 inches (123.83 mm) in diameter and designed with a sleeve back end to prevent water from coming in contact with the engine shaft. To obtain the required pressures, a built-in oil bath lubricated gearbox shall be provided between the pump end and engine. The gearbox shall be coupled together with a stainless steel band clamp. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type. The pump body shall be equipped with a petcock drain valve.

Priming
The pump shall be equipped with an exhaust venture primer of brass and stainless steel construction. The primer shall be capable of 20 inches of mercury vacuum. The primer shall be actuated with a spring return, single control lever located at the operator's panel. The primer to pump line shall be equipped with an automatic check valve for priming form an open body of water and a manual shut-off for pumping from a pressurized water source.

Suction/Discharge
The suction discharge ports shall be female pipe thread, designed and located to accept applicable hose thread adapters. The discharge shall be equipped with a 175° swivel, 10° droop, gateable, screw down valve. This valve shall also be equipped with an automatic check valve for priming and a drain cock valve to relieve discharge hose pressure.

Engine
The engine shall be a 4-cycle gasoline Briggs and Stratton Vanguard series 350400 V-Twin, overhead valve, air cooled design. Engine rating shall be 18 BHP at 4000 rpm with a torque of 30 lb-ft at 2600 rpm. Engine displacement shall be 570cc and shall be designed to meet 1994 CARB (California Air Resources Board) standards. A 12-volt electric system shall be provided with electric starter and a 16 amp alternator. Recoil backup engine starting shall be provided. Engine shall be equipped with a residential muffler with USDA approved spark arrestor and a removable heat isolation blanket.

Mounting Platform/Base Fuel Tank/Wraparound Frame
The pump/engine shall be isolation mounted onto a cross linked polyethylene platform which also serves as a 3 gallon fuel tank. A tubular rollover protective frame shall be provided with swing-out lifting handles.

Instrumentation
The pump shall be supplied with a mounted control panel. This panel shall include a throttle lever, primer lever, master switch, starter button, choke control, a 2.5 inch liquid filled discharge gauge and an oil pressure warning light.

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PUMP SPECIFICATIONS

HPW100-H20 Portable Pump

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
The pump body shall be made of alloy aluminum castings coupled together with a stainless steel band clamp with an O-ring seal which allows quick pump volute removal for servicing. The pump end shall be factory hydrostatically tested to 400 PSI for 10 minutes. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The impeller shall be 4.875 inches (123.83 mm) in diameter and designed with a sleeve back end to prevent water from coming in contact with the engine shaft. To obtain the required pressures, a built-in oil bath lubricated gearbox shall be provided between the pump end and engine. The gearbox shall be coupled together with a stainless steel band clamp. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type. The pump body shall be equipped with a petcock drain valve.

Priming
The pump shall be equipped with an exhaust venture primer of brass and stainless steel construction. The primer shall be capable of 20 inches of mercury vacuum. The primer shall be actuated with a spring return, single control lever located at the operator's panel. The primer to pump line shall be equipped with an automatic check valve for priming form an open body of water and a manual shut-off for pumping from a pressurized water source.

Suction/Discharge
The suction and discharge ports shall be female pipe thread, designed and located to accept applicable hose thread adapters.

Engine
The engine shall be a 4-cycle gasoline Honda series GX620, overhead valve, air cooled design. Engine rating shall be 20 BHP at 3600. Engine displacement shall be 614cc and shall be designed to meet 1994 CARB (California Air Resources Board) standards. A 12-volt electric system shall be provided with electric starter and a 20amp alternator. Recoil backup engine starting shall be provided. Engine shall be equipped with a residential muffler with USDA approved spark arrestor and a removable heat isolation blanket.

Mounting Platform/Base Fuel Tank/Wraparound Frame
The pump/engine shall be isolation mounted onto a cross linked polyethylene platform which also serves as a 3 gallon fuel tank. A tubular rollover protective frame shall be provided with four (4) swing-out handles.

Instrumentation
The pump shall be supplied with a mounted control panel. This panel shall include a throttle lever, primer lever, master switch, starter button, choke control, a 2.5 inch liquid filled discharge gauge and an oil pressure warning light.

PUMP SPECIFICATIONS

HPW200-B18 Portable Pump

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.

Performance
The pump/engine shall perform to the standards of ISO 9 and NFPA 1906 low pressure pump rating. Typical pump performance from 5 foot draft at sea level shall be: 60 GPM @ 150 PSI, 150GPM @ 100 PSI, and 245 GPM @ 25 PSI.

Pump
The pump body shall be made of alloy aluminum castings coupled together with a stainless steel band clamp with an O-ring seal which allows quick pump volute removal for servicing. The pump end shall be factory hydrostatically tested to 250 PSI for 10 minutes. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The impeller shall be 8.75inches (222.25 mm) in diameter and designed with a sleeve back end to prevent water from coming in contact with the engine shaft. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type. The pump body shall be equipped with a petcock drain valve.

Priming
The pump shall be equipped with an exhaust venture primer of brass and stainless steel construction. The primer shall be capable of 20 inches of mercury vacuum. The primer shall be actuated with a spring return, single control lever located at the operator's panel. The primer to pump line shall be equipped with an automatic check valve for priming form an open body of water and a manual shut-off for pumping from a pressurized water source.

Suction/Discharge
The suction discharge ports shall be female pipe thread, designed and located to accept applicable hose thread adapters. The discharge shall be equipped with a 175° swivel, 10° droop, gateable, screw down valve. This valve shall also be equipped with an automatic check valve for priming and a drain cock valve to relieve discharge hose pressure.

Engine
The engine shall be a 4-cycle gasoline Briggs and Stratton Vanguard series 350400 V-Twin, overhead valve, air cooled design. Engine rating shall be 18 BHP at 4000 rpm with a torque of 30 lb-ft at 2600 rpm. Engine displacement shall be 570cc and shall be designed to meet 1994 CARB (California Air Resources Board) standards. A 12-volt electric system shall be provided with electric starter and a 16 amp alternator. Recoil backup engine starting shall be provided. Engine shall be equipped with a residential muffler with USDA approved spark arrestor and a removable heat isolation blanket.

Mounting Platform/Base Fuel Tank/Wraparound Frame
The pump/engine shall be isolation mounted onto a cross linked polyethylene platform which also serves as a 3 gallon fuel tank. A tubular rollover protective frame shall be provided with swing-out lifting handles.

Instrumentation
The pump shall be supplied with a remote mounted control panel. This panel shall include a throttle lever, primer lever, master switch, starter button, choke control, a 2.5 inch liquid filled discharge gauge and an oil pressure warning light.

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PUMP SPECIFICATIONS

HPW200-H20 Portable Pump

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
The pump body shall be made of alloy aluminum castings coupled together with a stainless steel band clamp with an O-ring seal which allows quick pump volute removal for servicing. The pump end shall be factory hydrostatically tested to 250 PSI for 10 minutes. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The impeller shall be 8.75inches (222.25 mm) in diameter and designed with a sleeve back end to prevent water from coming in contact with the engine shaft. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type. The pump body shall be equipped with a petcock drain valve.

Priming
The pump shall be equipped with an exhaust venture primer of brass and stainless steel construction. The primer shall be capable of 20 inches of mercury vacuum. The primer shall be actuated with a spring return, single control lever located at the operator's panel. The primer to pump line shall be equipped with an automatic check valve for priming form an open body of water and a manual shut-off for pumping from a pressurized water source.

Suction/Discharge
The suction and discharge ports shall be female pipe thread, designed and located to accept applicable hose thread adapters.

Engine
The engine shall be a 4-cycle gasoline Honda series GX620, overhead valve, air cooled design. Engine rating shall be 20 BHP at 3600. Engine displacement shall be 614cc and shall be designed to meet 1994 CARB (California Air Resources Board) standards. A 12-volt electric system shall be provided with electric starter and a 20amp alternator. Recoil backup engine starting shall be provided. Engine shall be equipped with a residential muffler with USDA approved spark arrestor and a removable heat isolation blanket.

Mounting Platform/Base Fuel Tank/Wraparound Frame
The pump/engine shall be isolation mounted onto a cross linked polyethylene platform which also serves as a 3 gallon fuel tank. A tubular rollover protective frame shall be provided with four (4) swing-out handles.

Instrumentation
The pump shall be supplied with a mounted control panel. This panel shall include a throttle lever, primer lever, master switch, starter button, choke control, a 2.5 inch liquid filled discharge gauge and an oil pressure warning light.

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PUMP SPECIFICATIONS

HPW300-B18 Portable Pump

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.

Performance
The pump/engine shall perform to the standards of CEN 6/5 and NFPA 1906 low pressure pump rating. Typical pump performance from 5 foot draft at sea level shall be: 150 GPM @ 100 PSI, 250 GPM @ 75 PSI, and 380 GPM @ 25 PSI.

Pump
The pump body shall be made of alloy aluminum castings coupled together with a stainless steel band clamp with an O-ring seal which allows quick pump volute removal for servicing. The pump end shall be factory hydrostatically tested to 200 PSI for 10 minutes. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The impeller shall be 8.75inches (222.25 mm) in diameter and designed with a sleeve back end to prevent water from coming in contact with the engine shaft. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type. The pump body shall be equipped with a petcock drain valve.

Priming
The pump shall be equipped with an exhaust venture primer of brass and stainless steel construction. The primer shall be capable of 20 inches of mercury vacuum. The primer shall be actuated with a spring return, single control lever located at the operator’s panel. The primer to pump line shall be equipped with an automatic check valve for priming form an open body of water and a manual shut-off for pumping from a pressurized water source.

Suction/Discharge
The suction discharge ports shall be female pipe thread, designed and located to accept applicable hose thread adapters. The discharge shall be equipped with a 175° swivel, 10° droop, gateable, screw down valve. This valve shall also be equipped with an automatic check valve for priming and a drain cock valve to relieve discharge hose pressure

Engine
The engine shall be a 4-cycle gasoline Briggs and Stratton Vanguard series 350400 V-Twin, overhead valve, air cooled design. Engine rating shall be 18 BHP at 4000 rpm with a torque of 30 lb-ft at 2600 rpm. Engine displacement shall be 570cc and shall be designed to meet 1994 CARB (California Air Resources Board) standards. A 12-volt electric system shall be provided with electric starter and a 16 amp alternator. Recoil backup engine starting shall be provided. Engine shall be equipped with a residential muffler with USDA approved spark arrestor and a removable heat isolation blanket.

Mounting Platform/Base Fuel Tank/Wraparound Frame
The pump/engine shall be isolation mounted onto a cross linked polyethylene platform which also serves as a 3 gallon fuel tank. A tubular rollover protective frame shall be provided with swing-out lifting handles.

Instrumentation
The pump shall be supplied with a mounted control panel. This panel shall include a throttle lever, primer lever, master switch, starter button, choke control, a 2.5 inch liquid filled discharge gauge and an oil pressure warning light.

PUMP SPECIFICATIONS

HPW300-H20 Portable Pump

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
The pump body shall be made of alloy aluminum castings coupled together with a stainless steel band clamp with an O-ring seal which allows quick pump volute removal for servicing. The pump end shall be factory hydrostatically tested to 200 PSI for 10 minutes. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The impeller shall be 8.75inches (222.25 mm) in diameter and designed with a sleeve back end to prevent water from coming in contact with the engine shaft. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type. The pump body shall be equipped with a petcock drain valve.

Priming
The pump shall be equipped with an exhaust venture primer of brass and stainless steel construction. The primer shall be capable of 20 inches of mercury vacuum. The primer shall be actuated with a spring return, single control lever located at the operator's panel. The primer to pump line shall be equipped with an automatic check valve for priming form an open body of water and a manual shut-off for pumping from a pressurized water source.

Suction/Discharge
The suction and discharge ports shall be female pipe thread, designed and located to accept applicable hose thread adapters.

Engine
The engine shall be a 4-cycle gasoline Honda series GX620, overhead valve, air cooled design. Engine rating shall be 20 BHP at 3600. Engine displacement shall be 614cc and shall be designed to meet 1994 CARB (California Air Resources Board) standards. A 12-volt electric system shall be provided with electric starter and a 20amp alternator. Recoil backup engine starting shall be provided. Engine shall be equipped with a residential muffler with USDA approved spark arrestor and a removable heat isolation blanket.

Mounting Platform/Base Fuel Tank/Wraparound Frame
The pump/engine shall be isolation mounted onto a cross linked polyethylene platform which also serves as a 3 gallon fuel tank. A tubular rollover protective frame shall be provided with four (4) swing-out handles.

Instrumentation
The pump shall be supplied with a mounted control panel. This panel shall include a throttle lever, primer lever, master switch, starter button, choke control, a 2.5 inch liquid filled discharge gauge and an oil pressure warning light.

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PUMP SPECIFICATIONS

HPW400-B18 Portable Pump

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.

Performance
Typical pump performance from 5 foot draft at sea level shall be: 90 GPM @ 100 PSI, 340 GPM @ 50 PSI, and 460 GPM @ 25 PSI.

Pump
The pump body shall be made of alloy aluminum castings coupled together with a stainless steel band clamp with an O-ring seal which allows quick pump volute removal for servicing. The pump end shall be factory hydrostatically tested to 200 PSI for 10 minutes. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The impeller shall be 7.25 inches (185.15 mm) in diameter and designed with a sleeve back end to prevent water from coming in contact with the engine shaft. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type. The pump body shall be equipped with a petcock drain valve.

Priming
The pump shall be equipped with an exhaust venture primer of brass and stainless steel construction. The primer shall be capable of 20 inches of mercury vacuum. The primer shall be actuated with a spring return, single control lever located at the operator's panel. The primer to pump line shall be equipped with an automatic check valve for priming form an open body of water and a manual shut-off for pumping from a pressurized water source.

Suction/Discharge
The suction discharge ports shall be female pipe thread, designed and located to accept applicable hose thread adapters. The discharge shall be equipped with two (2) 175° swivels, 10° droop, gateable, screw down valve. This valve shall also be equipped with an automatic check valve for priming and a drain cock valve to relieve discharge hose pressure.

Engine
The engine shall be a 4-cycle gasoline Briggs and Stratton Vanguard series 350400 V-Twin, overhead valve, air cooled design. Engine rating shall be 18 BHP at 4000 rpm with a torque of 30 lb-ft at 2600 rpm. Engine displacement shall be 570cc and shall be designed to meet 1994 CARB (California Air Resources Board) standards. A 12-volt electric system shall be provided with electric starter and a 16 amp alternator. Recoil backup engine starting shall be provided. Engine shall be equipped with a residential muffler with USDA approved spark arrestor and a removable heat isolation blanket.

Mounting Platform/Base Fuel Tank/Wraparound Frame
The pump/engine shall be isolation mounted onto a cross linked polyethylene platform which also serves as a 3 gallon fuel tank. A tubular rollover protective frame shall be provided with swing-out lifting handles.

Instrumentation
The pump shall be supplied with a mounted control panel. This panel shall include a throttle lever, primer lever, master switch, starter button, choke control, a 2.5 inch liquid filled discharge gauge and an oil pressure warning light.

PUMP SPECIFICATIONS

HPX75-B18 Portable Pump

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.

Performance
The pump/engine shall perform to the standards of ISO 9 and NFPA 1906 high pressure rating @ 20 GPM and medium pressure rating of 90 GPM. Typical pump performance from 5 foot draft at sea level shall be: 15 GPM @ 325 PSI, 105 GPM @ 150 PSI, and 130 GPM @ 50 PSI.

Pump
The pump body shall be made of alloy aluminum castings coupled together with a stainless steel band clamp with an O-ring seal which allows quick pump volute removal for servicing. The pump end shall be factory hydrostatically tested to 400 PSI for 10 minutes. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The impeller shall be 4.875 inches in diameter and designed with a sleeve back end to prevent water from coming in contact with the engine shaft. To obtain the required pressures, a built-in oil bath lubricated gearbox shall be provided between the pump end and engine. The gearbox shall be coupled together with a stainless steel band clamp. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type. The pump body shall be equipped with a petcock drain valve.

Priming
The pump shall be equipped with an exhaust venture primer of brass and stainless steel construction. The primer shall be capable of 20 inches of mercury vacuum. The primer shall be actuated with a spring return, single control lever located at the operator’s panel. The primer to pump line shall be equipped with an automatic check valve for priming form an open body of water and a manual shut-off for pumping from a pressurized water source.

Suction/Discharge
The suction and discharge ports shall be female pipe thread, designed and located to accept applicable hose thread adapters.

Engine
The engine shall be a 4-cycle gasoline Briggs and Stratton Vanguard series 350400 V-Twin, overhead valve, air cooled design. Engine rating shall be 18 BHP at 4000 rpm with a torque of 30 lb-ft at 2600 rpm. Engine displacement shall be 570cc and shall be designed to meet 1994 CARB (California Air Resources Board) standards. A 12-volt electric system shall be provided with electric starter and a 16 amp alternator. Recoil backup engine starting shall be provided. Engine shall be equipped with a residential muffler with USDA approved spark arrestor.

Mounting Platform
The pump/engine shall be isolation mounted onto a steel base plate.

Instrumentation
The pump shall be supplied with a remote mounted control panel. This panel shall include a throttle lever, primer lever, master switch, starter button, choke control, a 2.5 inch liquid filled discharge gauge and an oil pressure warning light.

PUMP SPECIFICATIONS

HPX75-YD10 Portable Pump

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.

Performance
The pump/engine shall perform to the standards of ISO 9 and NFPA 1906 low pressure pump rating. Typical pump performance from 5 foot draft at sea level shall be: 60 GPM @ 150 PSI, 95 GPM @ 100 PSI, and 120 GPM @ 50 PSI.

Pump
The pump body shall be made of alloy aluminum castings coupled together with a stainless steel band clamp with an O-ring seal which allows quick pump volute removal for servicing. The pump end shall be factory hydrostatically tested to 400 PSI for 10 minutes. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The impeller shall be 4.875 inches in diameter and designed with a sleeve back end to prevent water from coming in contact with the engine shaft. To obtain the required pressures, a built-in oil bath lubricated gearbox shall be provided between the pump end and engine. The gearbox shall be coupled together with a stainless steel band clamp. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type. The pump body shall be equipped with a petcock drain valve.

Priming
The pump shall be equipped with an exhaust venture primer of brass and stainless steel construction. The primer shall be capable of 20 inches of mercury vacuum. The primer shall be actuated with a spring return, single control lever located at the operator's panel. The primer to pump line shall be equipped with an automatic check valve for priming form an open body of water and a manual shut-off for pumping from a pressurized water source.

Suction/Discharge
The suction and discharge ports shall be female pipe thread, designed and located to accept applicable hose thread adapters.

Engine
The engine shall be a 4 cycle diesel Yanmar series L100AE air cooled design. Engine rating shall be 10 BHP at 3600 rpm. A 12-volt electric system shall be provided with electric starter and alternator. Engine shall be equipped with a USDA approved spark arrestor.

Mounting Platform
The pump/engine shall be isolation mounted onto a steel base plate.

Instrumentation
The pump shall be supplied with a remote mounted control panel. This panel shall include a throttle lever, primer lever, master switch, starter button, a 2.5 inch liquid filled discharge gauge and an oil pressure warning light.

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PUMP SPECIFICATIONS

HPX100-B18 Portable Pump

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.

Performance
The pump/engine shall perform to the standards of ISO 9 and NFPA 1906 medium pressure rating @ 30 GPM. Typical pump performance from 5 foot draft at sea level shall be: 15 GPM @ 280 PSI, 100 GPM @ 150 PSI, and 150 GPM @ 50 PSI.

Pump
The pump body shall be made of alloy aluminum castings coupled together with a stainless steel band clamp with an O-ring seal which allows quick pump volute removal for servicing. The pump end shall be factory hydrostatically tested to 400 PSI for 10 minutes. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The impeller shall be 4.875 inches in diameter and designed with a sleeve back end to prevent water from coming in contact with the engine shaft. To obtain the required pressures, a built-in oil bath lubricated gearbox shall be provided between the pump end and engine. The gearbox shall be coupled together with a stainless steel band clamp. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type. The pump body shall be equipped with a petcock drain valve.

Priming
The pump shall be equipped with an exhaust venture primer of brass and stainless steel construction. The primer shall be capable of 20 inches of mercury vacuum. The primer shall be actuated with a spring return, single control lever located at the operator’s panel. The primer to pump line shall be equipped with an automatic check valve for priming form an open body of water and a manual shut-off for pumping from a pressurized water source.

Suction/Discharge
The suction and discharge ports shall be female pipe thread, designed and located to accept applicable hose thread adapters.

Engine
The engine shall be a 4-cycle gasoline Briggs and Stratton Vanguard series 350400 V-Twin, overhead valve, air cooled design. Engine rating shall be 18 BHP at 4000 rpm with a torque of 30 lb-ft at 2600 rpm. Engine displacement shall be 570cc and shall be designed to meet 1994 CARB (California Air Resources Board) standards. A 12-volt electric system shall be provided with electric starter and a 16 amp alternator. Recoil backup engine starting shall be provided. Engine shall be equipped with a residential muffler with USDA approved spark arrestor.

Mounting Platform
The pump/engine shall be isolation mounted onto a steel base plate.

Instrumentation
The pump shall be supplied with a remote mounted control panel. This panel shall include a throttle lever, primer lever, master switch, starter button, choke control, a 2.5 inch liquid filled discharge gauge and an oil pressure warning light.

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PUMP SPECIFICATIONS

HPX100-H20 Portable Pump

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
The pump body shall be made of alloy aluminum castings coupled together with a stainless steel band clamp with an O-ring seal which allows quick pump volute removal for servicing. The pump end shall be factory hydrostatically tested to 400 PSI for 10 minutes. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The impeller shall be 4.875 inches (123.83 mm) in diameter and designed with a sleeve back end to prevent water from coming in contact with the engine shaft. To obtain the required pressures, a built-in oil bath lubricated gearbox shall be provided between the pump end and engine. The gearbox shall be coupled together with a stainless steel band clamp. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type. The pump body shall be equipped with a petcock drain valve.

Priming
The pump shall be equipped with an exhaust venture primer of brass and stainless steel construction. The primer shall be capable of 20 inches of mercury vacuum. The primer shall be actuated with a spring return, single control lever located at the operator's panel. The primer to pump line shall be equipped with an automatic check valve for priming form an open body of water and a manual shut-off for pumping from a pressurized water source.

Suction/Discharge
The suction and discharge ports shall be female pipe thread, designed and located to accept applicable hose thread adapters.

Engine
The engine shall be a 4-cycle gasoline Honda series GX620, overhead valve, air cooled design. Engine rating shall be 20 BHP at 3600. Engine displacement shall be 614cc and shall be designed to meet 1994 CARB (California Air Resources Board) standards. A 12-volt electric system shall be provided with electric starter and a 20amp alternator. Recoil backup engine starting shall be provided. Engine shall be equipped with a residential muffler with USDA approved spark arrestor and a removable heat isolation blanket.

Mounting Platform
The pump/engine shall be isolation mounted onto a steel base plate.

Instrumentation
The pump shall be supplied with a remote mounted control panel. This panel shall include a throttle lever, primer lever, master switch, starter button, choke control, a 2.5 inch liquid filled discharge gauge and an oil pressure warning light.

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PUMP SPECIFICATIONS

HPX100-BD26 Portable Pump

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.

Performance
The pump/engine shall perform to the standards of ISO 9 and NFPA 1906 high pressure 50 GPM rating and medium pressure rating of 120 GPM. Typical pump performance from 5 foot draft at sea level shall be: 20 GPM @ 325 PSI, 130 GPM @ 150 PSI, and 170 GPM @ 25 PSI.

Pump
The pump body shall be made of alloy aluminum castings coupled together with a stainless steel band clamp with an O-ring seal which allows quick pump volute removal for servicing. The pump end shall be factory hydrostatically tested to 400 PSI for 10 minutes. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The impeller shall be 4.875 inches in diameter and designed with a sleeve back end to prevent water from coming in contact with the engine shaft. The impeller is directly threaded onto the engine crankshaft. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type. The pump body shall be equipped with a petcock drain valve.

Priming Pump
1. The priming pump shall be a positive displacement, oil-less rotary vane electric motor driven pump conforming to the requirements of NFPA 1901. The pump body shall be manufactured of heat treated anodized aluminum for wear and corrosion resistance.
2. The pump shall be capable of producing a minimum 24 Hg vacuum at 2000 feet above sea level.
3. The electric motor shall be a 12 VDC (or 24 VDC) totally enclosed unit.
4. The priming pump shall not require lubrication.
5. The priming pump shall be operated by a single push-pull control valve mounted on the pump operator panel. The control valve shall be of all bronze construction

Suction/Discharge
The suction and discharge ports shall be female pipe thread, designed and located to accept applicable hose thread adapters.

Engine
The engine shall be a 4 cycle diesel Briggs and Stratton Vanguard series DM950D radiator liquid cooled design. Engine rating shall be 26 BHP at 3600 rpm. A 12-volt electric system shall be provided with electric starter and alternator. Engine shall be equipped with a USDA approved spark arrestor.

Mounting Platform
The pump/engine shall be isolation mounted on engine mounting legs

Instrumentation
The pump shall be supplied with a remote mounted control panel. This panel shall include a throttle lever, primer lever, master switch, starter button, a 2.5 inch liquid filled discharge gauge and an oil pressure warning light.

PUMP SPECIFICATIONS

HPX100-LD23 Portable Pump

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.

Performance
The pump/engine shall perform to the standards of ISO 9 and NFPA 1906 high pressure 30 GPM rating and medium pressure rating of 120 GPM. Typical pump performance from draft at sea level shall be: 10 GPM @ 325 PSI, 125GPM @ 150 PSI and 145 GPM @ 50 PSI.

Pump
The pump body shall be made of alloy aluminum castings coupled together with a stainless steel band clamp with an O-ring seal which allows quick pump volute removal for servicing. The pump end shall be factory hydrostatically tested to 400 PSI for 10 minutes. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The impeller shall be 4.875 inches in diameter and designed with a sleeve back end to prevent water from coming in contact with the engine shaft. To obtain the required pressures, a built-in oil bath lubricated gearbox shall be provided between the pump end and engine. The gearbox shall be coupled together with a stainless steel band clamp. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type. The pump body shall be equipped with a petcock drain valve.

Priming Pump
1. The priming pump shall be a positive displacement, oil-less rotary vane electric motor driven pump conforming to the requirements of NFPA 1901. The pump body shall be manufactured of heat treated anodized aluminum for wear and corrosion resistance.
2. The pump shall be capable of producing a minimum 24 Hg vacuum at 2000 feet above sea level.
3. The electric motor shall be a 12 VDC (or 24 VDC) totally enclosed unit.
4. The priming pump shall not require lubrication.
5. The priming pump shall be operated by a single push-pull control valve mounted on the pump operator panel. The control valve shall be of all bronze construction

Suction/Discharge
The suction and discharge ports shall be female pipe thread, designed and located to accept applicable hose thread adapters.

Engine
The engine shall be a 4 cycle diesel Lombardini series LDW903 radiator liquid cooled design. Engine rating shall be 23 BHP at 3600 rpm. A 12-volt electric system shall be provided with electric starter and alternator. Engine shall be equipped with a USDA approved spark arrestor.
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Mounting Platform
The pump/engine shall be isolation mounted on engine mounting legs

Instrumentation
The pump shall be supplied with a remote mounted control panel. This panel shall include a throttle lever, primer lever, master switch, starter button, a 2.5 inch liquid filled discharge gauge and an oil pressure warning light.

PUMP SPECIFICATIONS

HPX100-ZD25 Portable Pump

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.

Performance
The pump/engine shall perform to the standards of ISO 9 and NFPA 1906 high pressure 30 GPM rating and medium pressure rating of 120 GPM. Typical pump performance from draft at sea level shall be:
10 GPM @ 360 PSI, 130 GPM @ 150 PSI and 145 GPM @ 50 PSI.

Pump
The pump body shall be made of alloy aluminum castings coupled together with a stainless steel band clamp with an O-ring seal which allows quick pump volute removal for servicing. The pump end shall be factory hydrostatically tested to 400 PSI for 10 minutes. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The impeller shall be 4.875 inches in diameter and designed with a sleeve back end to prevent water from coming in contact with the engine shaft. To obtain the required pressures, a built-in oil bath lubricated gearbox shall be provided between the pump end and engine. The gearbox shall be coupled together with a stainless steel band clamp. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type. The pump body shall be equipped with a petcock drain valve.

Priming Pump
1. The priming pump shall be a positive displacement, oil-less rotary vane electric motor driven pump conforming to the requirements of NFPA 1901. The pump body shall be manufactured of heat treated anodized aluminum for wear and corrosion resistance.
2. The pump shall be capable of producing a minimum 24 Hg vacuum at 2000 feet above sea level.
3. The electric motor shall be a 12 VDC (or 24 VDC) totally enclosed unit.
4. The priming pump shall not require lubrication.
5. The priming pump shall be operated by a single push-pull control valve mounted on the pump operator panel. The control valve shall be of all bronze construction

Suction/Discharge
The suction and discharge ports shall be female pipe thread, designed and located to accept applicable hose thread adapters.

Engine
The engine shall be a 4-cycle diesel Isuzu series radiator liquid cooled design. Engine rating shall be 25 BHP at 3600 rpm. A 12-volt electric system shall be provided with electric starter and an alternator. Engine shall be equipped with a residential muffler with a USDA approved spark arrestor.

Mounting Platform
The pump/engine shall be isolation mounted on engine mounting legs

Instrumentation
The pump shall be supplied with a remote mounted control panel. This panel shall include a throttle lever, primer lever, master switch, starter button, a 2.5 inch liquid filled discharge gauge and an oil pressure warning light.

PUMP SPECIFICATIONS

HPX200-B18 Portable Pump

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.

Performance
The pump/engine shall perform to the standards of ISO 9 and NFPA 1906 low pressure pump rating. Typical pump performance from 5 foot draft at sea level shall be: 60 GPM @ 150 PSI, 150GPM @ 100 PSI, and 245 GPM @ 25 PSI.

Pump
The pump body shall be made of alloy aluminum castings coupled together with a stainless steel band clamp with an O-ring seal which allows quick pump volute removal for servicing. The pump end shall be factory hydrostatically tested to 250 PSI for 10 minutes. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The impeller shall be 8.75 inches in diameter and designed with a sleeve back end to prevent water from coming in contact with the engine shaft. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type. The pump body shall be equipped with a petcock drain valve.

Priming
The pump shall be equipped with an exhaust venture primer of brass and stainless steel construction. The primer shall be capable of 20 inches of mercury vacuum. The primer shall be actuated with a spring return, single control lever located at the operator's panel. The primer to pump line shall be equipped with an automatic check valve for priming form an open body of water and a manual shut-off for pumping from a pressurized water source.

Suction/Discharge
The suction and discharge ports shall be female pipe thread, designed and located to accept applicable hose thread adapters.

Engine
The engine shall be a 4 cycle gasoline Briggs and Stratton Vanguard series 350400 V Twin, overhead valve, air cooled design. Engine rating shall be 18 BHP at 4000 rpm with a torque of 30 lb-ft at 2600 rpm. Engine displacement shall be 570cc and shall be designed to meet 1994 CARB (California Air Resources Board) standards. A 12-volt electric system shall be provided with electric starter and a 16 amp alternator. Recoil backup engine starting shall be provided. Engine shall be equipped with a residential muffler with USDA approved spark arrestor.

Mounting Platform
The pump/engine shall be isolation mounted onto a steel base plate.

Instrumentation
The pump shall be supplied with a remote mounted control panel. This includes a throttle lever, primer lever, master switch, starter button, choke control, a 2.5 inch liquid filled discharge gauge and an oil pressure warning light.

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PUMP SPECIFICATIONS

HPX200-H20 Portable Pump

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
The pump body shall be made of alloy aluminum castings coupled together with a stainless steel band clamp with an O-ring seal which allows quick pump volute removal for servicing. The pump end shall be factory hydrostatically tested to 250 PSI for 10 minutes. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The impeller shall be 8.75 inches (222.25 mm) in diameter and designed with a sleeve back end to prevent water from coming in contact with the engine shaft. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type. The pump body shall be equipped with a petcock drain valve.

Priming
The pump shall be equipped with an exhaust venture primer of brass and stainless steel construction. The primer shall be capable of 20 inches of mercury vacuum. The primer shall be actuated with a spring return, single control lever located at the operator's panel. The primer to pump line shall be equipped with an automatic check valve for priming form an open body of water and a manual shut-off for pumping from a pressurized water source.

Suction/Discharge
The suction and discharge ports shall be female pipe thread, designed and located to accept applicable hose thread adapters.

Engine
The engine shall be a 4-cycle gasoline Honda series GX620, overhead valve, air cooled design. Engine rating shall be 20 BHP at 3600. Engine displacement shall be 614cc and shall be designed to meet 1994 CARB (California Air Resources Board) standards. A 12-volt electric system shall be provided with electric starter and a 20amp alternator. Recoil backup engine starting shall be provided. Engine shall be equipped with a residential muffler with USDA approved spark arrestor and a removable heat isolation blanket.

Mounting Platform
The pump/engine shall be isolation mounted onto a steel base plate.

Instrumentation
The pump shall be supplied with a control and gauge for easy viewing. This includes a throttle lever, primer lever, master switch, starter button, choke control, a 2.5 inch liquid filled discharge gauge and an oil pressure warning light.

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PUMP SPECIFICATIONS

HPX200-BD26 Portable Pump

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.

Performance
The pump/engine shall perform to the standards of NFPA 1906 low pressure pump rating. Typical pump performance from 5 foot draft at sea level shall be: 160 GPM @ 125 PSI, 200GPM @ 100 PSI and 270 GPM @ 50 PSI.

Pump
The pump body shall be made of alloy aluminum castings coupled together with a stainless steel band clamp with an O-ring seal which allows quick pump volute removal for servicing. The pump end shall be factory hydrostatically tested to 250 PSI for 10 minutes. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The impeller shall be 8.75 inches in diameter and designed with a sleeve back end to prevent water from coming in contact with the engine shaft. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type. The pump body shall be equipped with a petcock drain valve.

Priming Pump

1. The priming pump shall be a positive displacement, oil-less rotary vane electric motor driven pump conforming to the requirements of NFPA 1901. The pump body shall be manufactured of heat treated anodized aluminum for wear and corrosion resistance.
2. The pump shall be capable of producing a minimum 24 Hg vacuum at 2000 feet above sea level.
3. The electric motor shall be a 12 VDC (or 24 VDC) totally enclosed unit.
4. The priming pump shall not require lubrication.
5. The priming pump shall be operated by a single push-pull control valve mounted on the pump operator panel. The control valve shall be of all bronze construction

Suction/Discharge
The suction and discharge ports shall be female pipe thread, designed and located to accept applicable hose thread adapters.

Engine
The engine shall be a 4 cycle diesel Briggs and Stratton Vanguard series DM950D radiator liquid cooled design. Engine rating shall be 26 BHP at 3600 rpm. A 12-volt electric system shall be provided with electric starter and alternator. Engine shall be equipped with a USDA approved spark arrestor.

Mounting Platform
The pump/engine shall be isolation mounted on engine mounting legs

Instrumentation
The pump shall be supplied with a remote mounted control panel. This panel shall include a throttle lever, primer lever, master switch, starter button, a 2.5 inch liquid filled discharge gauge and an oil pressure warning light.

PUMP SPECIFICATIONS

HPX200-YD10 Portable Pump

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.

Performance
The pump/engine shall perform to the standards of ISO 9 and NFPA 1906 low pressure pump rating. Typical pump performance from 5 foot draft at sea level shall be: 40 GPM @ 100 PSI, 140GPM @ 50 PSI, and 185 GPM @ 25 PSI.

Pump
The pump body shall be made of alloy aluminum castings coupled together with a stainless steel band clamp with an O-ring seal which allows quick pump volute removal for servicing. The pump end shall be factory hydrostatically tested to 250 PSI for 10 minutes. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The impeller shall be 8.75 inches in diameter and designed with a sleeve back end to prevent water from coming in contact with the engine shaft. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type. The pump body shall be equipped with a petcock drain valve.

Priming
The pump shall be equipped with an exhaust venture primer of brass and stainless steel construction. The primer shall be capable of 20 inches of mercury vacuum. The primer shall be actuated with a spring return, single control lever located at the operator's panel. The primer to pump line shall be equipped with an automatic check valve for priming form an open body of water and a manual shut-off for pumping from a pressurized water source.

Suction/Discharge
The suction and discharge ports shall be female pipe thread, designed and located to accept applicable hose thread adapters.

Engine
The engine shall be a 4 cycle diesel Yanmar series L100AE air cooled design. Engine rating shall be 10 BHP at 3600 rpm. A 12-volt electric system shall be provided with electric starter and alternator. Engine shall be equipped with a USDA approved spark arrestor.

Mounting Platform
The pump/engine shall be isolation mounted onto a steel base plate.

Instrumentation
The pump shall be supplied with a remote mounted control panel. This panel shall include a throttle lever, primer lever, master switch, starter button, a 2.5 inch liquid filled discharge gauge and an oil pressure warning light.

PUMP SPECIFICATIONS

HPX300-B18 Portable Pump

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.

Performance
The pump/engine shall perform to the standards of CEN 6/5 and NFPA 1906 low pressure pump rating. Typical pump performance from 5 foot draft at sea level shall be: 150 GPM @ 100 PSI, 250 GPM @ 75 PSI, and 380 GPM @ 25 PSI.

Pump
The pump body shall be made of alloy aluminum castings coupled together with a stainless steel band clamp with an O-ring seal which allows quick pump volute removal for servicing. The pump end shall be factory hydrostatically tested to 250 PSI for 10 minutes. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The impeller shall be 8.75 inches in diameter and designed with a sleeve back end to prevent water from coming in contact with the engine shaft. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type. The pump body shall be equipped with a petcock drain valve.

Priming
The pump shall be equipped with an exhaust venture primer of brass and stainless steel construction. The primer shall be capable of 20 inches of mercury vacuum. The primer shall be actuated with a spring return, single control lever located at the operator's panel. The primer to pump line shall be equipped with an automatic check valve for priming form an open body of water and a manual shut-off for pumping from a pressurized water source.

Suction/Discharge
The suction and discharge ports shall be female pipe thread, designed and located to accept applicable hose thread adapters.

Engine
The engine shall be a 4 cycle gasoline Briggs and Stratton Vanguard series 350400 V Twin, overhead valve, air cooled design. Engine rating shall be 18 BHP at 4000 rpm with a torque of 30 lb-ft at 2600 rpm. Engine displacement shall be 570cc and shall be designed to meet 1994 CARB (California Air Resources Board) standards. A 12-volt electric system shall be provided with electric starter and a 16 amp alternator. Recoil backup engine starting shall be provided. Engine shall be equipped with a residential muffler with USDA approved spark arrestor.

Mounting Platform
The pump/engine shall be isolation mounted onto a steel base plate.

Instrumentation
The pump shall be supplied with a remote mounted control panel. This includes a throttle lever, primer lever, master switch, starter button, choke control, a 2.5 inch liquid filled discharge gauge and an oil pressure warning light.

PUMP SPECIFICATIONS

HPX300-H20 Portable Pump

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
The pump body shall be made of alloy aluminum castings coupled together with a stainless steel band clamp with an O-ring seal which allows quick pump volute removal for servicing. The pump end shall be factory hydrostatically tested to 250 PSI for 10 minutes. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The impeller shall be 8.75 inches (222.25 mm) in diameter and designed with a sleeve back end to prevent water from coming in contact with the engine shaft. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type. The pump body shall be equipped with a petcock drain valve.

Priming
The pump shall be equipped with an exhaust venture primer of brass and stainless steel construction. The primer shall be capable of 20 inches of mercury vacuum. The primer shall be actuated with a spring return, single control lever located at the operator's panel. The primer to pump line shall be equipped with an automatic check valve for priming form an open body of water and a manual shut-off for pumping from a pressurized water source.

Suction/Discharge
The suction and discharge ports shall be female pipe thread, designed and located to accept applicable hose thread adapters.

Engine
The engine shall be a 4-cycle gasoline Honda series GX620, overhead valve, air cooled design. Engine rating shall be 20 BHP at 3600. Engine displacement shall be 614cc and shall be designed to meet 1994 CARB (California Air Resources Board) standards. A 12-volt electric system shall be provided with electric starter and a 20amp alternator. Recoil backup engine starting shall be provided. Engine shall be equipped with a residential muffler with USDA approved spark arrestor and a removable heat isolation blanket.

Mounting Platform
The pump/engine shall be isolation mounted onto a steel base plate.

Instrumentation
The pump shall be supplied with a control and gauge for easy viewing. This includes a throttle lever, primer lever, master switch, starter button, choke control, a 2.5 inch liquid filled discharge gauge and an oil pressure warning light.

PUMP SPECIFICATIONS

HPX300-BD26 Portable Pump

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
The pump body shall be made of alloy aluminum castings coupled together with a stainless steel band clamp with an O-ring seal which allows quick pump volute removal for servicing. The pump end shall be factory hydrostatically tested to 200 PSI for 10 minutes. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The impeller shall be 8.75 inches in diameter and designed with a sleeve back end to prevent water from coming in contact with the engine shaft. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type. The pump body shall be equipped with a petcock drain valve.

Priming Pump

1. The priming pump shall be a positive displacement, oil-less rotary vane electric motor driven pump conforming to the requirements of NFPA 1901. The pump body shall be manufactured of heat treated anodized aluminum for wear and corrosion resistance.
2. The pump shall be capable of producing a minimum 24 Hg vacuum at 2000 feet above sea level.
3. The electric motor shall be a 12 VDC (or 24 VDC) totally enclosed unit.
4. The priming pump shall not require lubrication.
5. The priming pump shall be operated by a single push-pull control valve mounted on the pump operator panel. The control valve shall be of all bronze construction

Suction/Discharge
The suction and discharge ports shall be female pipe thread, designed and located to accept applicable hose thread adapters.

Engine
The engine shall be a 4 cycle diesel Briggs and Stratton Vanguard series DM950D radiator liquid cooled design. Engine rating shall be 26 BHP at 3600 rpm. A 12-volt electric system shall be provided with electric starter and alternator. Engine shall be equipped with a USDA approved spark arrestor.

Mounting Platform
The pump/engine shall be isolation mounted on engine mounting legs

Instrumentation
The pump shall be supplied with a remote mounted control panel. This panel shall include a throttle lever, primer lever, master switch, starter button, a 2.5 inch liquid filled discharge gauge and an oil pressure warning light.

PUMP SPECIFICATIONS

HPX400-B18 Portable Pump

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.

Performance
Typical pump performance from 5 foot draft at sea level shall be: 90 GPM @ 100 PSI, 340 GPM @ 50 PSI, and 460 GPM @ 25 PSI.

Pump
The pump body shall be made of alloy aluminum castings coupled together with a stainless steel band clamp with an O-ring seal which allows quick pump volute removal for servicing. The pump end shall be factory hydrostatically tested to 200 PSI for 10 minutes. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The impeller shall be 7.25 inches in diameter and designed with a sleeve back end to prevent water from coming in contact with the engine shaft. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type. The pump body shall be equipped with a petcock drain valve.

Priming
The pump shall be equipped with an exhaust venture primer of brass and stainless steel construction. The primer shall be capable of 20 inches of mercury vacuum. The primer shall be actuated with a spring return, single control lever located at the operator's panel. The primer to pump line shall be equipped with an automatic check valve for priming form an open body of water and a manual shut-off for pumping from a pressurized water source.

Suction/Discharge
The suction and discharge ports shall be female pipe thread, designed and located to accept applicable hose thread adapters.

Engine
The engine shall be a 4 cycle gasoline Briggs and Stratton Vanguard series 350400 V Twin, overhead valve, air cooled design. Engine rating shall be 18 BHP at 4000 rpm with a torque of 30 lb-ft at 2600 rpm. Engine displacement shall be 570cc and shall be designed to meet 1994 CARB (California Air Resources Board) standards. A 12-volt electric system shall be provided with electric starter and a 16 amp alternator. Recoil backup engine starting shall be provided. Engine shall be equipped with a residential muffler with USDA approved spark arrestor.

Mounting Platform
The pump/engine shall be isolation mounted onto a steel base plate.

Instrumentation
The pump shall be supplied with a remote mounted control panel. This includes a throttle lever, primer lever, master switch, starter button, choke control, a 2.5 inch liquid filled discharge gauge and an oil pressure warning light.

PUMP SPECIFICATIONS

HPX400-BD26 Portable Pump

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.

Performance
Typical pump performance from 5 foot draft at sea level shall be: 540 GPM @ 25 PSI, 420 GPM @ 50 PSI, and 310 GPM @ 75 PSI.

Pump
The pump body shall be made of alloy aluminum castings coupled together with a stainless steel band clamp with an O-ring seal which allows quick pump volute removal for servicing. The pump end shall be factory hydrostatically tested to 200 PSI for 10 minutes. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The impeller shall be 7.25 inches in diameter and designed with a sleeve back end to prevent water from coming in contact with the engine shaft. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type. The pump body shall be equipped with a petcock drain valve.

Priming Pump

1. The priming pump shall be a positive displacement, oil-less rotary vane electric motor driven pump conforming to the requirements of NFPA 1901. The pump body shall be manufactured of heat treated anodized aluminum for wear and corrosion resistance.
2. The pump shall be capable of producing a minimum 24 Hg vacuum at 2000 feet above sea level.
3. The electric motor shall be a 12 VDC (or 24 VDC) totally enclosed unit.
4. The priming pump shall not require lubrication.
5. The priming pump shall be operated by a single push-pull control valve mounted on the pump operator panel. The control valve shall be of all bronze construction

Suction/Discharge
The suction and discharge ports shall be female pipe thread, designed and located to accept applicable hose thread adapters.

Engine
The engine shall be a 4 cycle diesel Briggs and Stratton Vanguard series DM950D radiator liquid cooled design. Engine rating shall be 26 BHP at 3600 rpm. A 12-volt electric system shall be provided with electric starter and alternator. Engine shall be equipped with a USDA approved spark arrestor.

Mounting Platform
The pump/engine shall be isolation mounted on engine mounting legs

Instrumentation
The pump shall be supplied with a remote mounted control panel. This panel shall include a throttle lever, primer lever, master switch, starter button, a 2.5 inch liquid filled discharge gauge and an oil pressure warning light.

PUMP SPECIFICATIONS

HPXB75-B18 Portable Pump

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.

Performance
The pump/engine shall perform to the standards of ISO 9 and NFPA 1906 high pressure rating @ 20 GPM and medium pressure rating @ 90 GPM. Typical pump performance from 5 foot draft at sea level shall be: 15 GPM @ 325 PSI, 105 GPM @ 150 PSI, and 130 GPM @ 50 PSI.

Pump
The pump body shall be made of alloy aluminum castings coupled together with a stainless steel band clamp with an O-ring seal which allows quick pump volute removal for servicing. The pump end shall be factory hydrostatically tested to 400 PSI for 10 minutes. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The impeller shall be 4.875 inches in diameter and designed with a sleeve back end to prevent water from coming in contact with the engine shaft. To obtain the required pressures, a built-in oil bath lubricated gearbox shall be provided between the pump end and engine. The gearbox shall be coupled together with a stainless steel band clamp. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type. The pump body shall be equipped with a petcock drain valve.

Priming
The pump shall be equipped with an exhaust venture primer of brass and stainless steel construction. The primer shall be capable of 20 inches of mercury vacuum. The primer shall be actuated with a spring return, single control lever located at the operator's panel. The primer to pump line shall be equipped with an automatic check valve for priming form an open body of water and a manual shut-off for pumping from a pressurized water source.

Suction/Discharge
The suction and discharge ports shall be female pipe thread, designed and located to accept applicable hose thread adapters.

Engine
The engine shall be a 4-cycle gasoline Briggs and Stratton Vanguard series 350400 V-Twin, overhead valve, air cooled design. Engine rating shall be 18 BHP at 4000 rpm with a torque of 30 lb-ft at 2600 rpm. Engine displacement shall be 570cc and shall be designed to meet 1994 CARB (California Air Resources Board) standards. A 12-volt electric system shall be provided with electric starter and a 16 amp alternator. Recoil backup engine starting shall be provided. Engine shall be equipped with a residential muffler with USDA approved spark arrestor.

Mounting Platform/Base Fuel Tank
The pump/engine shall be isolation mounted onto a cross linked polyethylene platform which also serves as a 3 gallon fuel tank.

Instrumentation
The pump shall be supplied with a remote mounted control panel. This panel shall include a throttle lever, primer lever, master switch, starter button, choke control, a 2.5 inch liquid filled discharge gauge and an oil pressure warning light.

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Phone: 610-825-6300, Fax: 610-825-6440, www.haleproducts.com

PUMP SPECIFICATIONS

HPXB100-B18 Portable Pump

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.

Performance
The pump/engine shall perform to the standards of ISO 9 and NFPA 1906 medium pressure rating @ 30 GPM. Typical pump performance from 5 foot draft at sea level shall be: 15 GPM @ 280 PSI, 100 GPM @ 150 PSI, and 150 GPM @ 50 PSI

Pump
The pump body shall be made of alloy aluminum castings coupled together with a stainless steel band clamp with an O-ring seal which allows quick pump volute removal for servicing. The pump end shall be factory hydrostatically tested to 400 PSI for 10 minutes. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The impeller shall be 4.875 inches in diameter and designed with a sleeve back end to prevent water from coming in contact with the engine shaft. To obtain the required pressures, a built-in oil bath lubricated gearbox shall be provided between the pump end and engine. The gearbox shall be coupled together with a stainless steel band clamp. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type. The pump body shall be equipped with a petcock drain valve.

Priming
The pump shall be equipped with an exhaust venture primer of brass and stainless steel construction. The primer shall be capable of 20 inches of mercury vacuum. The primer shall be actuated with a spring return, single control lever located at the operator's panel. The primer to pump line shall be equipped with an automatic check valve for priming form an open body of water and a manual shut-off for pumping from a pressurized water source.

Suction/Discharge
The suction and discharge ports shall be female pipe thread, designed and located to accept applicable hose thread adapters.

Engine
The engine shall be a 4-cycle gasoline Briggs and Stratton Vanguard series 350400 V-Twin, overhead valve, air cooled design. Engine rating shall be 18 BHP at 4000 rpm with a torque of 30 lb-ft at 2600 rpm. Engine displacement shall be 570cc and shall be designed to meet 1994 CARB (California Air Resources Board) standards. A 12-volt electric system shall be provided with electric starter and a 16 amp alternator. Recoil backup engine starting shall be provided. Engine shall be equipped with a residential muffler with USDA approved spark arrestor.

Mounting Platform/Base Fuel Tank
The pump/engine shall be isolation mounted onto a cross linked polyethylene platform which also serves as a 3 gallon fuel tank.

Instrumentation
The pump shall be supplied with a remote mounted control panel. This panel shall include a throttle lever, primer lever, master switch, starter button, choke control, a 2.5 inch liquid filled discharge gauge and an oil pressure warning light.

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PUMP SPECIFICATIONS

HPXB100-H20 Portable Pump

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
The pump body shall be made of alloy aluminum castings coupled together with a stainless steel band clamp with an O-ring seal which allows quick pump volute removal for servicing. The pump end shall be factory hydrostatically tested to 400 PSI for 10 minutes. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The impeller shall be 4.875 inches (123.83 mm) in diameter and designed with a sleeve back end to prevent water from coming in contact with the engine shaft. To obtain the required pressures, a built-in oil bath lubricated gearbox shall be provided between the pump end and engine. The gearbox shall be coupled together with a stainless steel band clamp. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type. The pump body shall be equipped with a petcock drain valve.

Priming
The pump shall be equipped with an exhaust venture primer of brass and stainless steel construction. The primer shall be capable of 20 inches of mercury vacuum. The primer shall be actuated with a spring return, single control lever located at the operator's panel. The primer to pump line shall be equipped with an automatic check valve for priming form an open body of water and a manual shut-off for pumping from a pressurized water source.

Suction/Discharge
The suction and discharge ports shall be female pipe thread, designed and located to accept applicable hose thread adapters.

Engine
The engine shall be a 4-cycle gasoline Honda series GX620, overhead valve, air cooled design. Engine rating shall be 20 BHP at 3600. Engine displacement shall be 614cc and shall be designed to meet 1994 CARB (California Air Resources Board) standards. A 12-volt electric system shall be provided with electric starter and a 20amp alternator. Recoil backup engine starting shall be provided. Engine shall be equipped with a residential muffler with USDA approved spark arrestor and a removable heat isolation blanket.

Mounting Platform/Base Fuel Tank
The pump/engine shall be isolation mounted onto a cross linked polyethylene platform which also serves as a 3 gallon fuel tank.

Instrumentation
The pump shall be supplied with a remote mounted control panel. This panel shall include a throttle lever, primer lever, master switch, starter button, choke control, a 2.5 inch liquid filled discharge gauge and an oil pressure warning light.

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PUMP SPECIFICATIONS

HPXB200-B18 Portable Pump

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.

Performance
The pump/engine shall perform to the standards of ISO 9 and NFPA 1906 low pressure pump rating. Typical pump performance from 5 foot draft at sea level shall be: 60 GPM @ 150 PSI, 150GPM @ 100 PSI, and 245 GPM @ 25 PSI.

Pump
The pump body shall be made of alloy aluminum castings coupled together with a stainless steel band clamp with an O-ring seal which allows quick pump volute removal for servicing. The pump end shall be factory hydrostatically tested to 250 PSI for 10 minutes. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The impeller shall be 8.75inches in diameter and designed with a sleeve back end to prevent water from coming in contact with the engine shaft. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type. The pump body shall be equipped with a petcock drain valve.

Priming
The pump shall be equipped with an exhaust venture primer of brass and stainless steel construction. The primer shall be capable of 20 inches of mercury vacuum. The primer shall be actuated with a spring return, single control lever located at the operator’s panel. The primer to pump line shall be equipped with an automatic check valve for priming form an open body of water and a manual shut-off for pumping from a pressurized water source.

Suction/Discharge
The suction and discharge ports shall be female pipe thread, designed and located to accept applicable hose thread adapters.

Engine
The engine shall be a 4-cycle gasoline Briggs and Stratton Vanguard series 350400 V-Twin, overhead valve, air cooled design. Engine rating shall be 18 BHP at 4000 rpm with a torque of 30 lb-ft at 2600 rpm. Engine displacement shall be 570cc and shall be designed to meet 1994 CARB (California Air Resources Board) standards. A 12-volt electric system shall be provided with electric starter and a 16 amp alternator. Recoil backup engine starting shall be provided. Engine shall be equipped with a residential muffler with USDA approved spark arrestor.

Mounting Platform/Base Fuel Tank
The pump/engine shall be isolation mounted onto a cross linked polyethylene platform which also serves as a 3 gallon fuel tank.

Instrumentation
The pump shall be supplied with a remote mounted control panel. This panel shall include a throttle lever, primer lever, master switch, starter button, choke control, a 2.5 inch liquid filled discharge gauge and an oil pressure warning light.

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PUMP SPECIFICATIONS

HPXB200-H20 Portable Pump

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
The pump body shall be made of alloy aluminum castings coupled together with a stainless steel band clamp with an O-ring seal which allows quick pump volute removal for servicing. The pump end shall be factory hydrostatically tested to 250 PSI for 10 minutes. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The impeller shall be 8.75inches (222.25 mm) in diameter and designed with a sleeve back end to prevent water from coming in contact with the engine shaft. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type. The pump body shall be equipped with a petcock drain valve.

Priming
The pump shall be equipped with an exhaust venture primer of brass and stainless steel construction. The primer shall be capable of 20 inches of mercury vacuum. The primer shall be actuated with a spring return, single control lever located at the operator's panel. The primer to pump line shall be equipped with an automatic check valve for priming form an open body of water and a manual shut-off for pumping from a pressurized water source.

Suction/Discharge
The suction and discharge ports shall be female pipe thread, designed and located to accept applicable hose thread adapters.

Engine
The engine shall be a 4-cycle gasoline Honda series GX620, overhead valve, air cooled design. Engine rating shall be 20 BHP at 3600. Engine displacement shall be 614cc and shall be designed to meet 1994 CARB (California Air Resources Board) standards. A 12-volt electric system shall be provided with electric starter and a 20amp alternator. Recoil backup engine starting shall be provided. Engine shall be equipped with a residential muffler with USDA approved spark arrestor and a removable heat isolation blanket.

Mounting Platform/Base Fuel Tank
The pump/engine shall be isolation mounted onto a cross linked polyethylene platform which also serves as a 3 gallon fuel tank.

Instrumentation
The pump shall be supplied with a remote mounted control panel. This panel shall include a throttle lever, primer lever, master switch, starter button, choke control, a 2.5 inch liquid filled discharge gauge and an oil pressure warning light.

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PUMP SPECIFICATIONS

HPXB300-B18 Portable Pump

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.

Performance
The pump/engine shall perform to the standards of CEN 6/5 and NFPA 1906 low pressure pump rating. Typical pump performance from 5 foot draft at sea level shall be: 150 GPM @ 100 PSI, 250 GPM @ 75 PSI, and 380 GPM @ 25 PSI.

Pump
The pump body shall be made of alloy aluminum castings coupled together with a stainless steel band clamp with an O-ring seal which allows quick pump volute removal for servicing. The pump end shall be factory hydrostatically tested to 200 PSI for 10 minutes. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The impeller shall be 8.75inches in diameter and designed with a sleeve back end to prevent water from coming in contact with the engine shaft. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type. The pump body shall be equipped with a petcock drain valve.

Priming
The pump shall be equipped with an exhaust venture primer of brass and stainless steel construction. The primer shall be capable of 20 inches of mercury vacuum. The primer shall be actuated with a spring return, single control lever located at the operator's panel. The primer to pump line shall be equipped with an automatic check valve for priming form an open body of water and a manual shut-off for pumping from a pressurized water source.

Suction/Discharge
The suction and discharge ports shall be female pipe thread, designed and located to accept applicable hose thread adapters.

Engine
The engine shall be a 4-cycle gasoline Briggs and Stratton Vanguard series 350400 V-Twin, overhead valve, air cooled design. Engine rating shall be 18 BHP at 4000 rpm with a torque of 30 lb-ft at 2600 rpm. Engine displacement shall be 570cc and shall be designed to meet 1994 CARB (California Air Resources Board) standards. A 12-volt electric system shall be provided with electric starter and a 16 amp alternator. Recoil backup engine starting shall be provided. Engine shall be equipped with a residential muffler with USDA approved spark arrestor.

Mounting Platform/Base Fuel Tank
The pump/engine shall be isolation mounted onto a cross linked polyethylene platform which also serves as a 3 gallon fuel tank.

Instrumentation
The pump shall be supplied with a remote mounted control panel. This panel shall include a throttle lever, primer lever, master switch, starter button, choke control, a 2.5 inch liquid filled discharge gauge and an oil pressure warning light.

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PUMP SPECIFICATIONS

HPXB300-H20 Portable Pump

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
The pump body shall be made of alloy aluminum castings coupled together with a stainless steel band clamp with an O-ring seal which allows quick pump volute removal for servicing. The pump end shall be factory hydrostatically tested to 200 PSI for 10 minutes. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The impeller shall be 8.75inches (222.25 mm) in diameter and designed with a sleeve back end to prevent water from coming in contact with the engine shaft. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type. The pump body shall be equipped with a petcock drain valve.

Priming
The pump shall be equipped with an exhaust venture primer of brass and stainless steel construction. The primer shall be capable of 20 inches of mercury vacuum. The primer shall be actuated with a spring return, single control lever located at the operator's panel. The primer to pump line shall be equipped with an automatic check valve for priming form an open body of water and a manual shut-off for pumping from a pressurized water source.

Suction/Discharge
The suction and discharge ports shall be female pipe thread, designed and located to accept applicable hose thread adapters.

Engine
The engine shall be a 4-cycle gasoline Honda series GX620, overhead valve, air cooled design. Engine rating shall be 20 BHP at 3600. Engine displacement shall be 614cc and shall be designed to meet 1994 CARB (California Air Resources Board) standards. A 12-volt electric system shall be provided with electric starter and a 20amp alternator. Recoil backup engine starting shall be provided. Engine shall be equipped with a residential muffler with USDA approved spark arrestor and a removable heat isolation blanket.

Mounting Platform/Base Fuel Tank
The pump/engine shall be isolation mounted onto a cross linked polyethylene platform which also serves as a 3 gallon fuel tank.

Instrumentation
The pump shall be supplied with a remote mounted control panel. This panel shall include a throttle lever, primer lever, master switch, starter button, choke control, a 2.5 inch liquid filled discharge gauge and an oil pressure warning light.

PUMP SPECIFICATIONS

HPXB400-B18 Portable Pump

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.

Performance
Typical pump performance from 5 foot draft at sea level shall be: 90 GPM @ 100 PSI, 340 GPM @ 50 PSI, and 460 GPM @ 25 PSI.

Pump
The pump body shall be made of alloy aluminum castings coupled together with a stainless steel band clamp with an O-ring seal which allows quick pump volute removal for servicing. The pump end shall be factory hydrostatically tested to 200 PSI for 10 minutes. The impeller shall be bronze. The renewable clearance rings shall be made of anodic plated bronze to inhibit galvanic corrosion. The impeller shall be 7.25 inches in diameter and designed with a sleeve back end to prevent water from coming in contact with the engine shaft. The pump shaft seal shall be an automatically adjusting, maintenance free, mechanical type. The pump body shall be equipped with a petcock drain valve.

Priming
The pump shall be equipped with an exhaust venture primer of brass and stainless steel construction. The primer shall be capable of 20 inches of mercury vacuum. The primer shall be actuated with a spring return, single control lever located at the operator's panel. The primer to pump line shall be equipped with an automatic check valve for priming form an open body of water and a manual shut-off for pumping from a pressurized water source.

Suction/Discharge
The suction and discharge ports shall be female pipe thread, designed and located to accept applicable hose thread adapters.

Engine
The engine shall be a 4-cycle gasoline Briggs and Stratton Vanguard series 350400 V-Twin, overhead valve, air cooled design. Engine rating shall be 18 BHP at 4000 rpm with a torque of 30 lb-ft at 2600 rpm. Engine displacement shall be 570cc and shall be designed to meet 1994 CARB (California Air Resources Board) standards. A 12-volt electric system shall be provided with electric starter and a 16 amp alternator. Recoil backup engine starting shall be provided. Engine shall be equipped with a residential muffler with USDA approved spark arrestor.

Mounting Platform/Base Fuel Tank
The pump/engine shall be isolation mounted onto a cross linked polyethylene platform which also serves as a 3 gallon fuel tank.

Instrumentation
The pump shall be supplied with a remote mounted control panel. This panel shall include a throttle lever, primer lever, master switch, starter button, choke control, a 2.5 inch liquid filled discharge gauge and an oil pressure warning light.

Hale Products Inc. A Unit of IDEX Corporation, 700 Spring Mill Ave., Conshohocken, PA 19428
Phone: 610-825-6300, Fax: 610-825-6440, www.haleproducts.com

MOBILE EQUIPMENT SALES CATALOG

Performance Curves

Premium Series

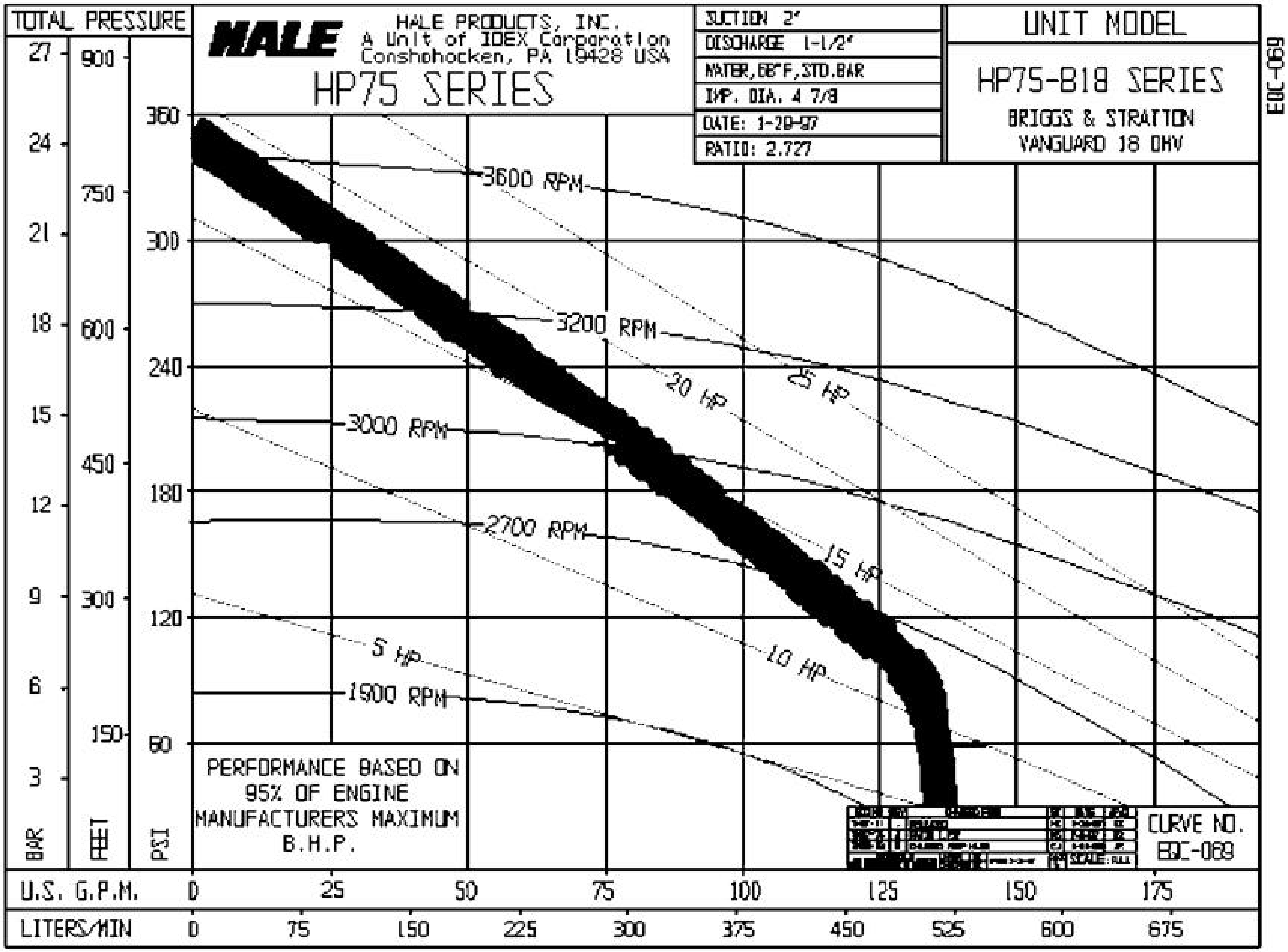
Transportable Series

MaxStream Pumps

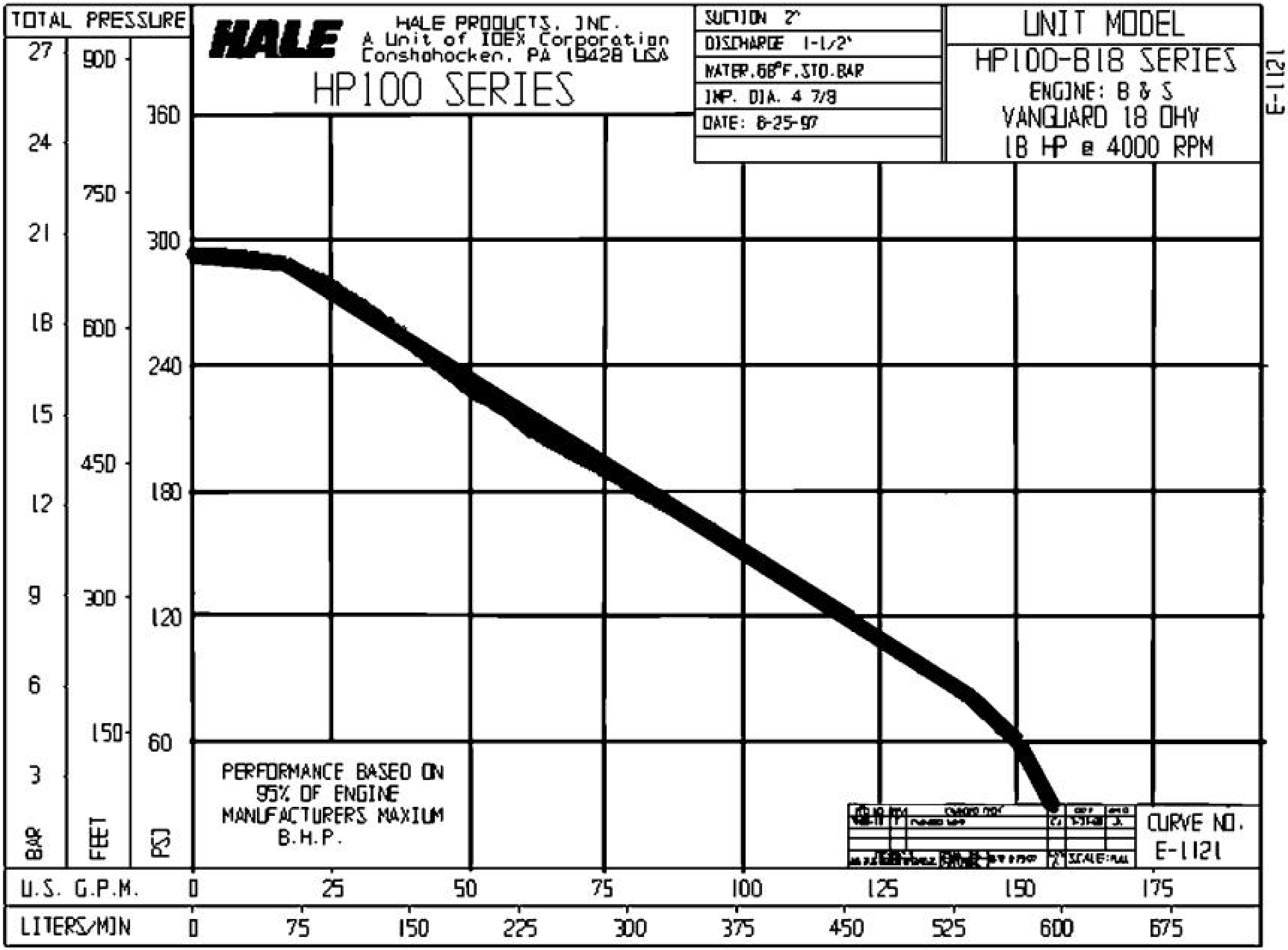
Miscellaneous Pumps

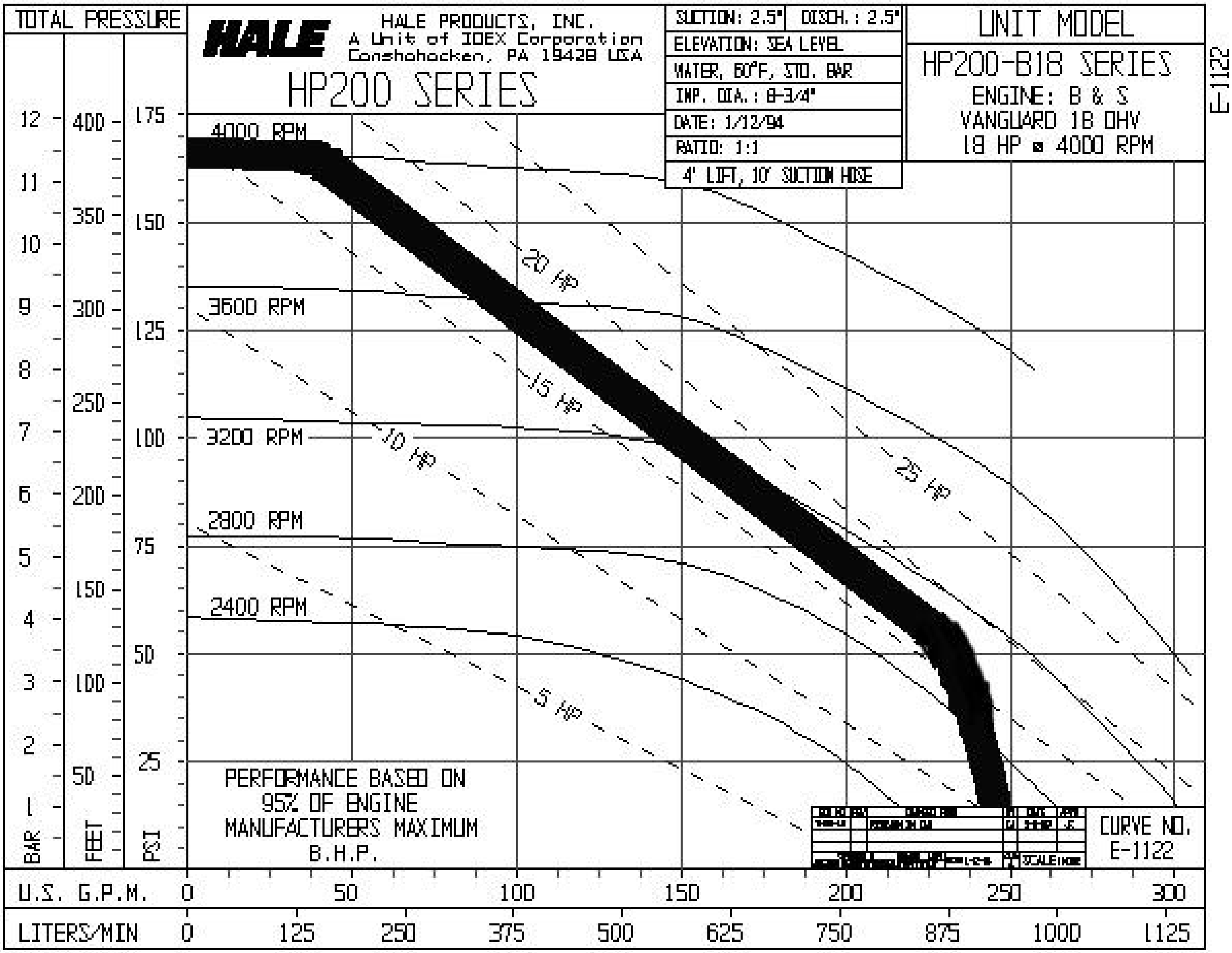
HALE

Class 1

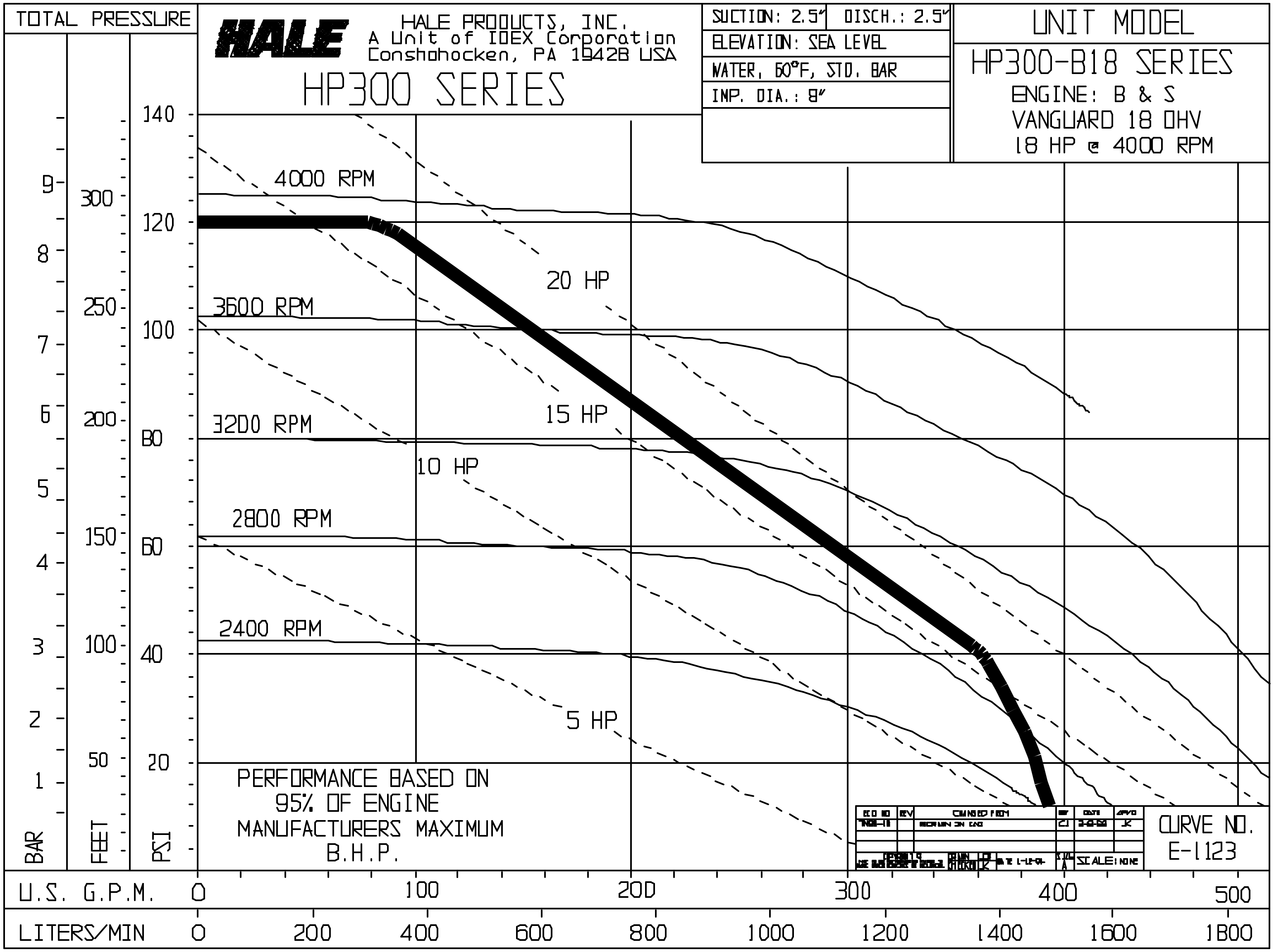


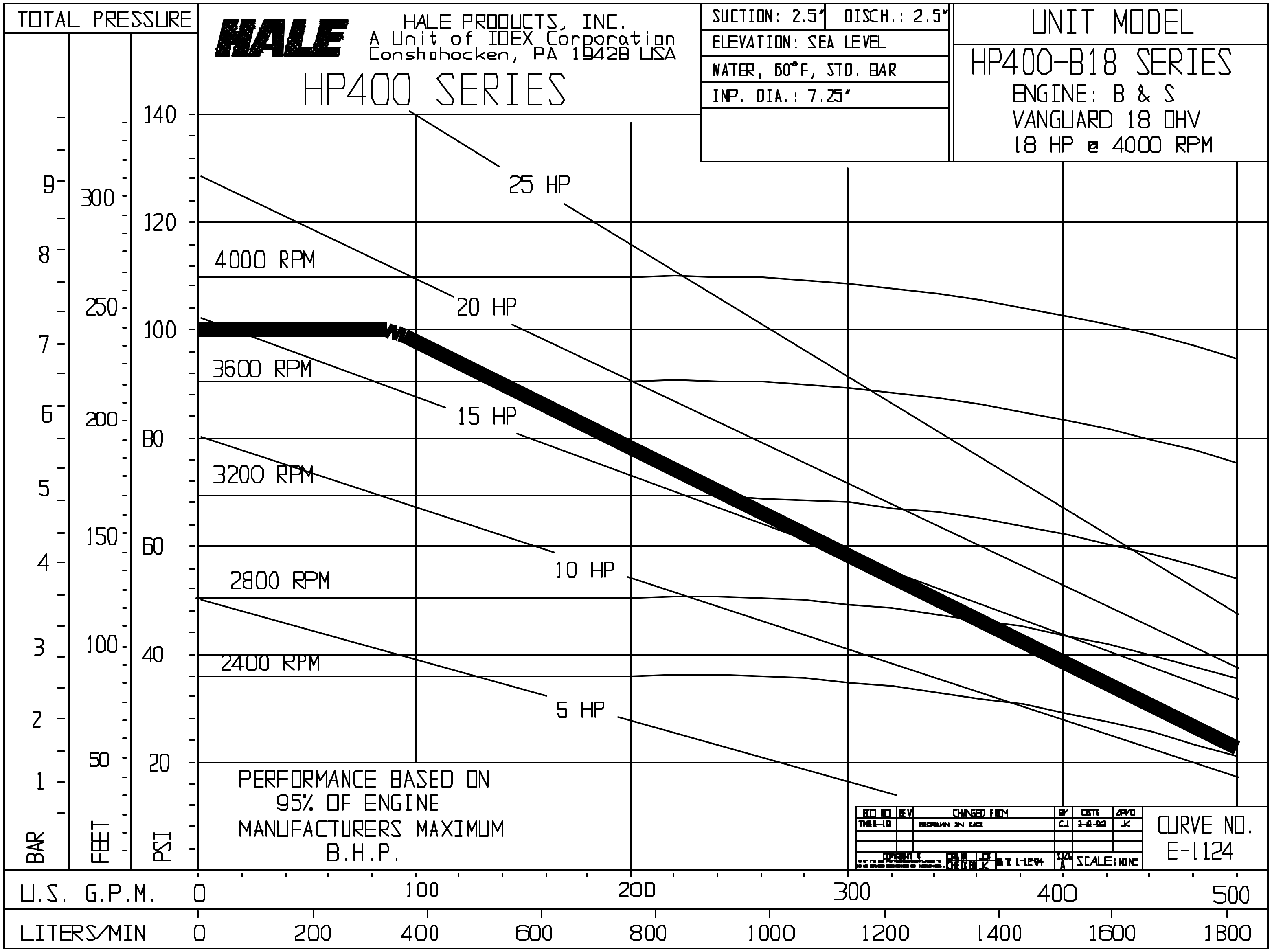
TOTAL PRESSURE
HALE
HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA
HP75 SERIES
SUCTION 2"
DISCHARGE 1-1/2"
WATER,68°F,STD.BAR
IMP. DIA. 4 7/8
DATE: 1-20-97
RATIO: 2.727
UNIT MODEL
HP75-B18 SERIES
BRIGGS & STRATTON
VANGUARD 18 OHV
EDC-069
3600 RPM
3200 RPM
3000 RPM
2700 RPM
1900 RPM
5 HP
10 HP
15 HP
20 HP
25 HP
PERFORMANCE BASED ON
95% OF ENGINE
MANUFACTURERS MAXIMUM
B.H.P.
CURVE NO.
EDC-069
BAR
FEET
PSI
27
24
21
18
15
12
9
6
3
900
750
600
450
300
150
360
300
240
180
120
60
U.S. G.P.M.
0
25
50
75
100
125
150
175
LITERS/MIN
0
75
150
225
300
375
450
525
600
675


TOTAL PRESSURE
HALE
HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA
HP100 SERIES
SUCTION 2"
DISCHARGE 1-1/2"
WATER,68°F,STD.BAR
IMP. DIA. 4 7/8
DATE: 8-25-97
UNIT MODEL
HP100-B18 SERIES
ENGINE: B & S
VANGUARD 18 OHV
18 HP @ 4000 RPM
E-1121
BAR
27
24
21
18
15
12
9
6
3
FEET
900
750
600
450
300
150
PSI
360
300
240
180
120
60
PERFORMANCE BASED ON
95% OF ENGINE
MANUFACTURERS MAXIUM
B.H.P.
CURVE NO.
E-1121
U.S. G.P.M.
0
25
50
75
100
125
150
175
LITERS/MIN
0
75
150
225
300
375
450
525
600
675

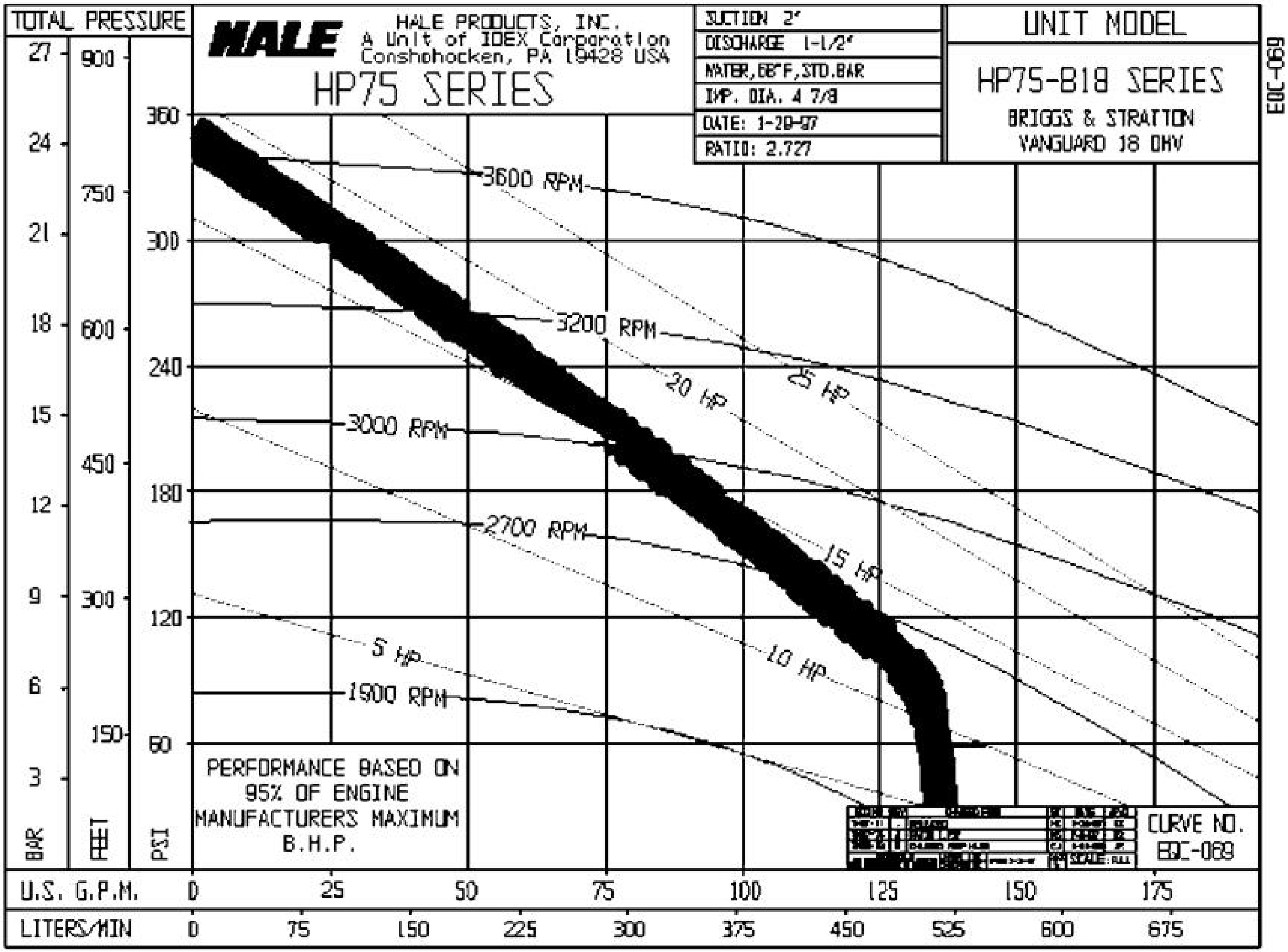


TOTAL PRESSURE
HALE
HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA
HP200 SERIES
SUCTION: 2.5"
DISCH.: 2.5"
ELEVATION: SEA LEVEL
WATER, 60°F, STD. BAR
IMP. DIA.: 8-3/4"
DATE: 1/12/94
RATIO: 1:1
4' LIFT, 10' SUCTION HOSE
UNIT MODEL
HP200-B18 SERIES
ENGINE: B & S
VANGUARD 18 OHV
18 HP @ 4000 RPM
E-1122
4000 RPM
3600 RPM
3200 RPM
2800 RPM
2400 RPM
20 HP
15 HP
10 HP
25 HP
5 HP
PERFORMANCE BASED ON
95% OF ENGINE
MANUFACTURERS MAXIMUM
B.H.P.
CURVE NO.
E-1122
BAR
FEET
PSI
12 11 10 9 8 7 6 5 4 3 2 1
400 350 300 250 200 150 100 50
175 150 125 100 75 50 25
U.S. G.P.M.
0 50 100 150 200 250 300
LITERS/MIN
0 125 250 375 500 625 750 875 1000 1125

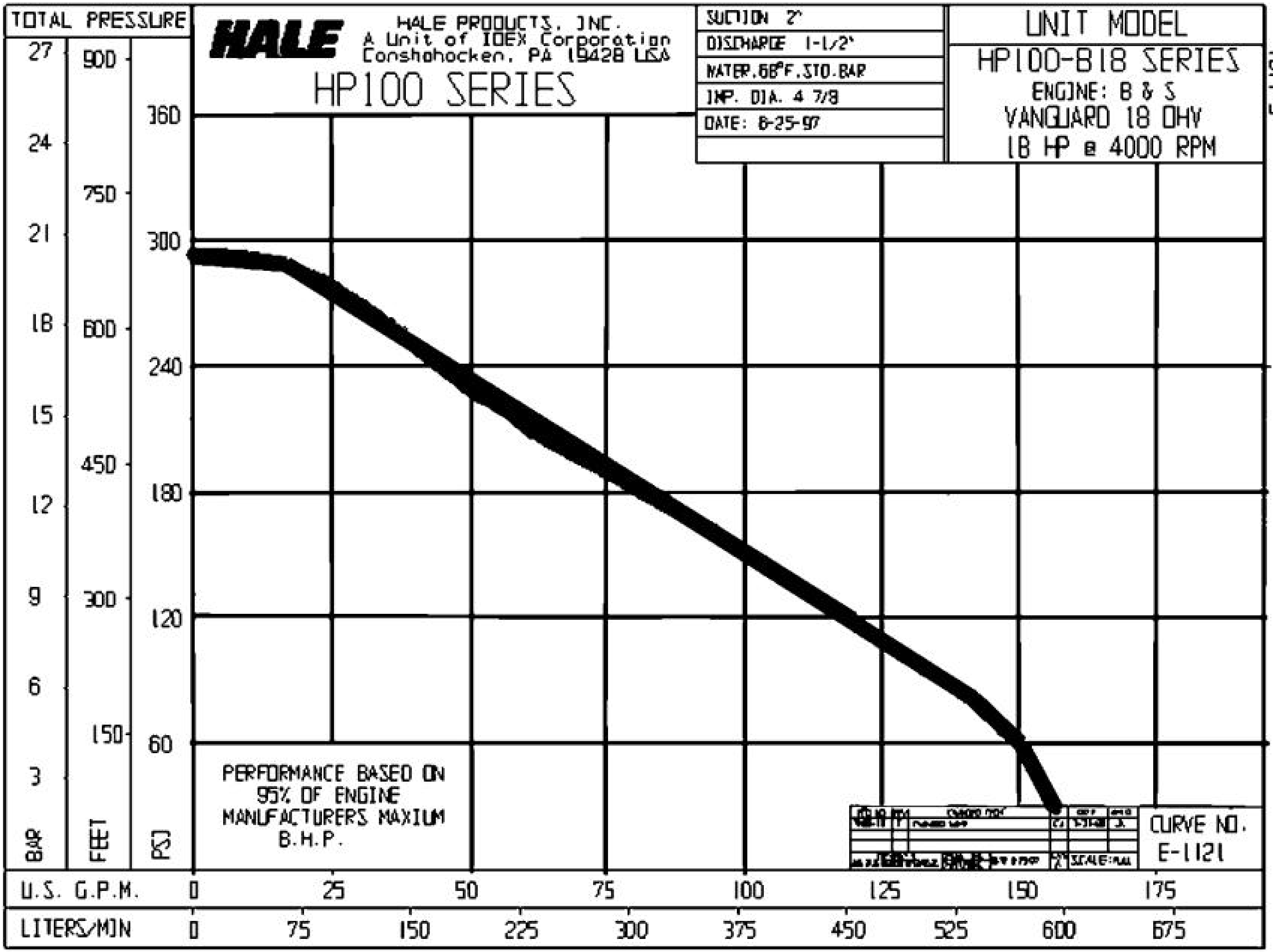

TOTAL PRESSURE
HALE
HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA
HP300 SERIES
SUCTION: 2.5"
DISCH.: 2.5"
ELEVATION: SEA LEVEL
WATER, 60°F, STD. BAR
IMP. DIA.: 8"
UNIT MODEL
HP300-B18 SERIES
ENGINE: B & S
VANGUARD 18 OHV
18 HP @ 4000 RPM
E-1123
4000 RPM
3600 RPM
3200 RPM
2800 RPM
2400 RPM
20 HP
15 HP
10 HP
5 HP
PERFORMANCE BASED ON
95% OF ENGINE
MANUFACTURERS MAXIMUM
B.H.P.
CURVE NO.
E-1123
SCALE: NONE
BAR
FEET
PSI
U.S. G.P.M.
LITERS/MIN
0
100
200
300
400
500
0
200
400
600
800
1000
1200
1400
1600
1800
20
40
60
80
100
120
140
50
100
150
200
250
300
1
2
3
4
5
6
7
8
9



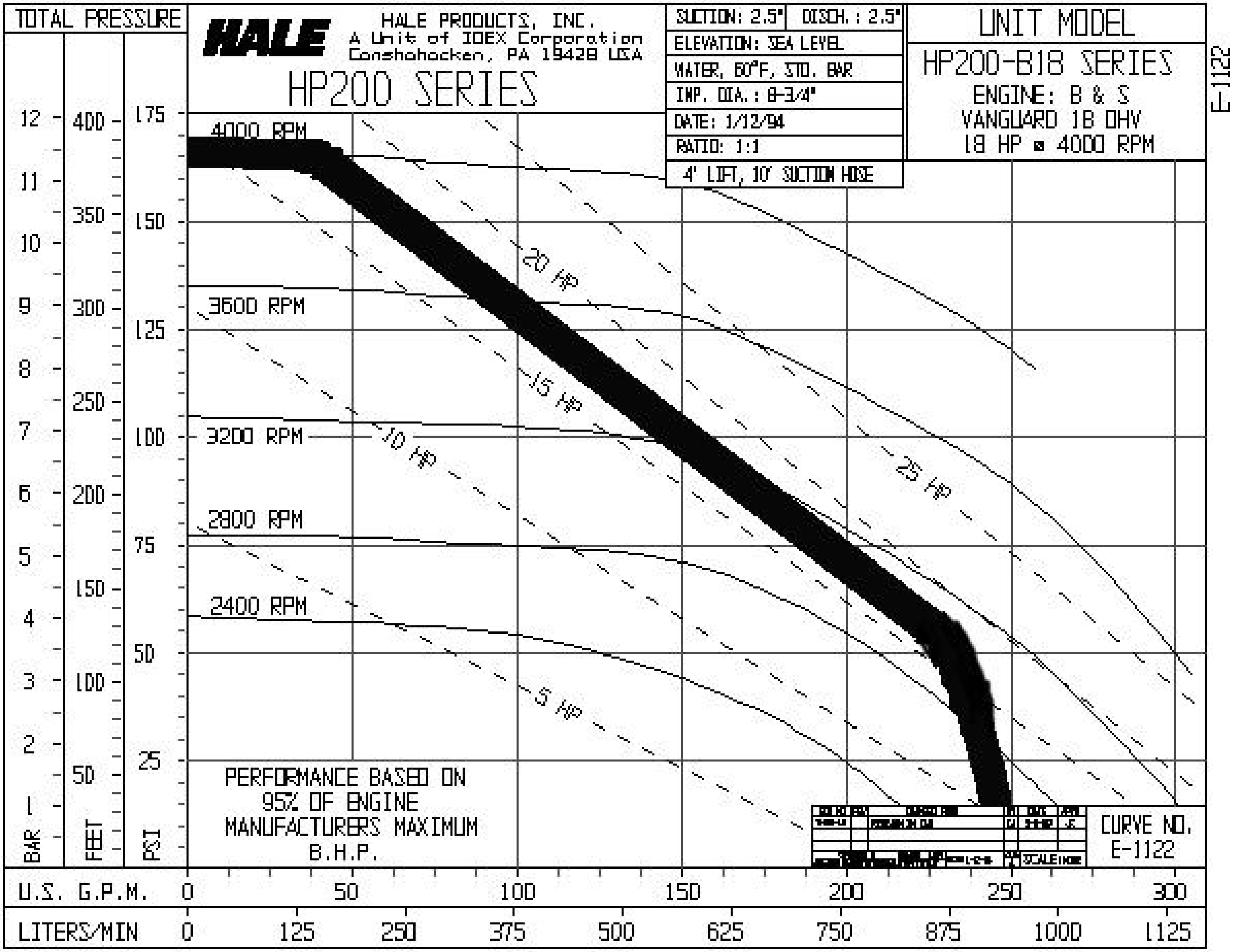
TOTAL PRESSURE
HALE
HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA
HP400 SERIES
SUCTION: 2.5" DISCH.: 2.5"
ELEVATION: SEA LEVEL
WATER, 60°F, STD. BAR
IMP. DIA.: 7.25"
UNIT MODEL
HP400-B18 SERIES
ENGINE: B & S
VANGUARD 18 OHV
18 HP @ 4000 RPM
E-1124
25 HP
20 HP
15 HP
10 HP
5 HP
4000 RPM
3600 RPM
3200 RPM
2800 RPM
2400 RPM
BAR
FEET
PSI
PERFORMANCE BASED ON
95% OF ENGINE
MANUFACTURERS MAXIMUM
B.H.P.
CURVE NO.
E-1124
SCALE NONE
U.S. G.P.M.
0 100 200 300 400 500
LITERS/MIN
0 200 400 600 800 1000 1200 1400 1600 1800



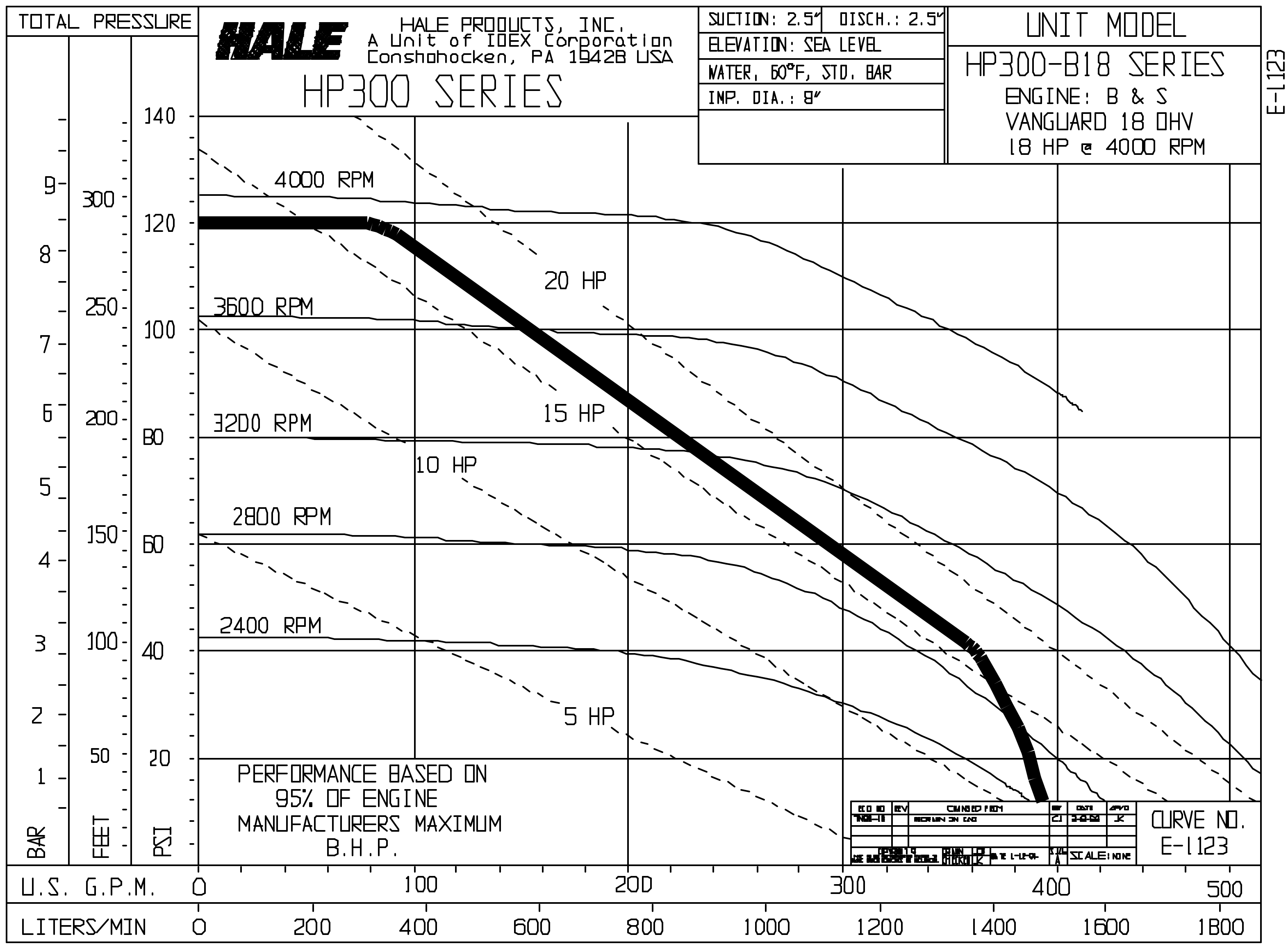
TOTAL PRESSURE
HALE
HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA
HP75 SERIES
SUCTION 2"
DISCHARGE 1-1/2"
WATER,68°F,STD.BAR
IMP. DIA. 4 7/8
DATE: 1-20-97
RATIO: 2.727
UNIT MODEL
HP75-B18 SERIES
BRIGGS & STRATTON
VANGUARD 18 OHV
EQC-069
3600 RPM
3200 RPM
3000 RPM
2700 RPM
1900 RPM
5 HP
10 HP
15 HP
20 HP
25 HP
PERFORMANCE BASED ON
95% OF ENGINE
MANUFACTURERS MAXIMUM
B.H.P.
CURVE NO.
EQC-069
BAR
FEET
PSI
U.S. G.P.M.
LITERS/MIN



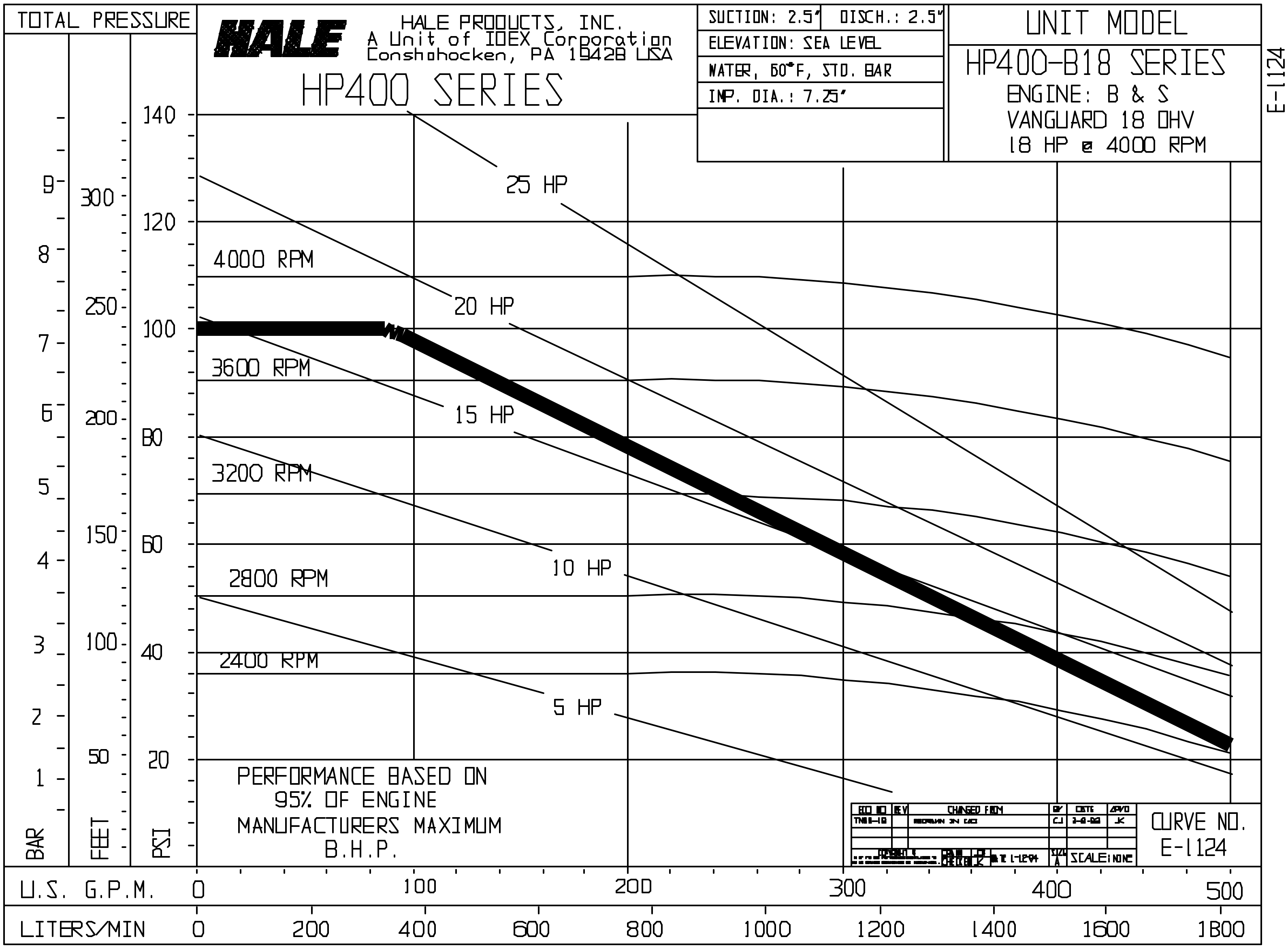
TOTAL PRESSURE
HALE
HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA
HP100 SERIES
SUCTION 2"
DISCHARGE 1-1/2"
WATER,68°F,STD.BAR
IMP. DIA. 4 7/8
DATE: 8-25-97
UNIT MODEL
HP100-B18 SERIES
ENGINE: B & S
VANGUARD 18 OHV
18 HP @ 4000 RPM
E-1121
PERFORMANCE BASED ON
95% OF ENGINE
MANUFACTURERS MAXIUM
B.H.P.
CURVE NO.
E-1121
BAR
FEET
PSI
U.S. G.P.M.
LITERS/MIN

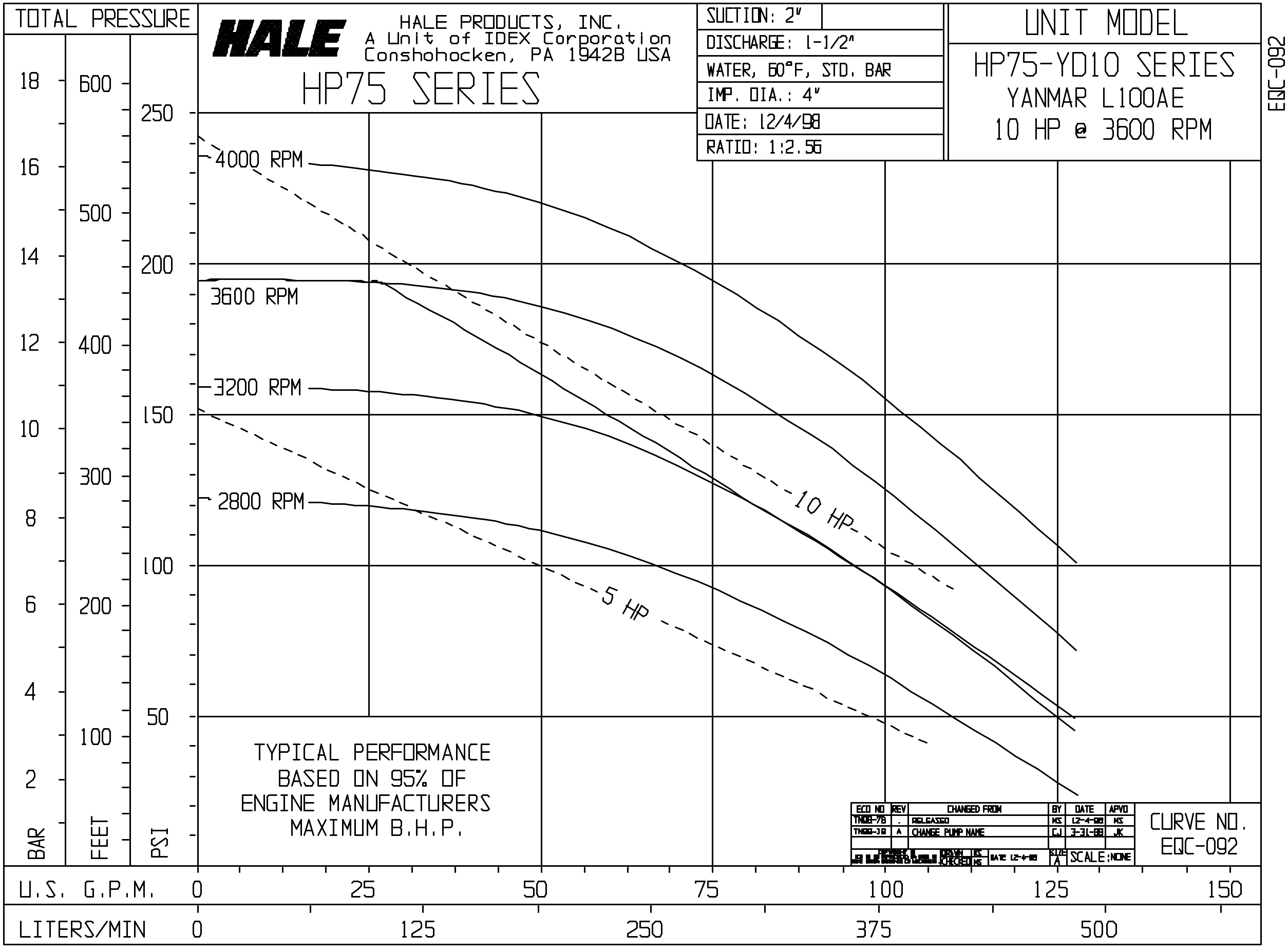


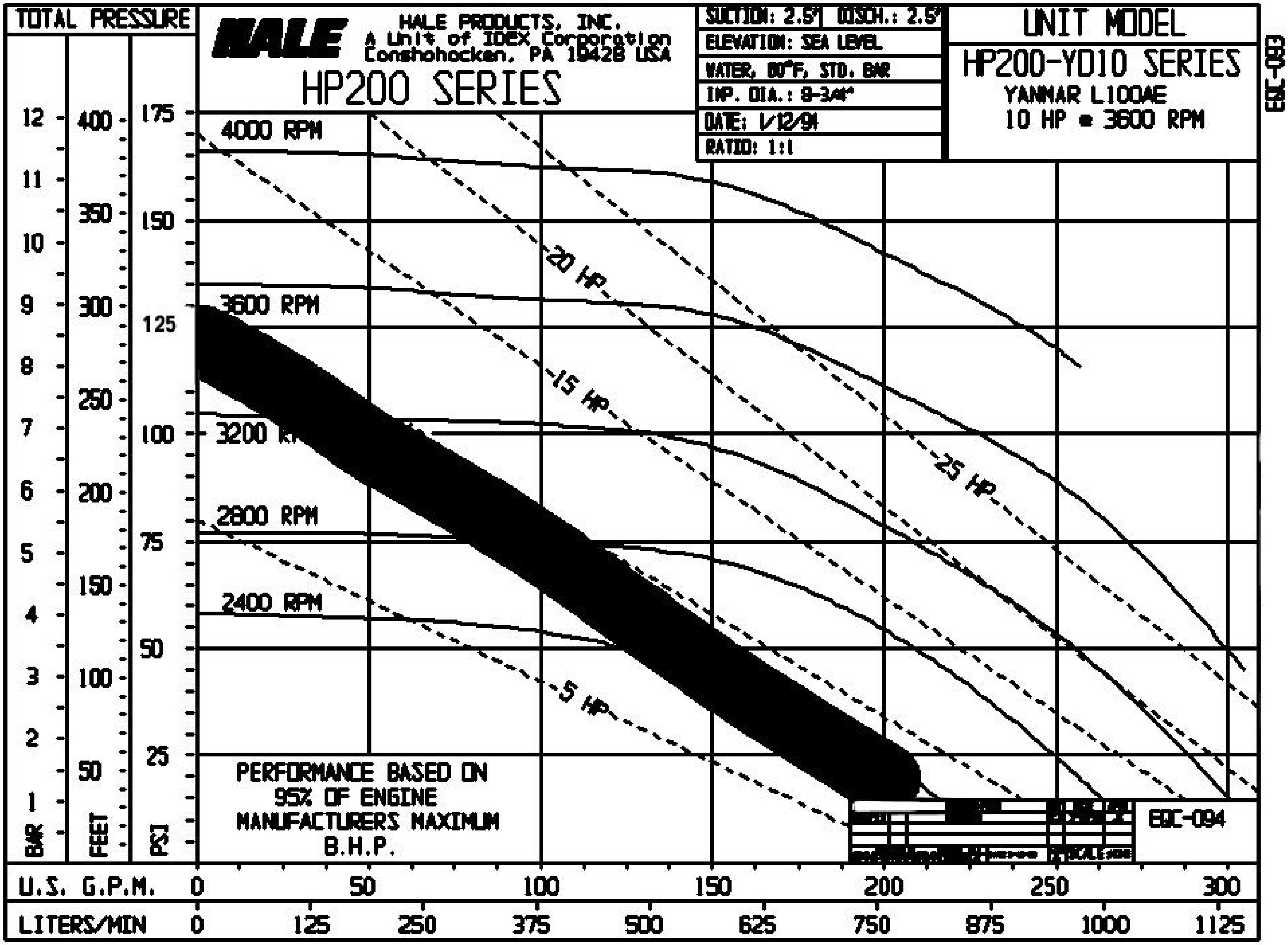
TOTAL PRESSURE
HALE
HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA
HP200 SERIES
SUCTION: 2.5" DISCH.: 2.5"
ELEVATION: SEA LEVEL
WATER, 60°F, STD. BAR
IMP. DIA.: 8-3/4"
DATE: 1/12/94
RATIO: 1:1
4' LIFT, 10' SUCTION HOSE
UNIT MODEL
HP200-B18 SERIES
ENGINE: B & S
VANGUARD 18 OHV
18 HP @ 4000 RPM
E-1122
4000 RPM
3600 RPM
3200 RPM
2800 RPM
2400 RPM
5 HP
10 HP
15 HP
20 HP
25 HP
PERFORMANCE BASED ON
95% OF ENGINE
MANUFACTURERS MAXIMUM
B.H.P.
CURVE NO.
E-1122
BAR
FEET
PSI
U.S. G.P.M.
LITERS/MIN



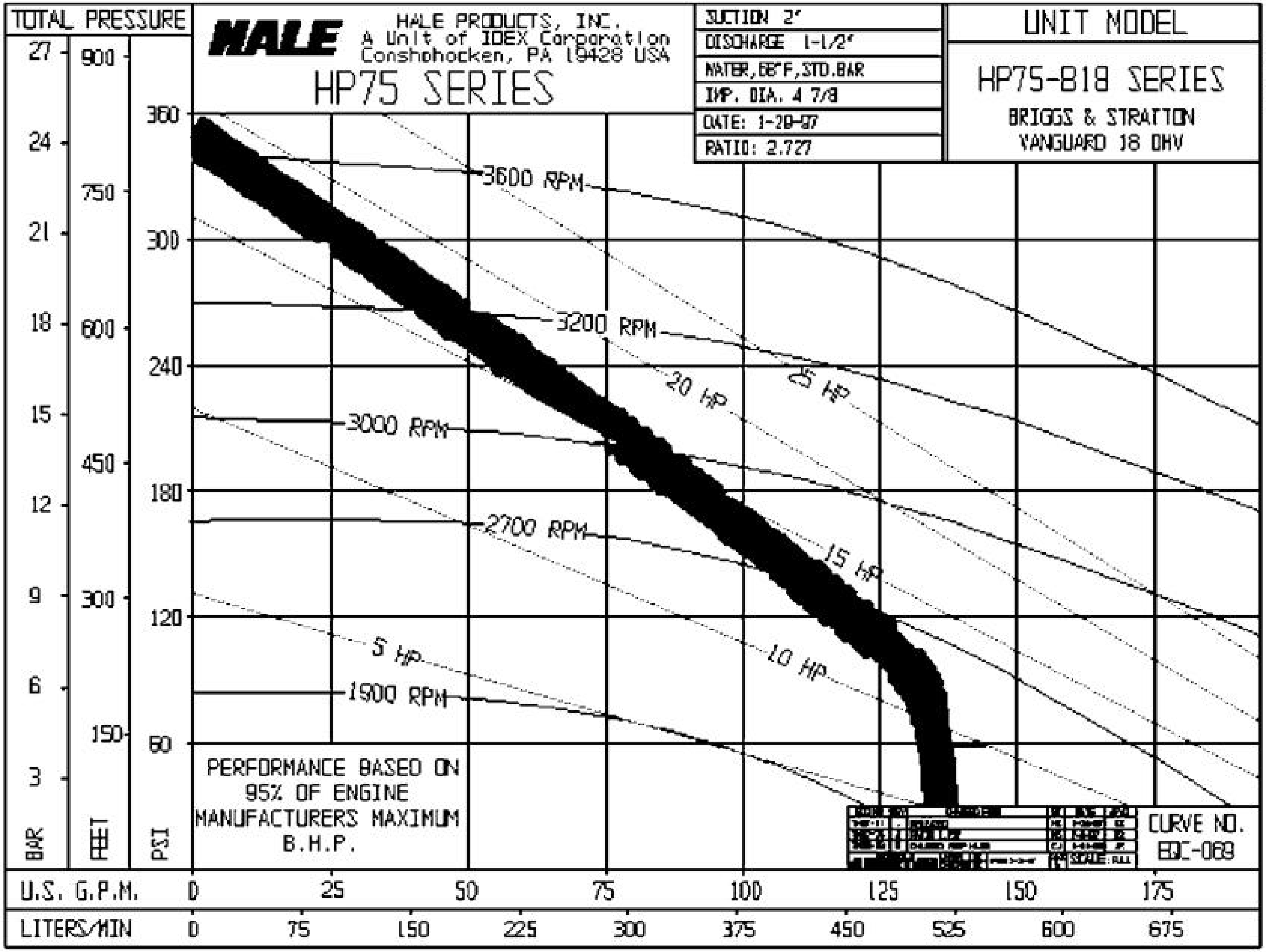
TOTAL PRESSURE
HALE
HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA
HP300 SERIES
SUCTION: 2.5"
DISCH.: 2.5"
ELEVATION: SEA LEVEL
WATER, 60°F, STD. BAR
IMP. DIA.: 8"
UNIT MODEL
HP300-B18 SERIES
ENGINE: B & S
VANGUARD 18 OHV
18 HP @ 4000 RPM
E-1123
4000 RPM
3600 RPM
3200 RPM
2800 RPM
2400 RPM
20 HP
15 HP
10 HP
5 HP
PERFORMANCE BASED ON
95% OF ENGINE
MANUFACTURERS MAXIMUM
B.H.P.
CURVE NO.
E-1123
BAR
FEET
PSI
U.S. G.P.M.
LITERS/MIN

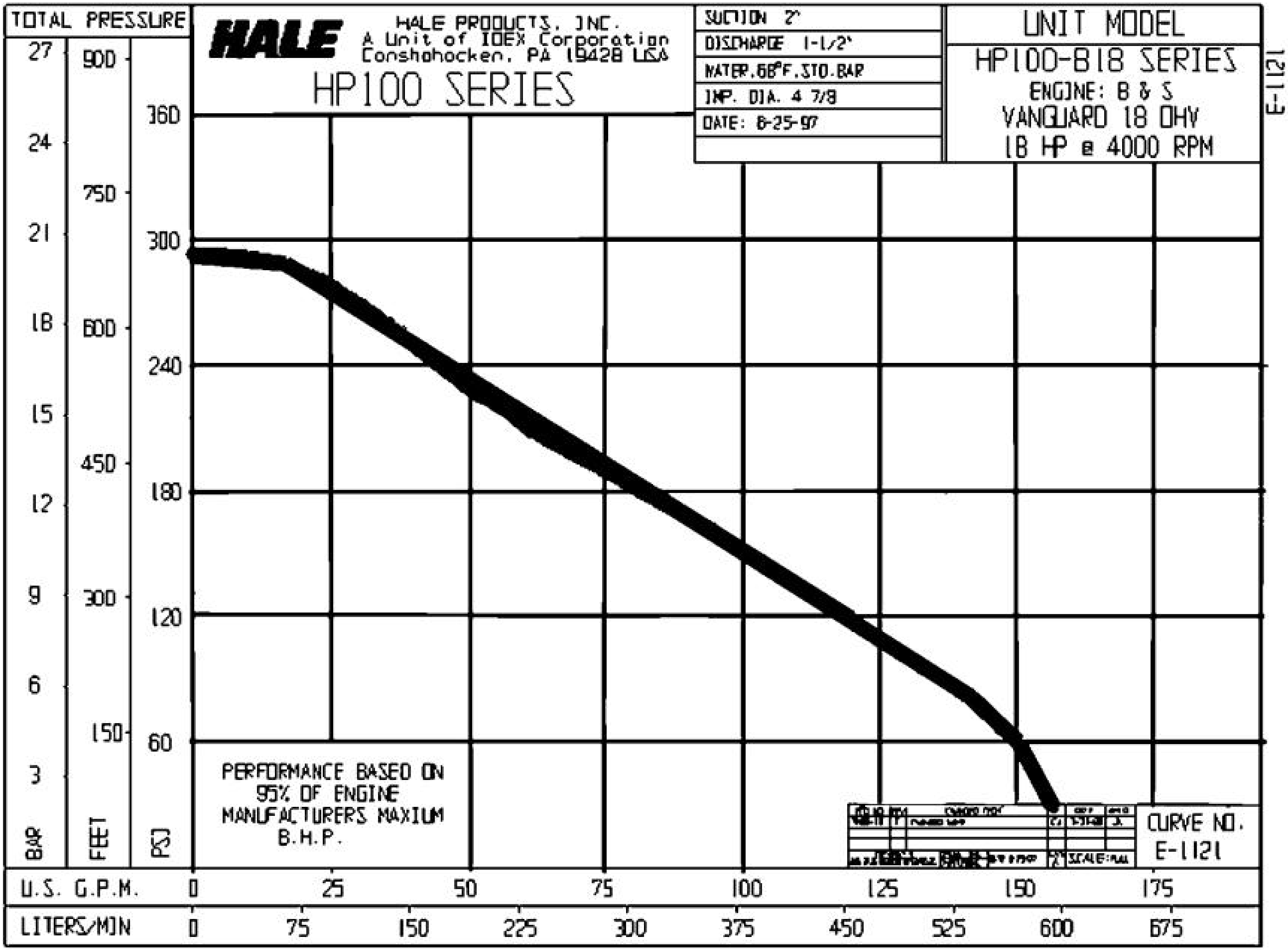

HALE
HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA
HP400 SERIES
SUCTION: 2.5"
DISCH.: 2.5"
ELEVATION: SEA LEVEL
WATER, 60°F, STD. BAR
IMP. DIA.: 7.25"
UNIT MODEL
HP400-B18 SERIES
ENGINE: B & S
VANGUARD 18 OHV
18 HP @ 4000 RPM
E-1124
TOTAL PRESSURE
BAR
FEET
PSI
4000 RPM
3600 RPM
3200 RPM
2800 RPM
2400 RPM
25 HP
20 HP
15 HP
10 HP
5 HP
PERFORMANCE BASED ON
95% OF ENGINE
MANUFACTURERS MAXIMUM
B.H.P.
CURVE NO.
E-1124
SCALE NONE
U.S. G.P.M.
LITERS/MIN

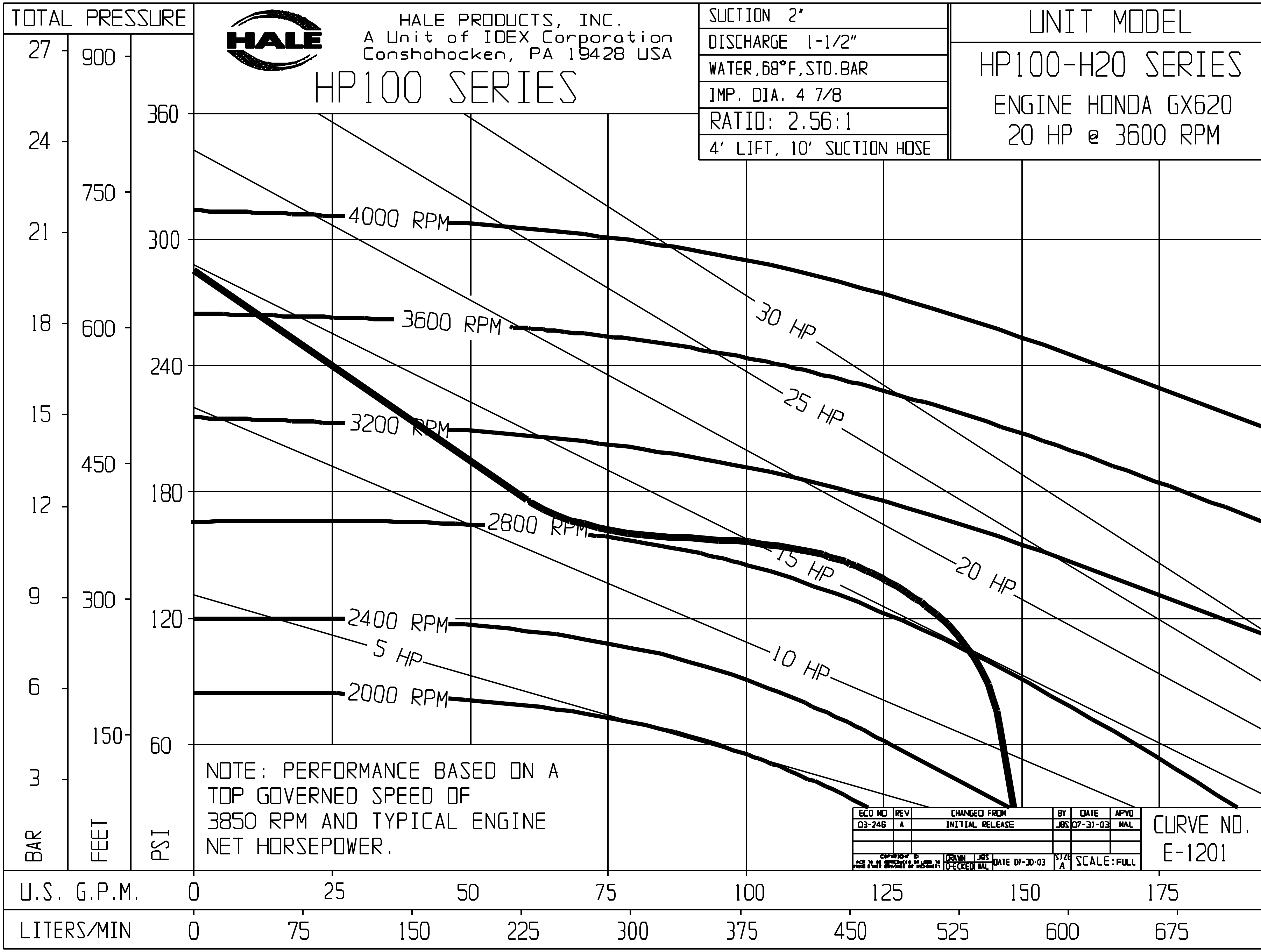

HALE
HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA
HP75 SERIES
SUCTION: 2"
DISCHARGE: 1-1/2"
WATER, 60°F, STD. BAR
IMP. DIA.: 4"
DATE: 12/4/98
RATIO: 1:2.56
UNIT MODEL
HP75-YD10 SERIES
YANMAR L100AE
10 HP @ 3600 RPM
EQC-092
TOTAL PRESSURE
BAR
FEET
PSI
4000 RPM
3600 RPM
3200 RPM
2800 RPM
10 HP
5 HP
TYPICAL PERFORMANCE
BASED ON 95% OF
ENGINE MANUFACTURERS
MAXIMUM B.H.P.
ECO NO
REV
CHANGED FROM
BY
DATE
APVD
RELEASED
CHANGE PUMP NAME
DRAWN
CHECKED
SIZE
A
SCALE: NONE
CURVE NO.
EQC-092
U.S. G.P.M.
LITERS/MIN



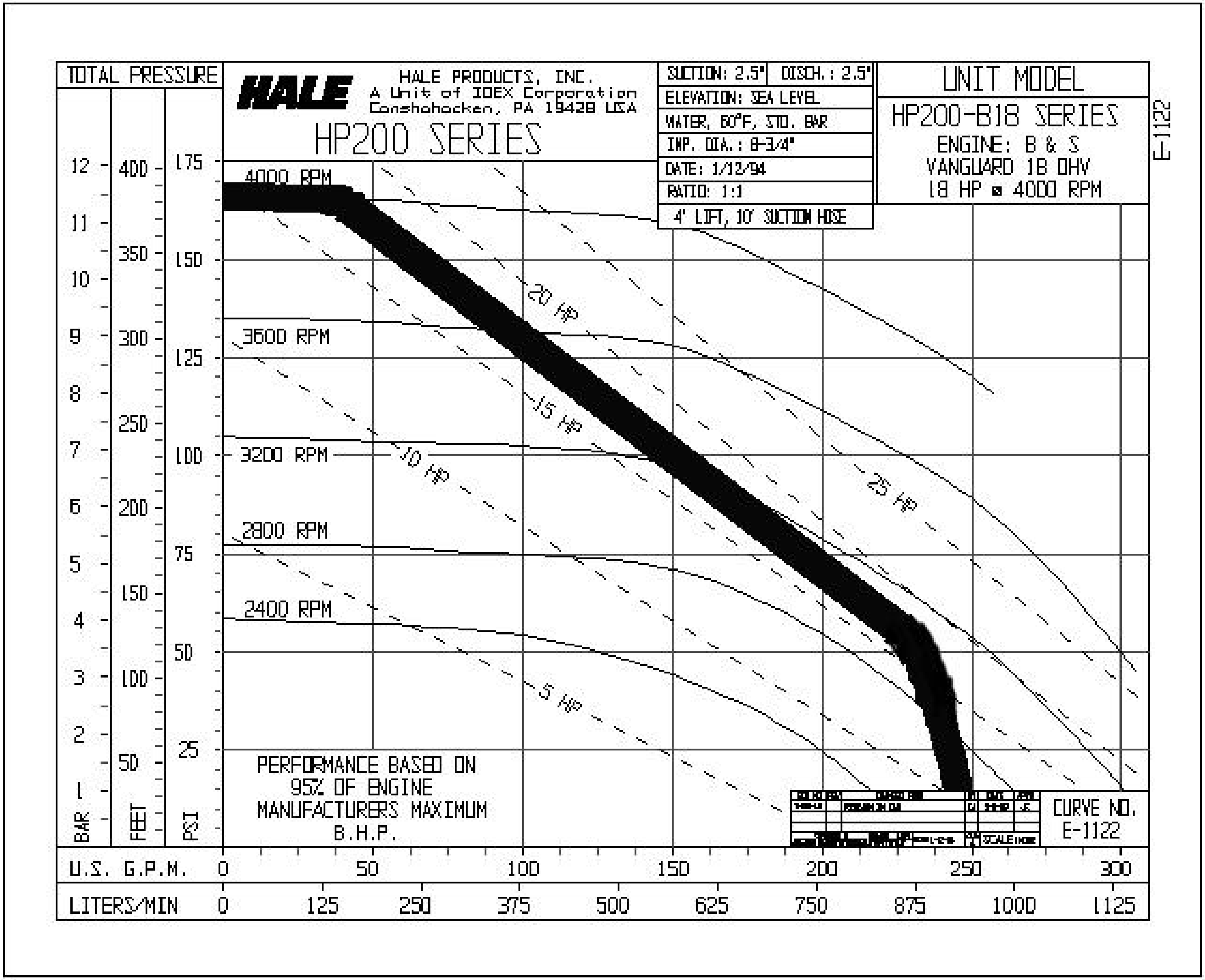
TOTAL PRESSURE
HALE
HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA
HP200 SERIES
SUCTION: 2.5" DISCH.: 2.5"
ELEVATION: SEA LEVEL
WATER, 80°F, STD. BAR
IMP. DIA.: 8-3/4"
DATE: 1/12/94
RATIO: 1:1
UNIT MODEL
HP200-YD10 SERIES
YANMAR L100AE
10 HP @ 3600 RPM
EQC-093
4000 RPM
3600 RPM
3200
2800 RPM
2400 RPM
20 HP
15 HP
25 HP
5 HP
PERFORMANCE BASED ON
95% OF ENGINE
MANUFACTURERS MAXIMUM
B.H.P.
EQC-094
BAR
FEET
PSI
12 11 10 9 8 7 6 5 4 3 2 1
400 350 300 250 200 150 100 50
175 150 125 100 75 50 25
U.S. G.P.M. 0 50 100 150 200 250 300
LITERS/MIN 0 125 250 375 500 625 750 875 1000 1125


TOTAL PRESSURE
HALE
HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA
HP75 SERIES
SUCTION 2"
DISCHARGE 1-1/2"
WATER,68°F,STD.BAR
IMP. DIA. 4 7/8
DATE: 1-28-97
RATIO: 2.727
UNIT MODEL
HP75-B18 SERIES
BRIGGS & STRATTON
VANGUARD 18 OHV
EQC-069
3600 RPM
3200 RPM
3000 RPM
2700 RPM
1900 RPM
5 HP
10 HP
15 HP
20 HP
25 HP
PERFORMANCE BASED ON
95% OF ENGINE
MANUFACTURERS MAXIMUM
B.H.P.
BAR
FEET
PSI
27
24
21
18
15
12
9
6
3
900
750
600
450
300
150
360
300
240
180
120
60
U.S. G.P.M.
0
25
50
75
100
125
150
175
LITERS/MIN
0
75
150
225
300
375
450
525
600
675
CURVE NO.
EQC-069
SCALE: FULL

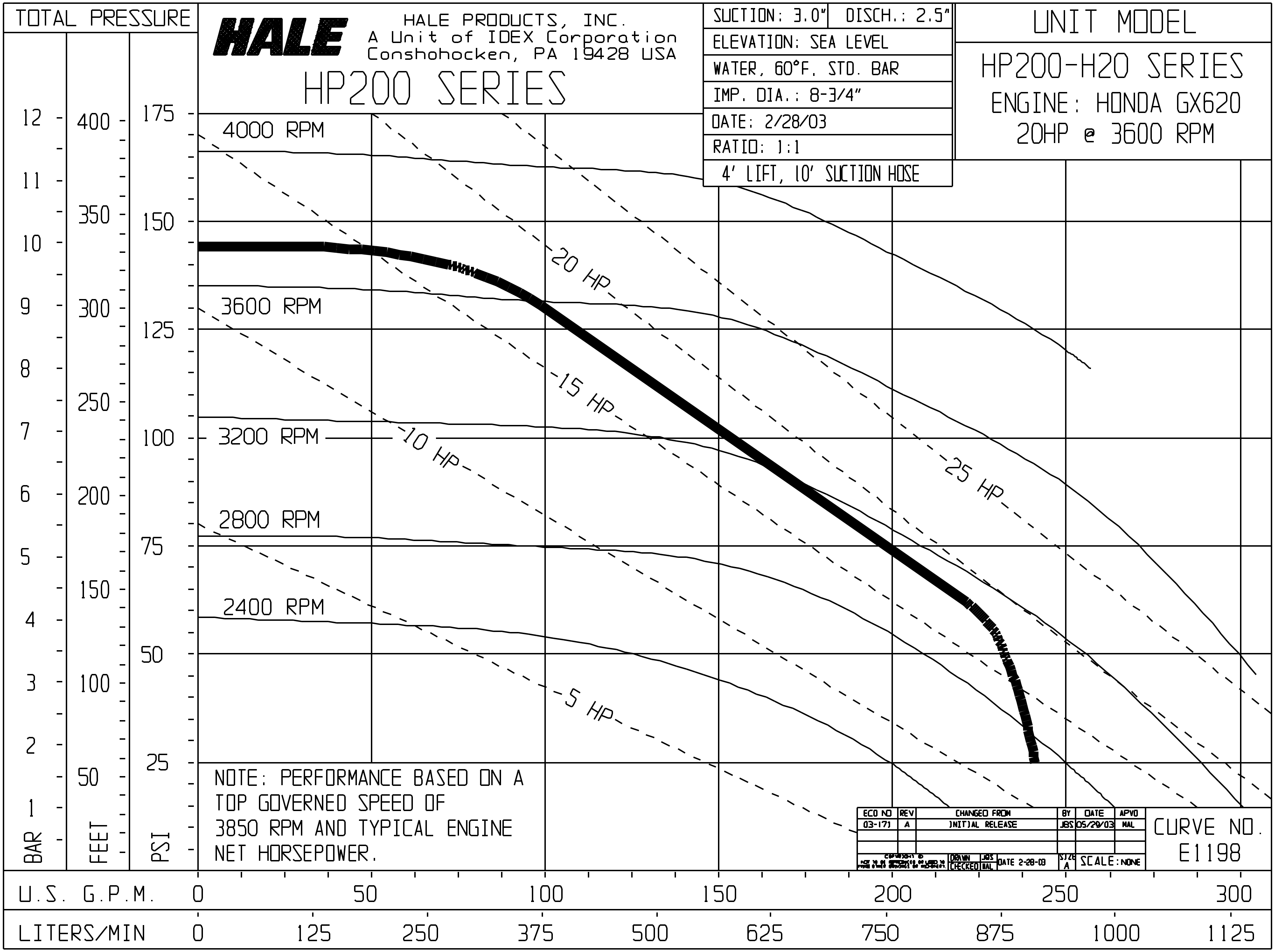

HALE
HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA
HP100 SERIES
SUCTION 2"
DISCHARGE 1-1/2"
WATER, 68°F, STD. BAR
IMP. DIA. 4 7/8
DATE: 8-25-97
UNIT MODEL
HP100-B18 SERIES
ENGINE: B & S
VANGUARD 18 OHV
18 HP @ 4000 RPM
E-1121
TOTAL PRESSURE
BAR
FEET
PSI
27
24
21
18
15
12
9
6
3
900
750
600
450
300
150
360
300
240
180
120
60
PERFORMANCE BASED ON
95% OF ENGINE
MANUFACTURERS MAXIUM
B.H.P.
CURVE NO.
E-1121
SCALE: FULL
U.S. G.P.M.
0
25
50
75
100
125
150
175
LITERS/MIN
0
75
150
225
300
375
450
525
600
675



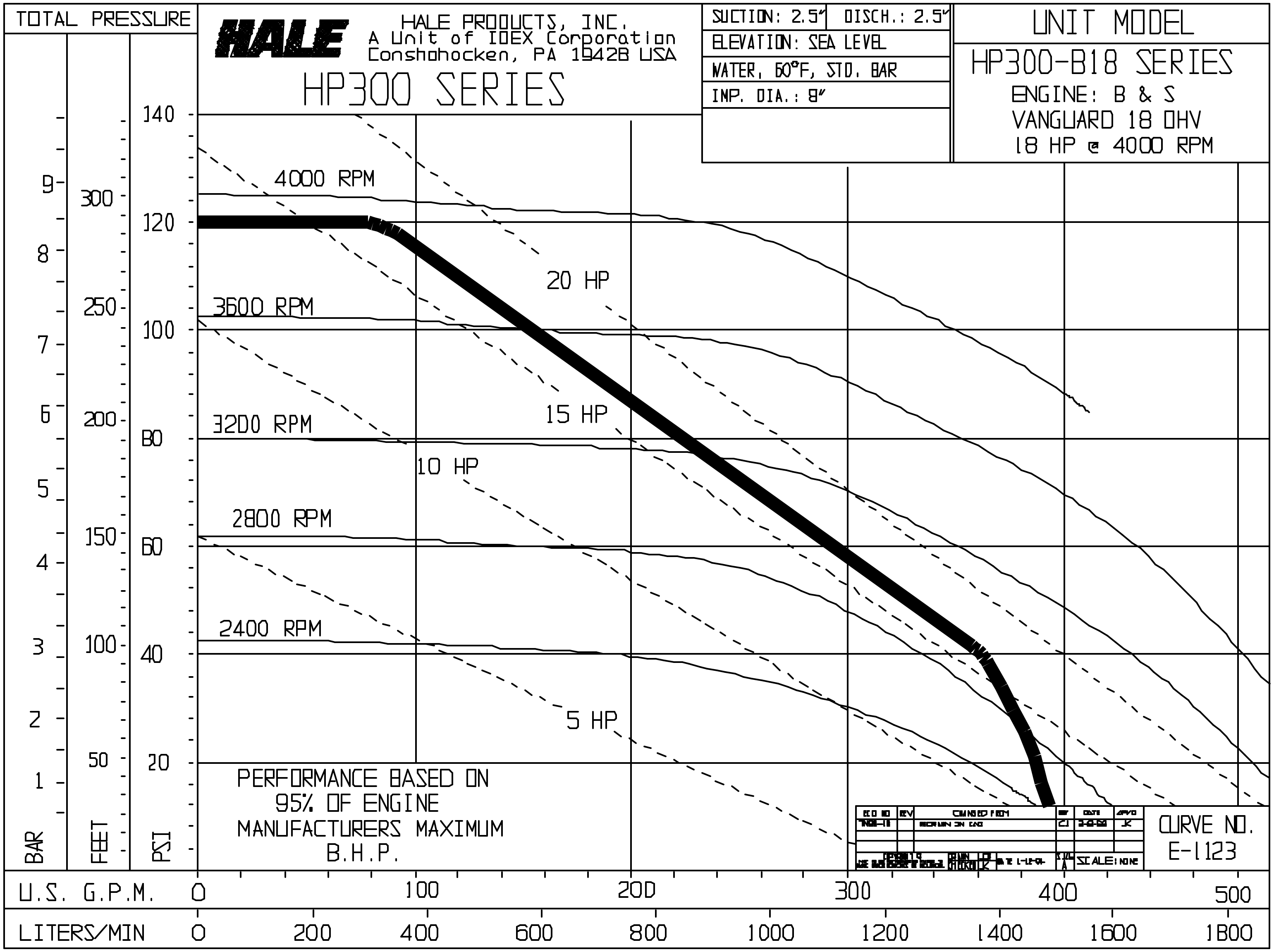
TOTAL PRESSURE
HALE
HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA
HP100 SERIES
SUCTION 2"
DISCHARGE 1-1/2"
WATER, 68°F, STD. BAR
IMP. DIA. 4 7/8
RATIO: 2.56:1
4' LIFT, 10' SUCTION HOSE
UNIT MODEL
HP100-H20 SERIES
ENGINE HONDA GX620
20 HP @ 3600 RPM
E-1201
4000 RPM
3600 RPM
3200 RPM
2800 RPM
2400 RPM
2000 RPM
30 HP
25 HP
20 HP
15 HP
10 HP
5 HP
NOTE: PERFORMANCE BASED ON A TOP GOVERNED SPEED OF 3850 RPM AND TYPICAL ENGINE NET HORSEPOWER.
BAR
FEET
PSI
27
24
21
18
15
12
9
6
3
900
750
600
450
300
150
360
300
240
180
120
60
U.S. G.P.M.
0
25
50
75
100
125
150
175
LITERS/MIN
0
75
150
225
300
375
450
525
600
675
ECO NO
REV
CHANGED FROM
BY
DATE
APVD
03-246
A
INITIAL RELEASE
JBS
07-31-03
NAL
DRAWN
JBS
CHECKED
NAL
DATE 07-30-03
SIZE
A
SCALE: FULL
CURVE NO.
E-1201



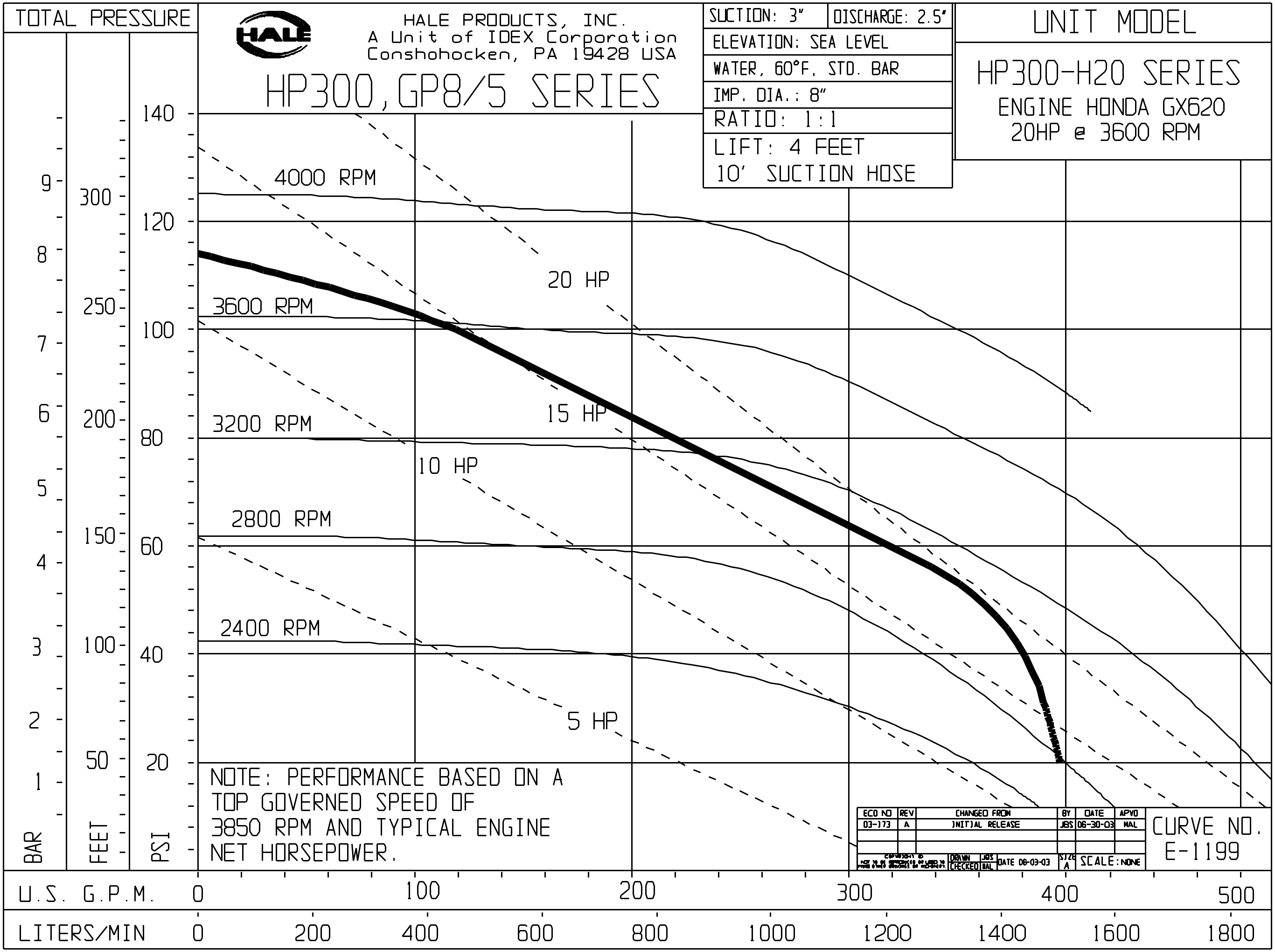
TOTAL PRESSURE
HALE
HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA
HP200 SERIES
SUCTION: 2.5"
DISCH.: 2.5"
ELEVATION: SEA LEVEL
WATER, 60°F, STD. BAR
IMP. DIA.: 8-3/4"
DATE: 1/12/94
RATIO: 1:1
4' LIFT, 10' SUCTION HOSE
UNIT MODEL
HP200-B18 SERIES
ENGINE: B & S
VANGUARD 18 OHV
18 HP @ 4000 RPM
E-1122
4000 RPM
3600 RPM
3200 RPM
2800 RPM
2400 RPM
20 HP
15 HP
10 HP
25 HP
5 HP
PERFORMANCE BASED ON
95% OF ENGINE
MANUFACTURERS MAXIMUM
B.H.P.
CURVE NO.
E-1122
BAR
FEET
PSI
U.S. G.P.M.
LITERS/MIN



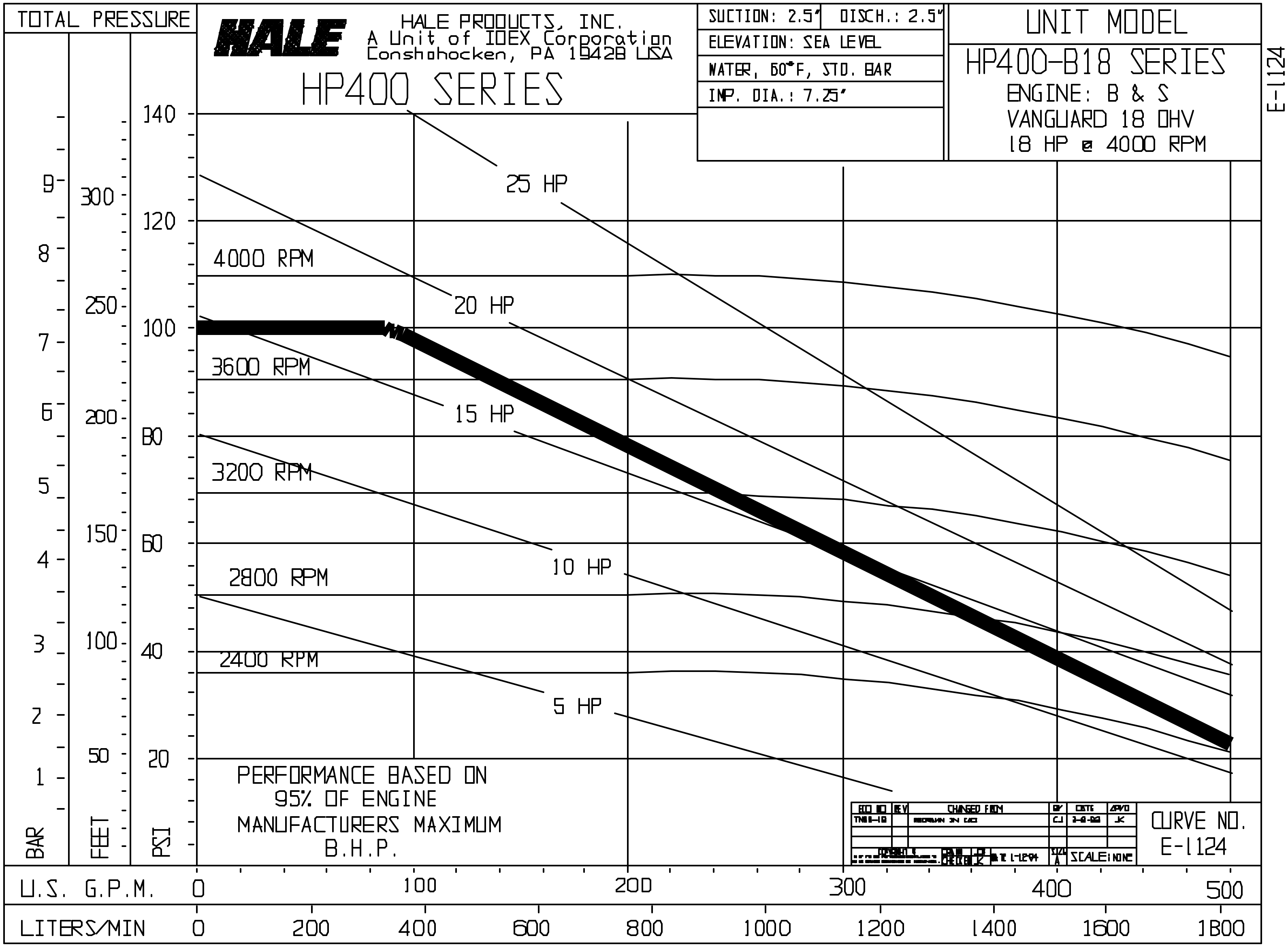
HALE
HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA
HP200 SERIES
SUCTION: 3.0" DISCH.: 2.5"
ELEVATION: SEA LEVEL
WATER, 60°F, STD. BAR
IMP. DIA.: 8-3/4"
DATE: 2/28/03
RATIO: 1:1
4' LIFT, 10' SUCTION HOSE
UNIT MODEL
HP200-H20 SERIES
ENGINE: HONDA GX620
20HP @ 3600 RPM
E1198
TOTAL PRESSURE
BAR
FEET
PSI
4000 RPM
3600 RPM
3200 RPM
2800 RPM
2400 RPM
5 HP
10 HP
15 HP
20 HP
25 HP
NOTE: PERFORMANCE BASED ON A TOP GOVERNED SPEED OF 3850 RPM AND TYPICAL ENGINE NET HORSEPOWER.
ECO NO REV CHANGED FROM BY DATE APVD
03-171 A INITIAL RELEASE JBS 05/29/03 MAL
DRAWN JBS CHECKED MAL DATE 2-28-03 SIZE A SCALE: NONE
CURVE NO. E1198
U.S. G.P.M. 0 50 100 150 200 250 300
LITERS/MIN 0 125 250 375 500 625 750 875 1000 1125

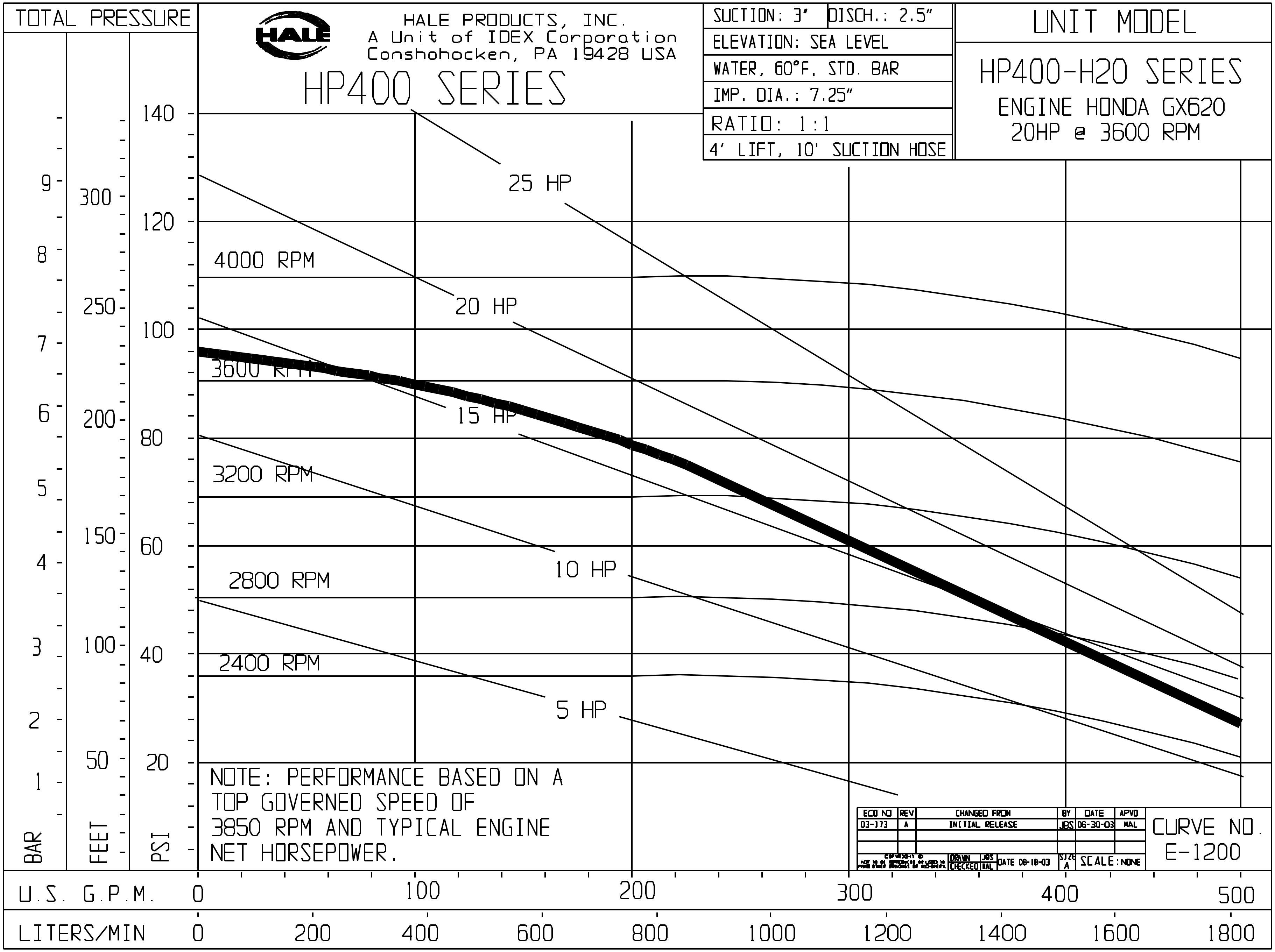


TOTAL PRESSURE
HALE
HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA
HP300 SERIES
SUCTION: 2.5"
DISCH.: 2.5"
ELEVATION: SEA LEVEL
WATER, 60°F, STD. BAR
IMP. DIA.: 8"
UNIT MODEL
HP300-B18 SERIES
ENGINE: B & S
VANGUARD 18 OHV
18 HP @ 4000 RPM
E-1123
4000 RPM
3600 RPM
3200 RPM
2800 RPM
2400 RPM
20 HP
15 HP
10 HP
5 HP
PERFORMANCE BASED ON
95% OF ENGINE
MANUFACTURERS MAXIMUM
B.H.P.
CURVE NO.
E-1123
BAR
FEET
PSI
U.S. G.P.M.
LITERS/MIN

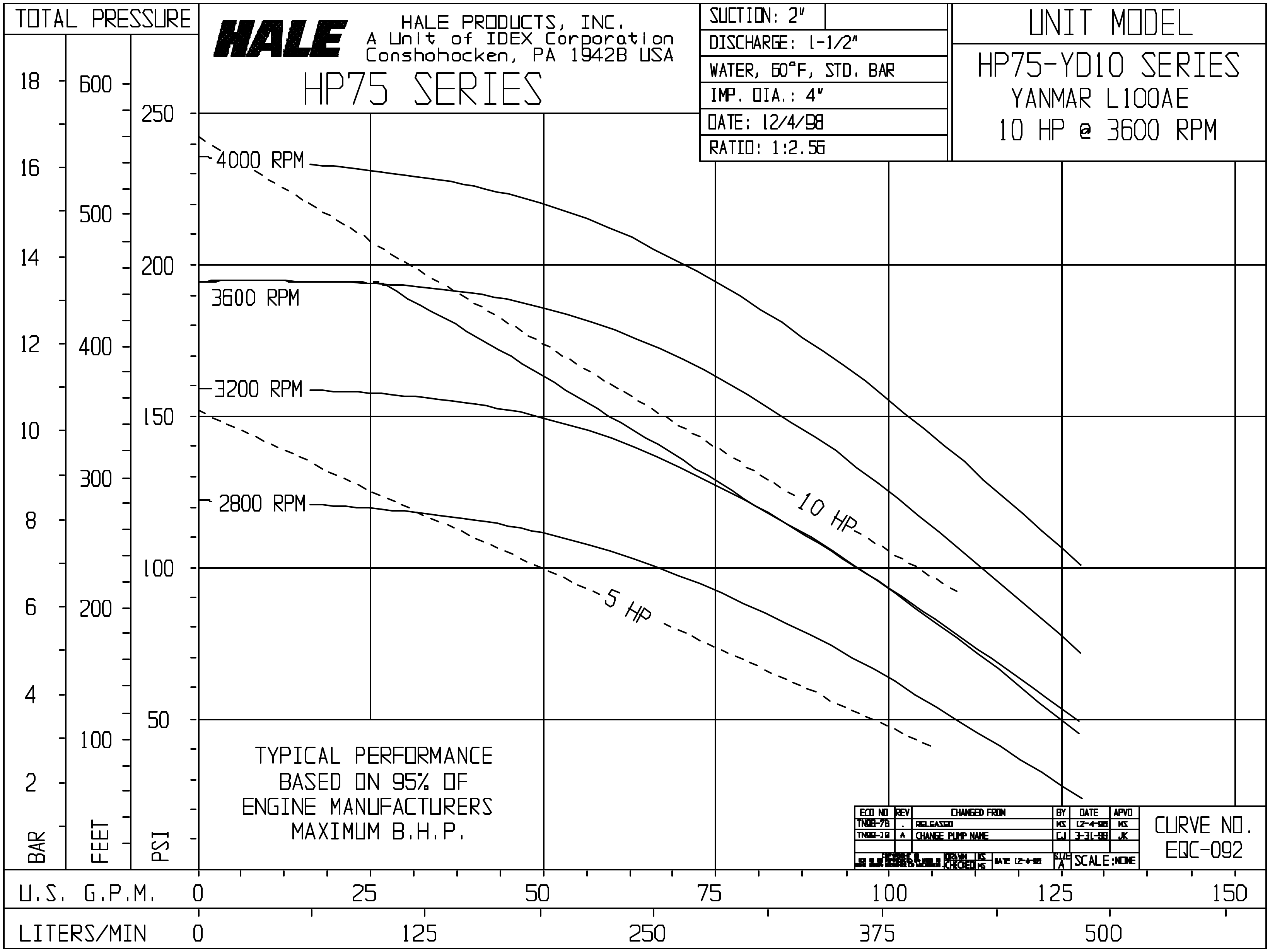

HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA
HP300, GP8/5 SERIES
SUCTION: 3"
DISCHARGE: 2.5"
ELEVATION: SEA LEVEL
WATER, 60°F, STD. BAR
IMP. DIA.: 8"
RATIO: 1:1
LIFT: 4 FEET
10' SUCTION HOSE
UNIT MODEL
HP300-H20 SERIES
ENGINE HONDA GX620
20HP @ 3600 RPM
TOTAL PRESSURE
BAR
FEET
PSI
4000 RPM
3600 RPM
3200 RPM
2800 RPM
2400 RPM
20 HP
15 HP
10 HP
5 HP
NOTE: PERFORMANCE BASED ON A TOP GOVERNED SPEED OF 3850 RPM AND TYPICAL ENGINE NET HORSEPOWER.
ECO NO | REV | CHANGED FROM | BY | DATE | APVD
03-173 | A | INITIAL RELEASE | JBS | 06-30-03 | NAL
DRAWN JBS
CHECKED NAL
DATE 06-03-03
SIZE A
SCALE: NONE
CURVE NO.
E-1199
U.S. G.P.M.
LITERS/MIN

E-1199

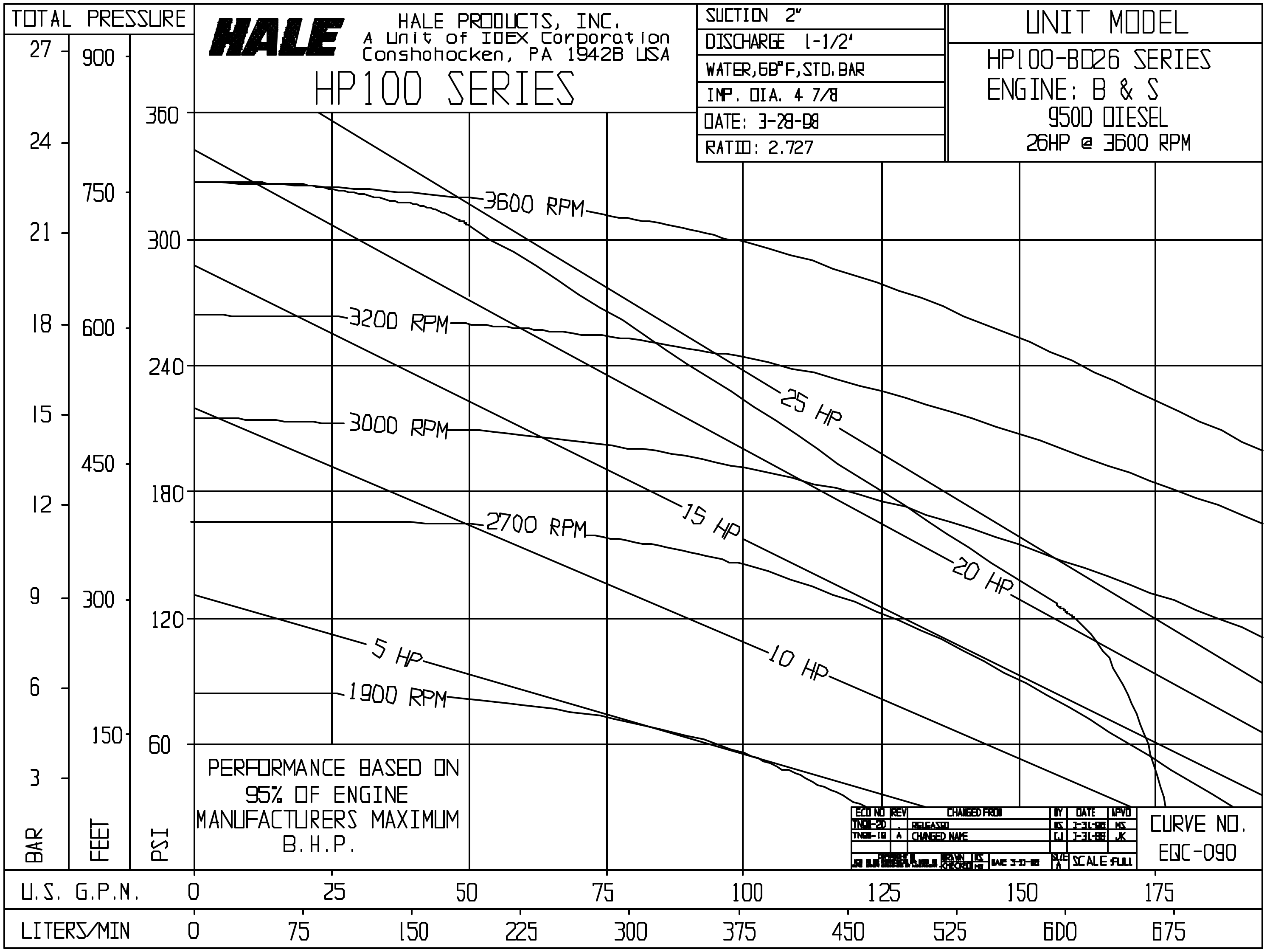

TOTAL PRESSURE
HALE
HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA
HP400 SERIES
SUCTION: 2.5" DISCH.: 2.5"
ELEVATION: SEA LEVEL
WATER, 60°F, STD. BAR
IMP. DIA.: 7.25"
UNIT MODEL
HP400-B18 SERIES
ENGINE: B & S
VANGUARD 18 OHV
18 HP @ 4000 RPM
E-1124
25 HP
20 HP
15 HP
10 HP
5 HP
4000 RPM
3600 RPM
3200 RPM
2800 RPM
2400 RPM
PERFORMANCE BASED ON
95% OF ENGINE
MANUFACTURERS MAXIMUM
B.H.P.
BAR
FEET
PSI
1 2 3 4 5 6 7 8 9
50 100 150 200 250 300
20 40 60 80 100 120 140
U.S. G.P.M. 0 100 200 300 400 500
LITERS/MIN 0 200 400 600 800 1000 1200 1400 1600 1800
CURVE NO.
E-1124
SCALE NONE

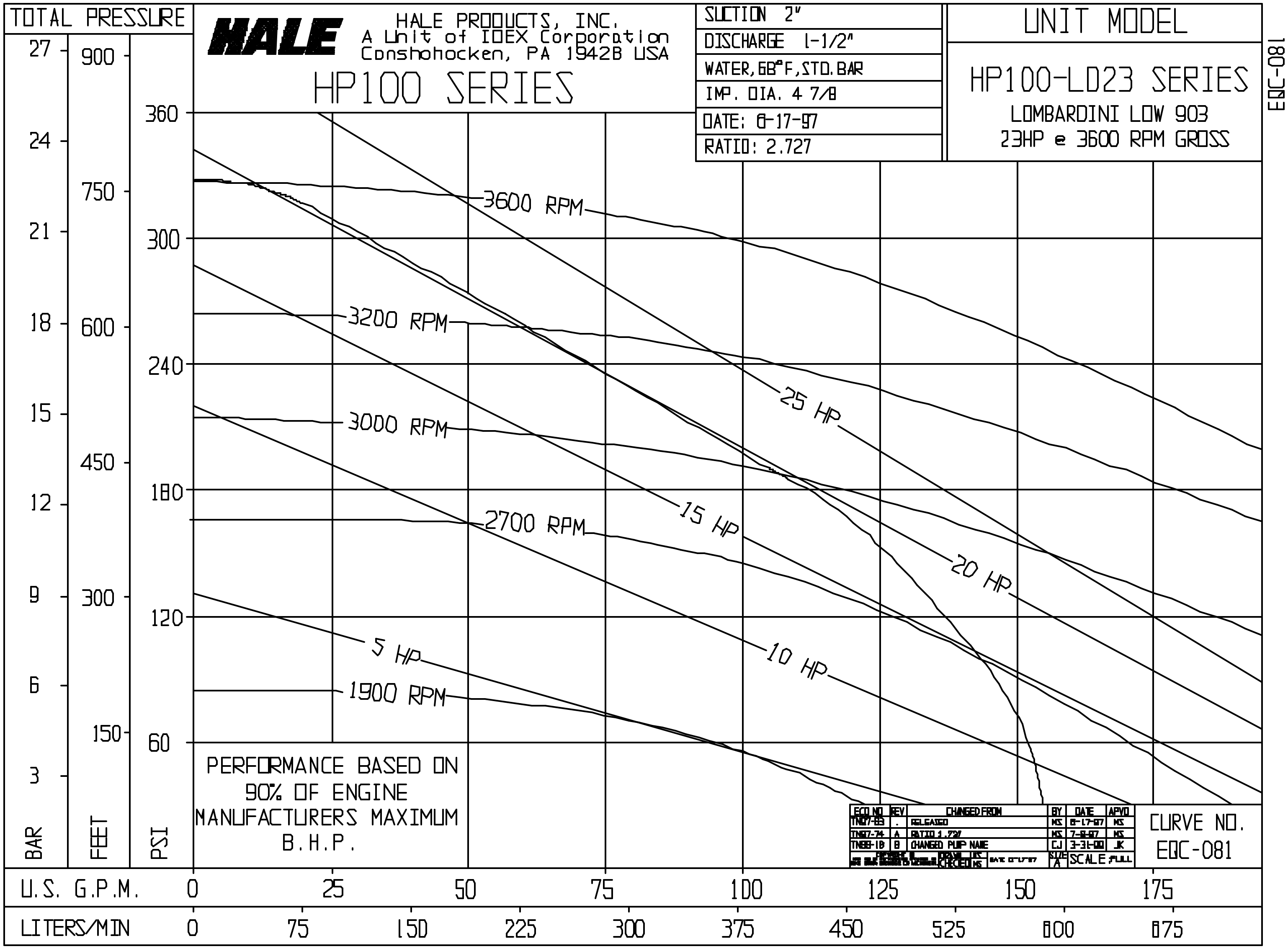

HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA
HP400 SERIES
SUCTION: 3" DISCH.: 2.5"
ELEVATION: SEA LEVEL
WATER, 60°F, STD. BAR
IMP. DIA.: 7.25"
RATIO: 1:1
4' LIFT, 10' SUCTION HOSE
UNIT MODEL
HP400-H20 SERIES
ENGINE HONDA GX620
20HP @ 3600 RPM
TOTAL PRESSURE
BAR
FEET
PSI
25 HP
20 HP
15 HP
10 HP
5 HP
4000 RPM
3600 RPM
3200 RPM
2800 RPM
2400 RPM
NOTE: PERFORMANCE BASED ON A TOP GOVERNED SPEED OF 3850 RPM AND TYPICAL ENGINE NET HORSEPOWER.
ECO NO REV CHANGED FROM BY DATE APVD
03-173 A INITIAL RELEASE JBS 06-30-03 MAL
DRAWN JBS CHECKED MAL DATE 06-18-03 SIZE A SCALE: NONE
CURVE NO. E-1200
U.S. G.P.M.
LITERS/MIN

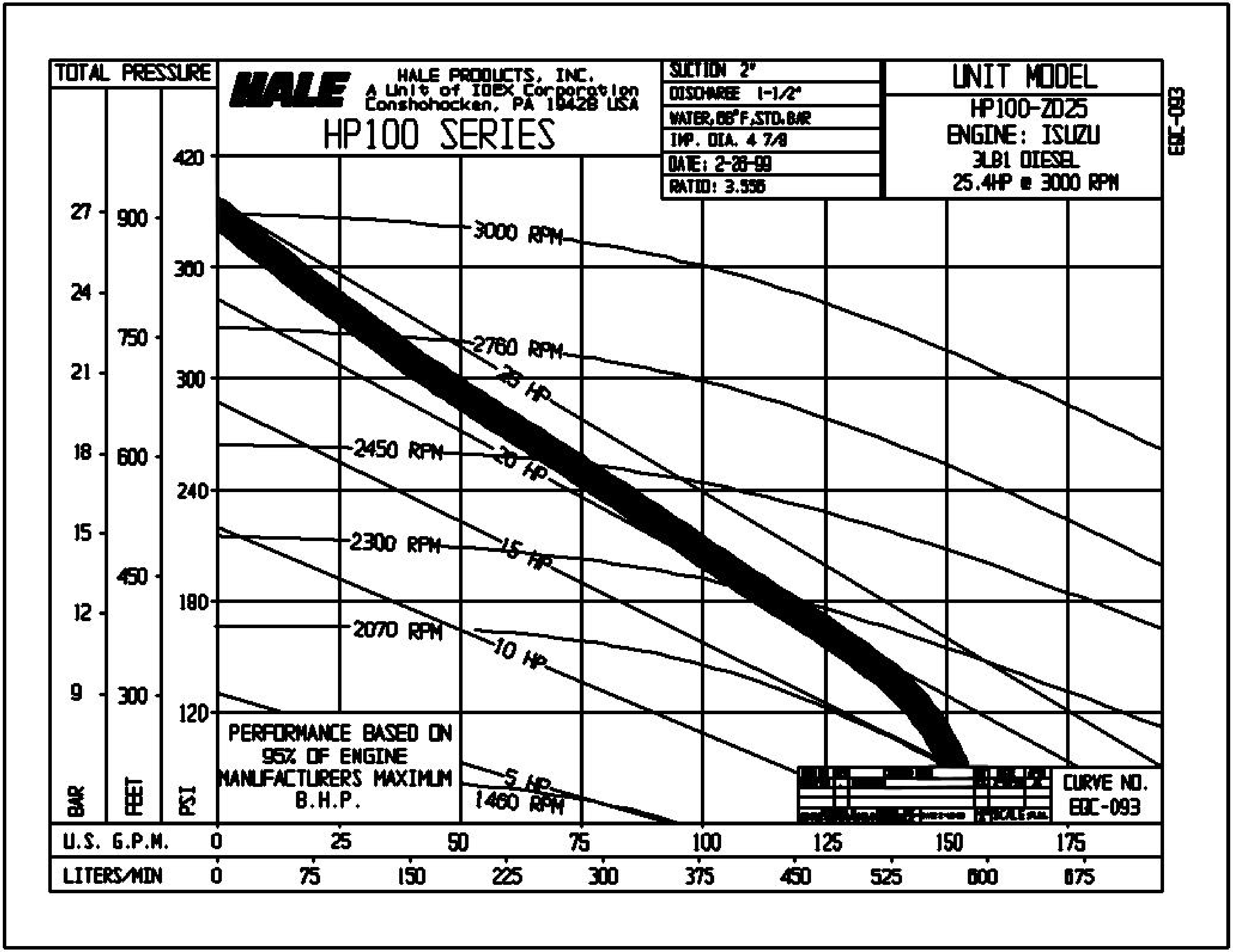
E-1200


TOTAL PRESSURE
HALE
HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA
HP75 SERIES
SUCTION: 2"
DISCHARGE: 1-1/2"
WATER, 60°F, STD. BAR
IMP. DIA.: 4"
DATE: 12/4/98
RATIO: 1:2.56
UNIT MODEL
HP75-YD10 SERIES
YANMAR L100AE
10 HP @ 3600 RPM
4000 RPM
3600 RPM
3200 RPM
2800 RPM
10 HP
5 HP
TYPICAL PERFORMANCE
BASED ON 95% OF
ENGINE MANUFACTURERS
MAXIMUM B.H.P.
BAR
FEET
PSI
18
16
14
12
10
8
6
4
2
600
500
400
300
200
100
250
200
150
100
50
U.S. G.P.M.
0
25
50
75
100
125
150
LITERS/MIN
0
125
250
375
500
ECO NO
REV
CHANGED FROM
BY
DATE
APVD
TN98-76
.
RELEASED
MS
12-4-98
MS
TN99-10
A
CHANGE PUMP NAME
CJ
3-31-99
JK
DRAWN
MS
CHECKED
MS
DATE 12-4-98
SIZE
A
SCALE:NONE
CURVE NO.
EQC-092

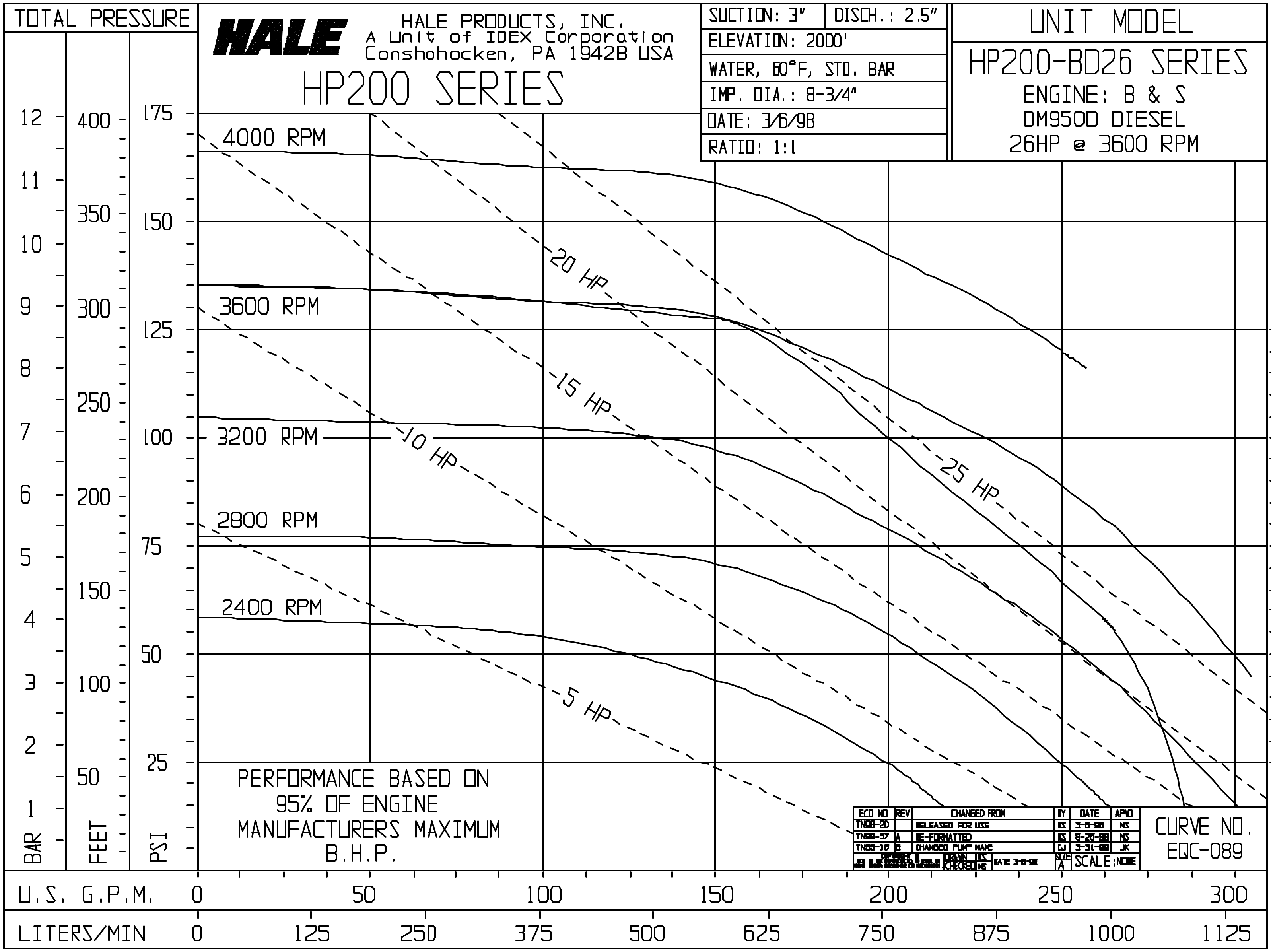
EQC-092


TOTAL PRESSURE
HALE
HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA
HP100 SERIES
SUCTION 2"
DISCHARGE 1-1/2"
WATER, 68°F, STD. BAR
IMP. DIA. 4 7/8
DATE: 3-28-08
RATIO: 2.727
UNIT MODEL
HP100-BD26 SERIES
ENGINE: B & S
950D DIESEL
26HP @ 3600 RPM
EQC-090
3600 RPM
3200 RPM
3000 RPM
2700 RPM
1900 RPM
5 HP
10 HP
15 HP
20 HP
25 HP
PERFORMANCE BASED ON
95% OF ENGINE
MANUFACTURERS MAXIMUM
B.H.P.
BAR
FEET
PSI
27
24
21
18
15
12
9
6
3
900
750
600
450
300
150
360
300
240
180
120
60
U.S. G.P.M.
0
25
50
75
100
125
150
175
LITERS/MIN
0
75
150
225
300
375
450
525
600
675
CURVE NO.
EQC-090
SCALE FULL

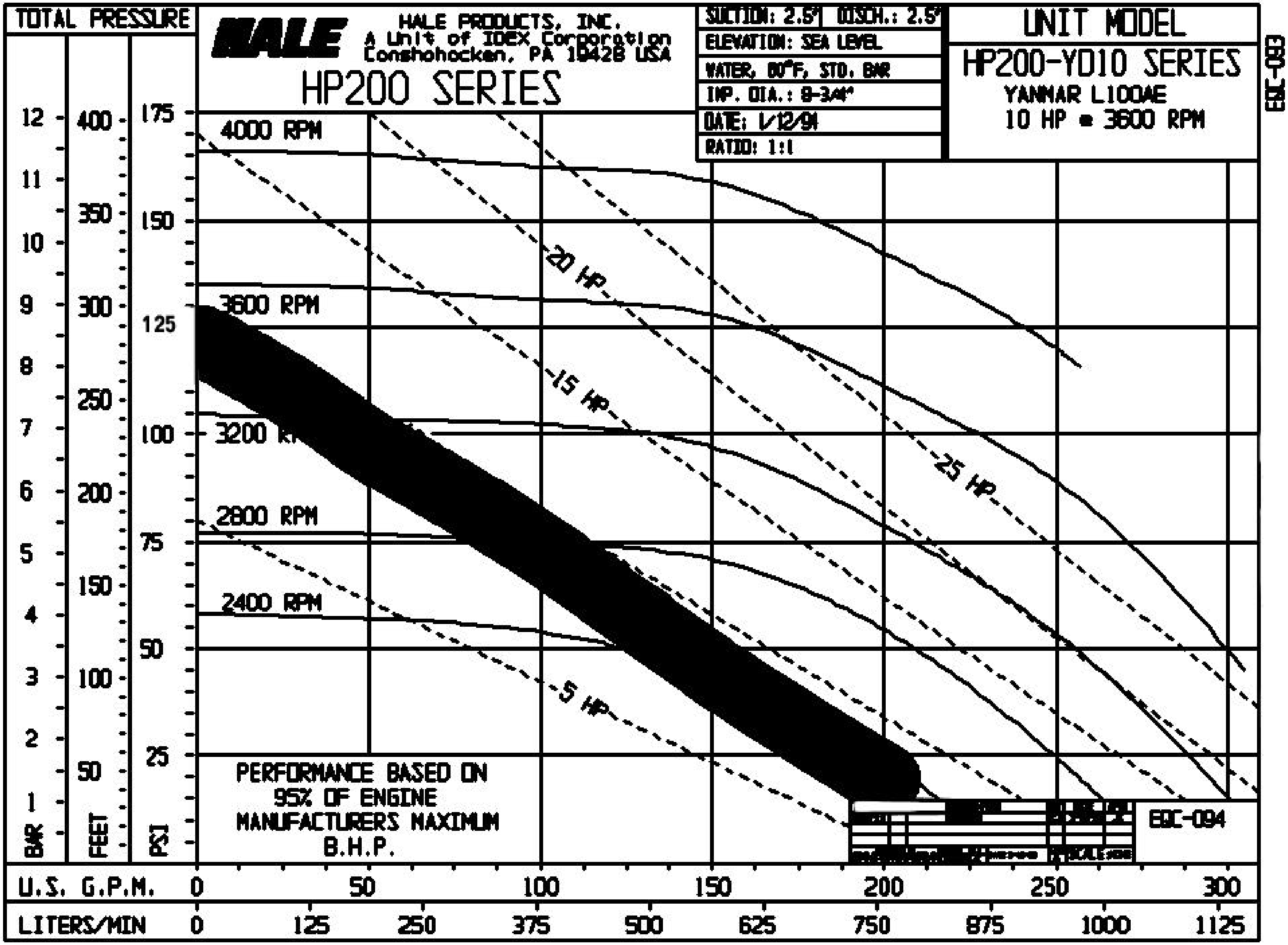

HALE
HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA
HP100 SERIES
SUCTION 2"
DISCHARGE 1-1/2"
WATER, 68°F, STD. BAR
IMP. DIA. 4 7/8
DATE: 6-17-97
RATIO: 2.727
UNIT MODEL
HP100-LD23 SERIES
LOMBARDINI LDW 903
23HP @ 3600 RPM GROSS
EQC-081
TOTAL PRESSURE
BAR
FEET
PSI
27
24
21
18
15
12
9
6
3
900
750
600
450
300
150
360
300
240
180
120
60
3600 RPM
3200 RPM
3000 RPM
2700 RPM
1900 RPM
25 HP
20 HP
15 HP
10 HP
5 HP
PERFORMANCE BASED ON
90% OF ENGINE
MANUFACTURERS MAXIMUM
B.H.P.
ECO NO
REV
CHANGED FROM
BY
DATE
APVD
RELEASED
RATIO 1.727
CHANGED PUMP NAME
SCALE FULL
CURVE NO.
EQC-081
U.S. G.P.M.
0
25
50
75
100
125
150
175
LITERS/MIN
0
75
150
225
300
375
450
525
600
675

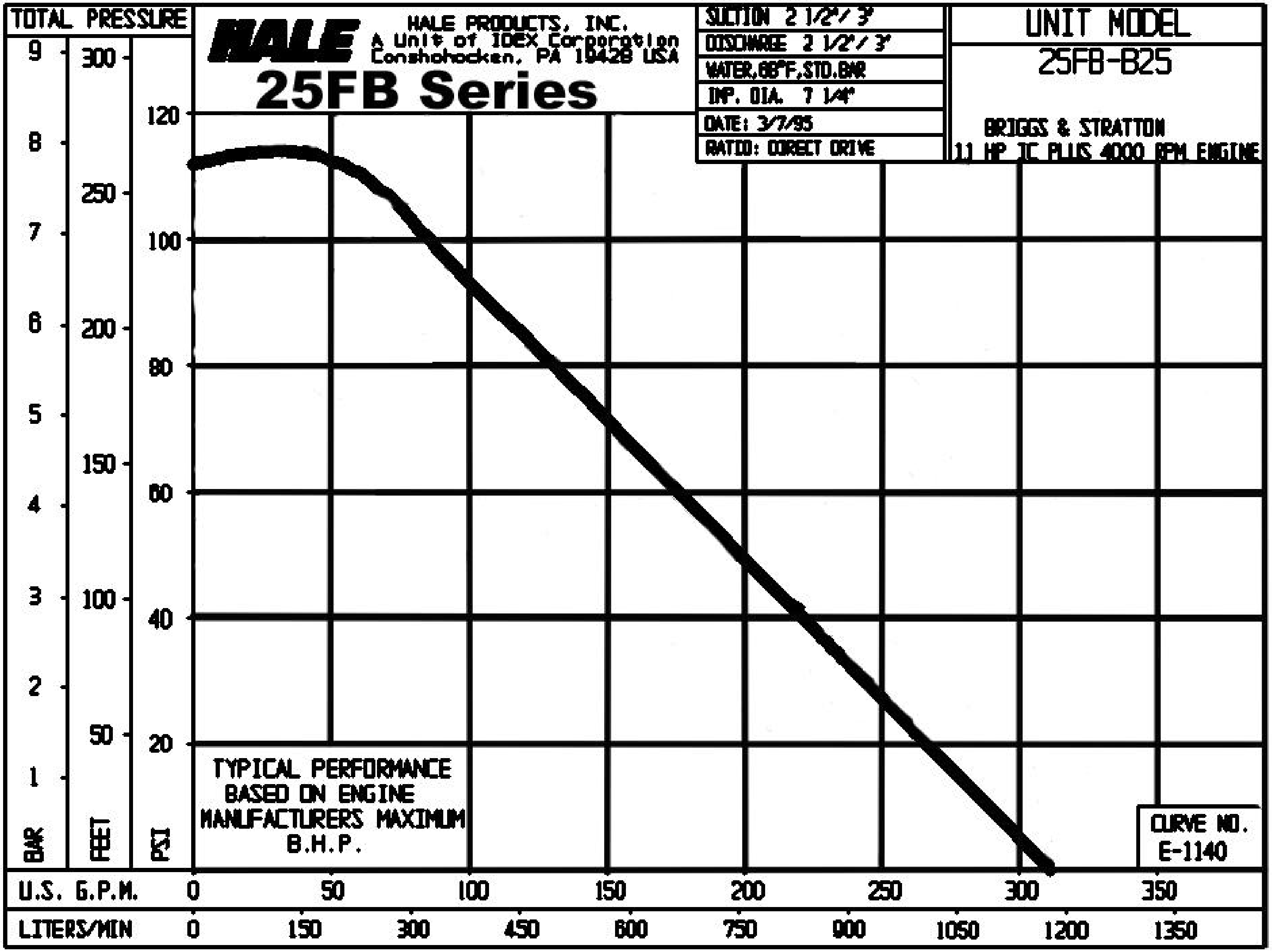


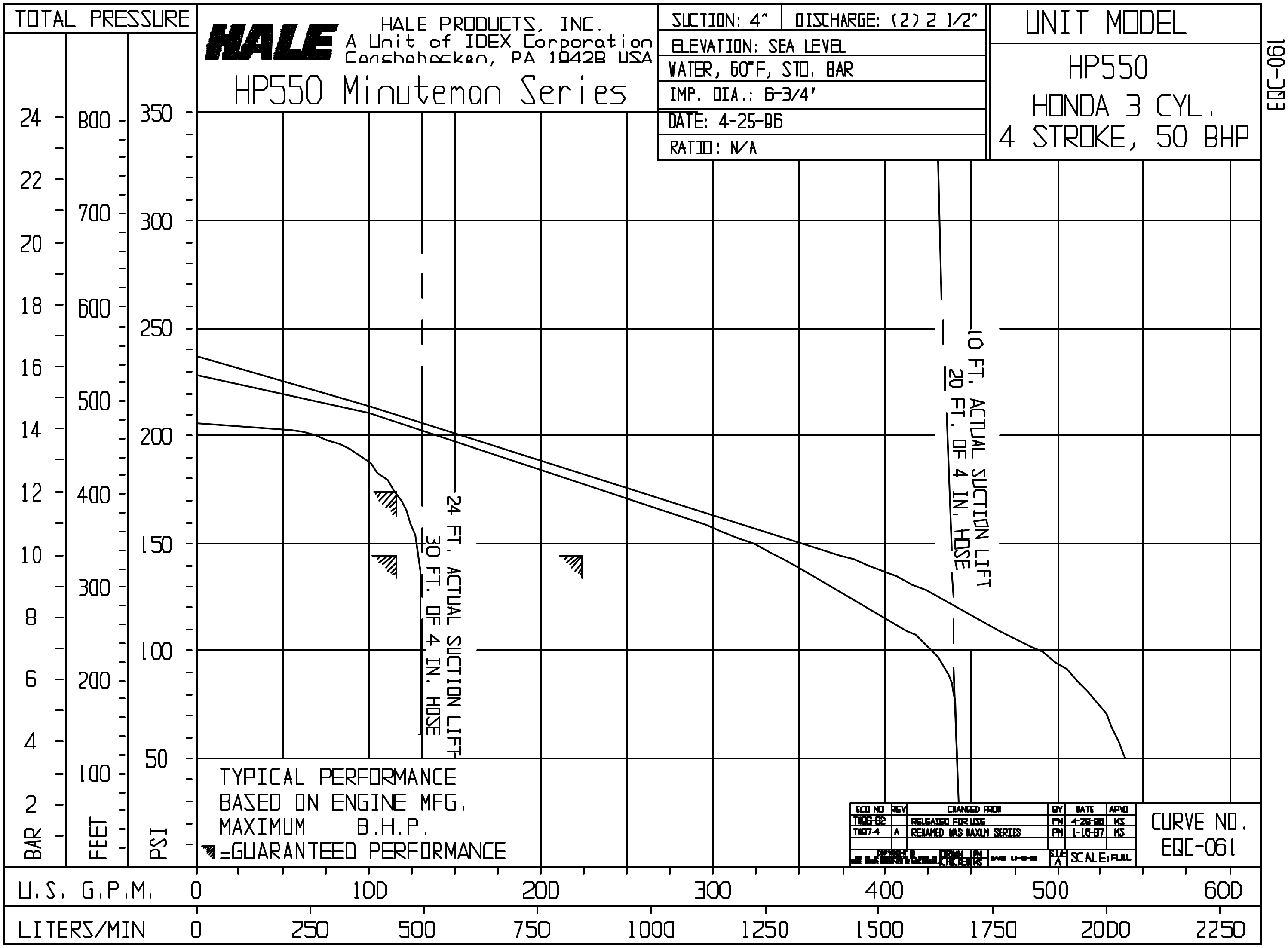
TOTAL PRESSURE
HALE
HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA
HP100 SERIES
SUCTION 2"
DISCHARGE 1-1/2"
WATER,68°F,STD.BAR
IMP. DIA. 4 7/8
DATE: 2-28-99
RATIO: 3.556
UNIT MODEL
HP100-Z025
ENGINE: ISUZU
3LB1 DIESEL
25.4HP @ 3000 RPM
EGC-093
3000 RPM
2760 RPM
2450 RPM
2300 RPM
2070 RPM
1460 RPM
25 HP
20 HP
15 HP
10 HP
5 HP
PERFORMANCE BASED ON
95% OF ENGINE
MANUFACTURERS MAXIMUM
B.H.P.
CURVE NO.
EGC-093
BAR
FEET
PSI
U.S. G.P.M.
LITERS/MIN

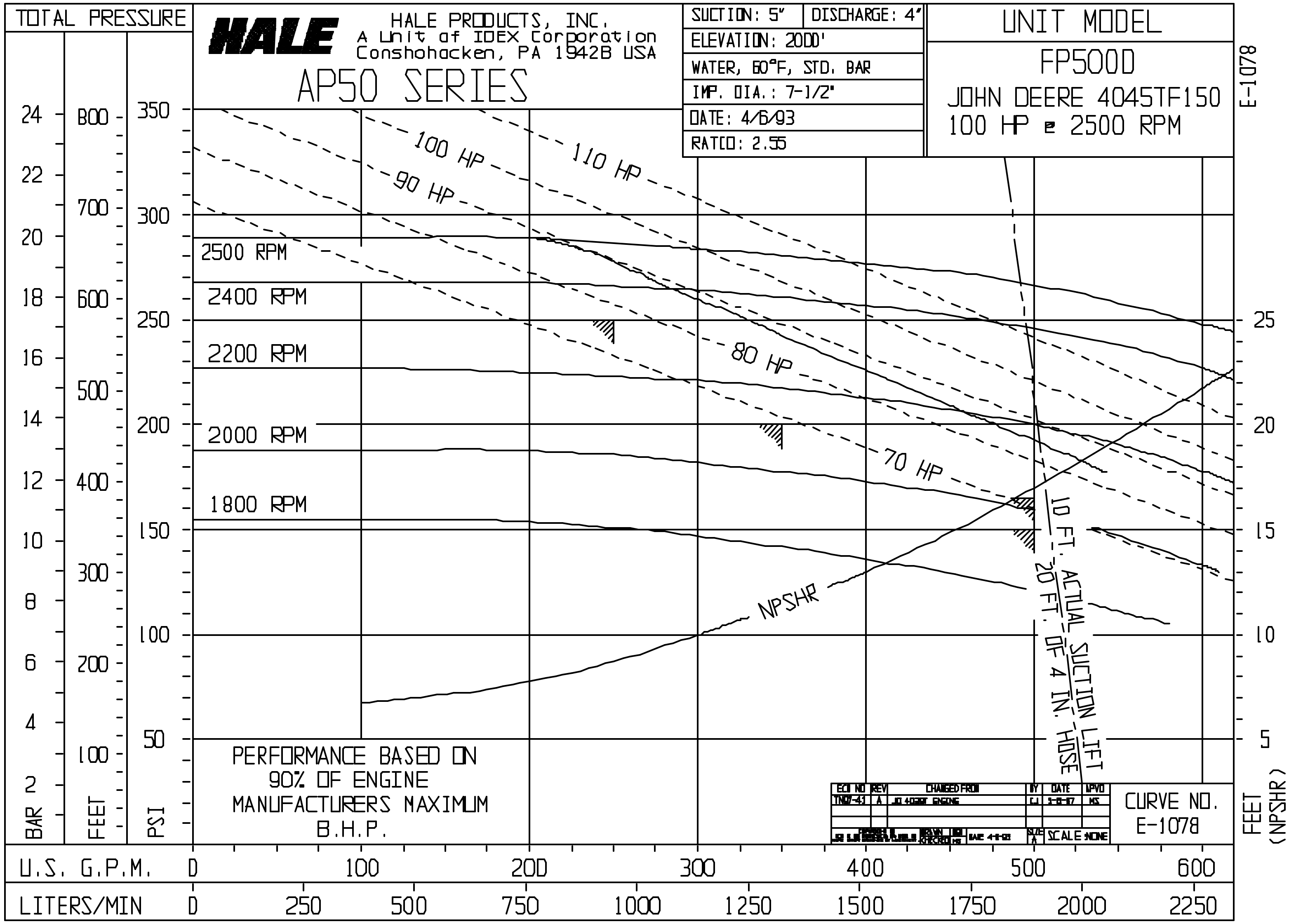


TOTAL PRESSURE
HALE
HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA
HP200 SERIES
SUCTION: 3"
DISCH.: 2.5"
ELEVATION: 2000'
WATER, 60°F, STD. BAR
IMP. DIA.: 8-3/4"
DATE: 3/6/98
RATIO: 1:1
UNIT MODEL
HP200-BD26 SERIES
ENGINE: B & S
DM950D DIESEL
26HP @ 3600 RPM
EQC-089
4000 RPM
3600 RPM
3200 RPM
2800 RPM
2400 RPM
20 HP
15 HP
10 HP
5 HP
25 HP
PERFORMANCE BASED ON
95% OF ENGINE
MANUFACTURERS MAXIMUM
B.H.P.
BAR
FEET
PSI
U.S. G.P.M.
LITERS/MIN
CURVE NO.
EQC-089
SCALE: NONE

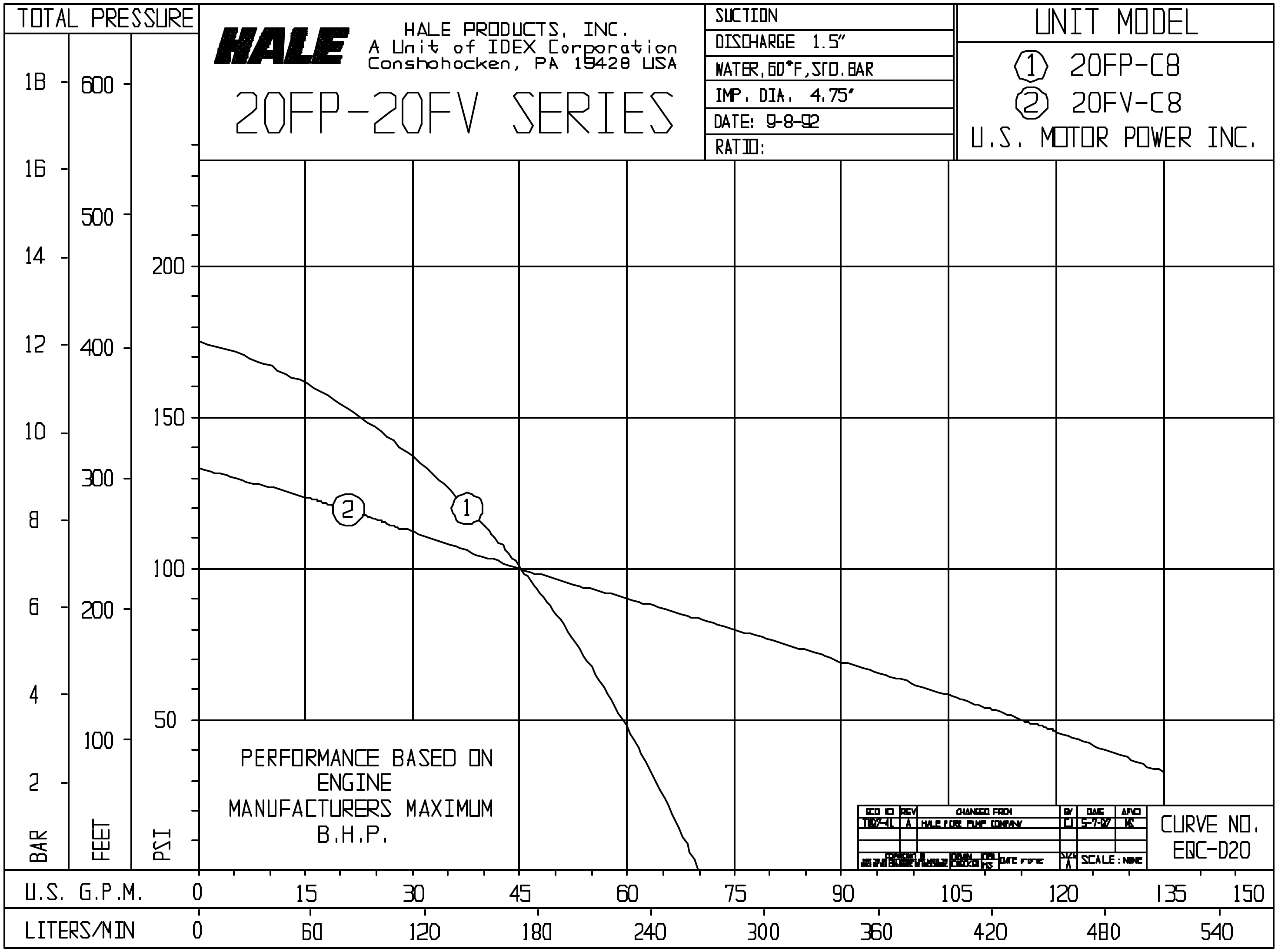

TOTAL PRESSURE
HALE
HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA
HP200 SERIES
SUCTION: 2.5" DISCH.: 2.5"
ELEVATION: SEA LEVEL
WATER, 60°F, STD. BAR
IMP. DIA.: 8-3/4"
DATE: 1/12/94
RATIO: 1:1
UNIT MODEL
HP200-YD10 SERIES
YANMAR L100AE
10 HP @ 3600 RPM
EQC-093
4000 RPM
3600 RPM
3200
2800 RPM
2400 RPM
20 HP
15 HP
25 HP
5 HP
PERFORMANCE BASED ON
95% OF ENGINE
MANUFACTURERS MAXIMUM
B.H.P.
EQC-094
BAR
FEET
PSI
U.S. G.P.M.
LITERS/MIN
12 11 10 9 8 7 6 5 4 3 2 1
400 350 300 250 200 150 100 50
175 150 125 100 75 50 25
0 50 100 150 200 250 300
0 125 250 375 500 625 750 875 1000 1125


TOTAL PRESSURE
HALE
HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA
25FB Series
SUCTION 2 1/2" / 3"
DISCHARGE 2 1/2" / 3"
WATER,68°F,STD.BAR
IMP. DIA. 7 1/4"
DATE: 3/7/95
RATIO: DIRECT DRIVE
UNIT MODEL
25FB-B25
BRIGGS & STRATTON
11 HP IC PLUS 4000 RPM ENGINE
BAR
FEET
PSI
TYPICAL PERFORMANCE
BASED ON ENGINE
MANUFACTURERS MAXIMUM
B.H.P.
CURVE NO.
E-1140
U.S. G.P.M.
LITERS/MIN

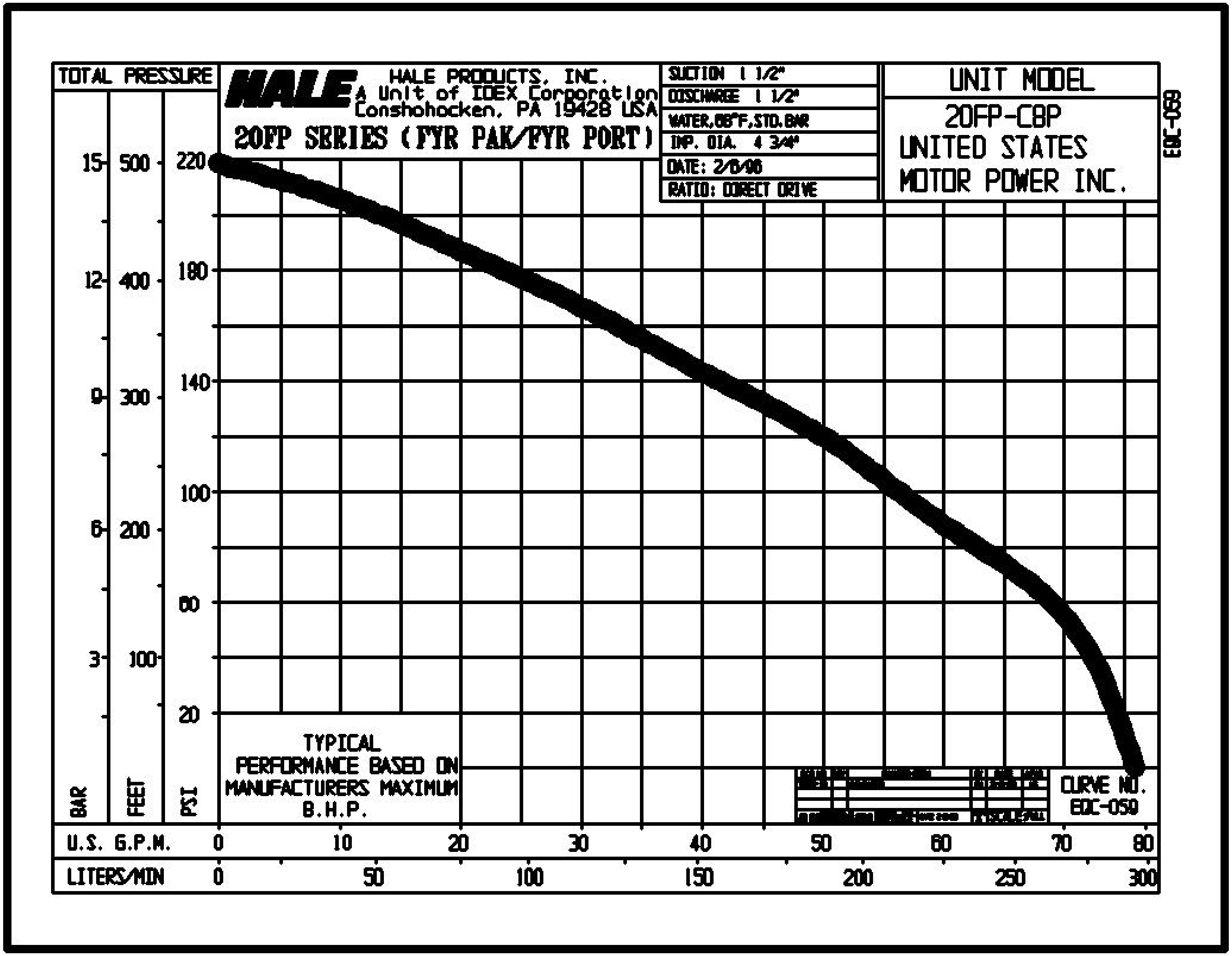

TOTAL PRESSURE
BAR
FEET
PSI
HALE
HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA
HP550 Minuteman Series
SUCTION: 4"
DISCHARGE: (2) 2 1/2"
ELEVATION: SEA LEVEL
WATER, 60°F, STD. BAR
IMP. DIA.: 6-3/4"
DATE: 4-25-06
RATIO: N/A
UNIT MODEL
HP550
HONDA 3 CYL.
4 STROKE, 50 BHP
EQC-061
24 FT. ACTUAL SUCTION LIFT
30 FT. OF 4 IN. HOSE
10 FT. ACTUAL SUCTION LIFT
20 FT. OF 4 IN. HOSE
TYPICAL PERFORMANCE
BASED ON ENGINE MFG.
MAXIMUM B.H.P.
=GUARANTEED PERFORMANCE
CURVE NO.
EQC-061
SCALE: FULL
U.S. G.P.M.
LITERS/MIN



TOTAL PRESSURE
HALE
HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA
AP50 SERIES
SUCTION: 5"
DISCHARGE: 4"
ELEVATION: 2000'
WATER, 60°F, STD. BAR
IMP. DIA.: 7-1/2"
DATE: 4/6/93
RATIO: 2.55
UNIT MODEL
FP500D
JOHN DEERE 4045TF150
100 HP @ 2500 RPM
E-1078
100 HP
110 HP
90 HP
80 HP
70 HP
2500 RPM
2400 RPM
2200 RPM
2000 RPM
1800 RPM
NPSHR
10 FT. ACTUAL SUCTION LIFT
20 FT. OF 4 IN. HOSE
PERFORMANCE BASED ON
90% OF ENGINE
MANUFACTURERS MAXIMUM
B.H.P.
CURVE NO.
E-1078
SCALE NONE
BAR
FEET
PSI
FEET (NPSHR)
U.S. G.P.M.
LITERS/MIN



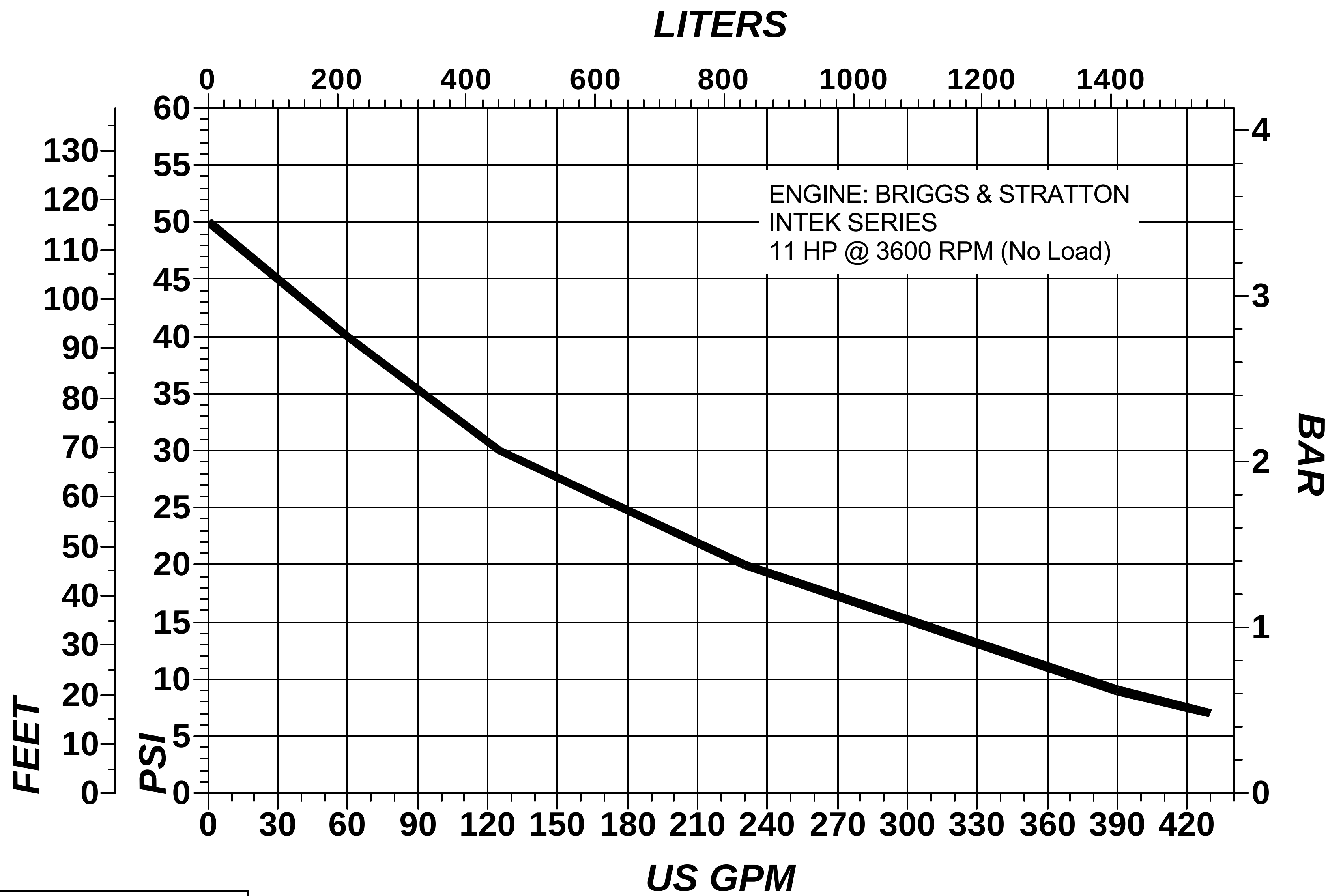
HALE
HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA
20FP-20FV SERIES
SUCTION
DISCHARGE 1.5"
WATER, 60°F, STD. BAR
IMP. DIA. 4.75"
DATE: 9-8-92
RATIO:
UNIT MODEL
1 20FP-C8
2 20FV-C8
U.S. MOTOR POWER INC.
EQC-020
TOTAL PRESSURE
BAR
FEET
PSI
PERFORMANCE BASED ON
ENGINE
MANUFACTURERS MAXIMUM
B.H.P.
CURVE NO.
EQC-020
SCALE: NONE
U.S. G.P.M.
LITERS/MIN



TOTAL PRESSURE
HALE
HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA
20FP SERIES (FYR PAK/FYR PORT)
SUCTION 1 1/2"
DISCHARGE 1 1/2"
WATER,68°F,STD.BAR
IMP. DIA. 4 3/4"
DATE: 2/6/98
RATIO: DIRECT DRIVE
UNIT MODEL
20FP-C8P
UNITED STATES
MOTOR POWER INC.
EDC-059
TYPICAL
PERFORMANCE BASED ON
MANUFACTURERS MAXIMUM
B.H.P.
CURVE NO.
EDC-059
BAR
FEET
PSI
15
12
9
6
3
500
400
300
200
100
220
180
140
100
60
20
U.S. G.P.M.
0
10
20
30
40
50
60
70
80
LITERS/MIN
0
50
100
150
200
250
300

SUPER CHIEF Performance Curve

(PERFORMANCE BASED ON A TOP GOVERNED SPEED OF 3600 RPM AND TYPICAL ENGINE NET HORSEPOWER)



DISCHARGE: 2.5" (6.5 mm)*

ELEVATION: SEA LEVEL

WATER @ 60°F, STD. BAR

IMPELLER: 6.375"

*NOTE: 3" (8mm) DISCHARGE HOSE RECOMMENDED FOR FULL OUTPUT.

ECO NO	REV	CHANGED FROM	BY	DATE	APVD
04-011	A	INITIAL RELEASE	JBS	01-16-04	MAL

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

Drawn	JBS	Date: 01-16-04
Checked	MAL	

E1208

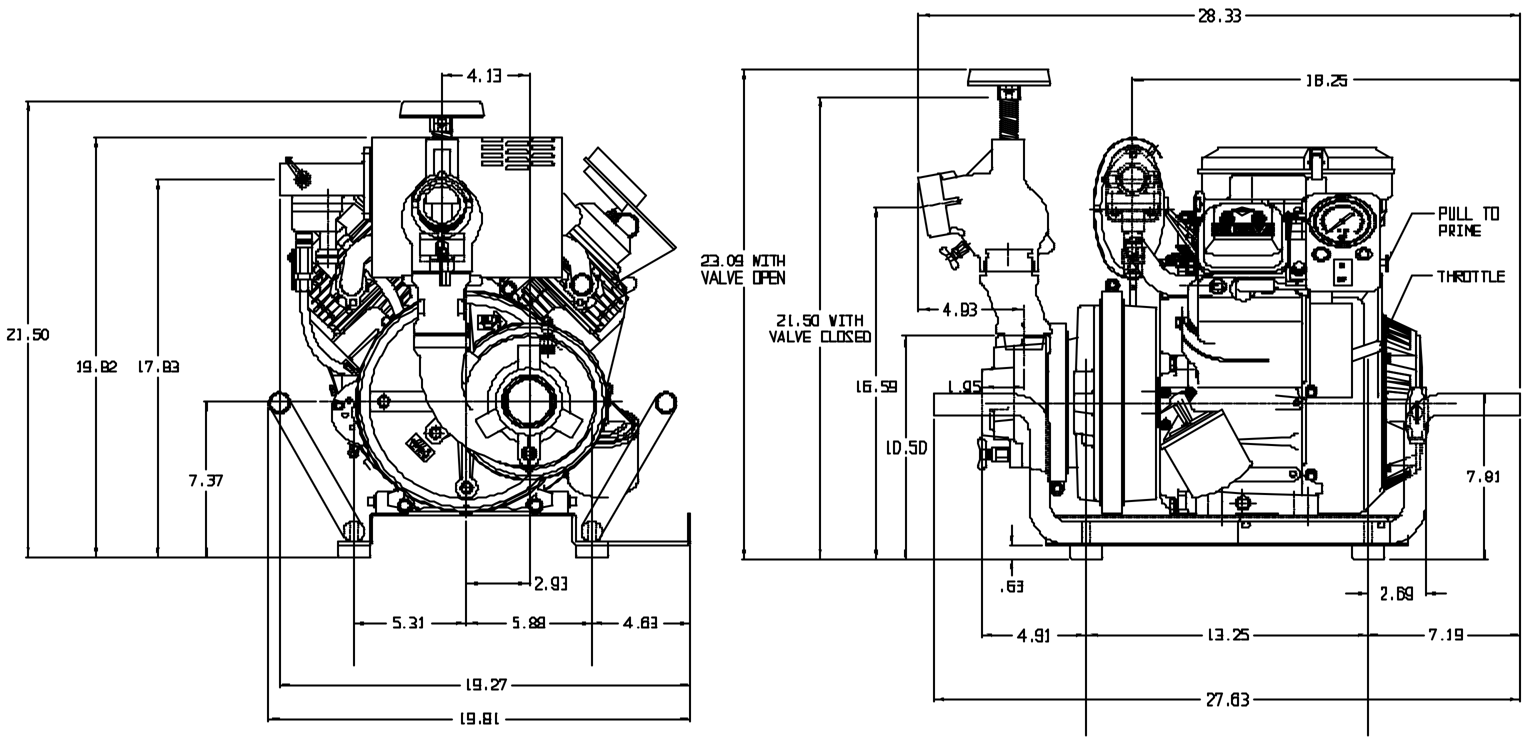
MOBILE EQUIPMENT SALES CATALOG

Line Drawings

HALE

Class 1

WEIGHT: 171 LBS



MODEL: HPT75-B18 AND HPT100-B18

NOTE: WEIGHT IS APPROXIMATE. ACTUAL WEIGHT DEPENDS ON FINAL CONFIGURATION.

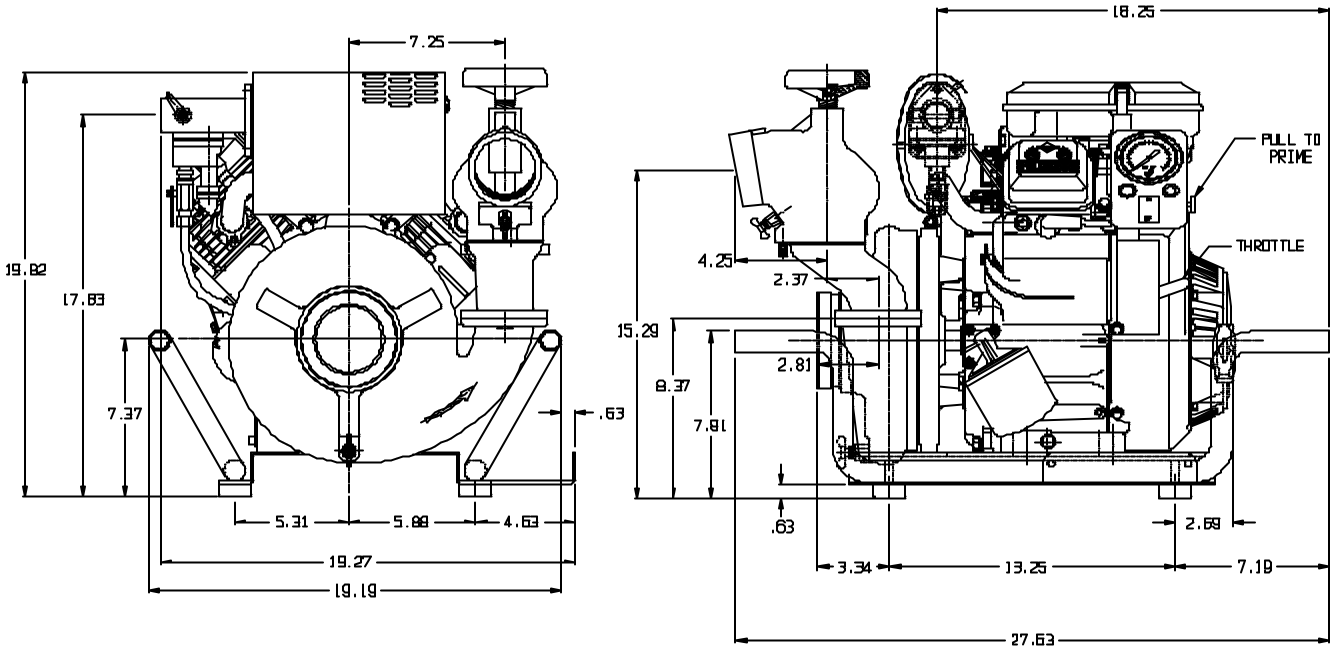
ECO NO	REV	CHANGED FROM	BY	DATE	APVD
		RELEASED	CJ	3-4-98	JK

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

DRAWN CJ | CHECKED JK | DATE 3-4-98 | SIZE B | SCALE: NONE

PLATE NO. EQ737

WEIGHT: 152 LBS



MODEL: HPT200-B18

NOTE: WEIGHT IS APPROXIMATE. ACTUAL WEIGHT DEPENDS ON FINAL CONFIGURATION.

ECO NO	REV	CHANGED FROM	BY	DATE	APVD
[illegible]		RELEASED	CJ	[illegible]	JK

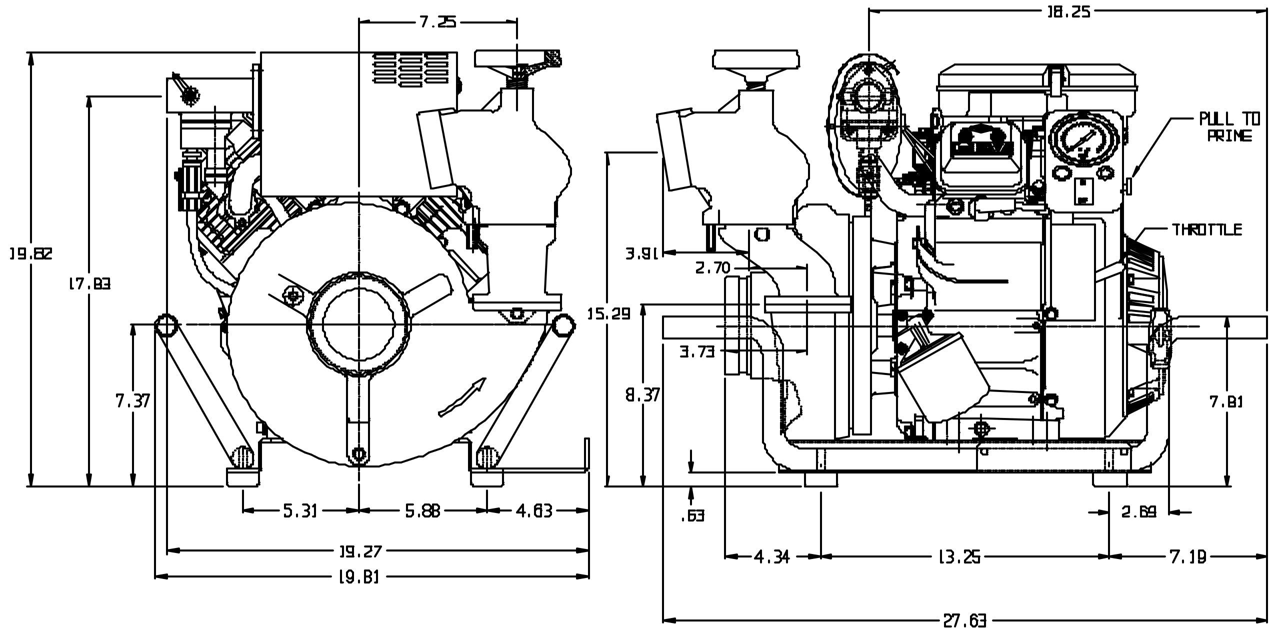
HALE

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

DRAWN CJ CHECKED JK DATE [illegible] SIZE B SCALE: NONE

PLATE NO. EQ738

WEIGHT: 154 LBS



MODEL: HPT300-B18

NOTE: WEIGTH IS APPROXIMATE. ACTUAL WEIGHT DEPENDS ON FINAL CONFIGURATION.

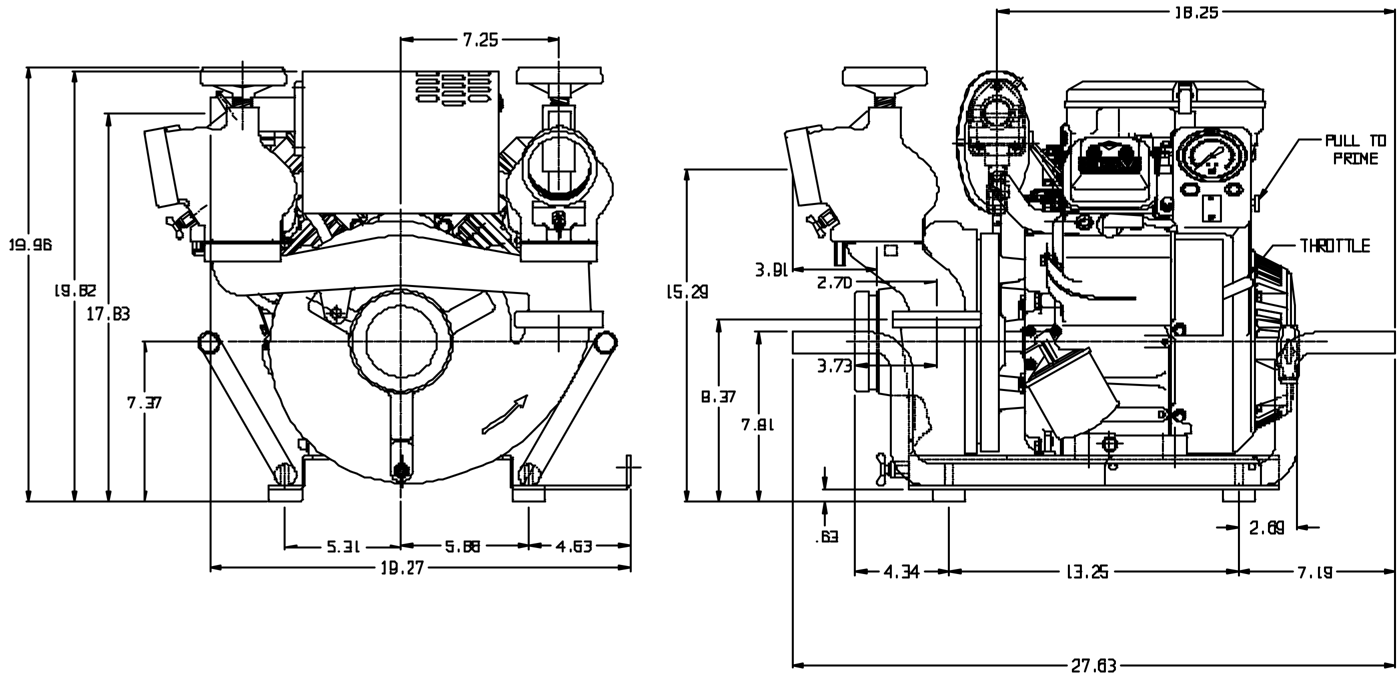
ECO NO	REV	CHANGES FROM	BY	DATE	APVD
[illegible]		RELEASED	CJ	[illegible]	JK

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

DRAWN CJ · CHECKED JK · DATE [illegible] · SIZE B · SCALE: NONE

PLATE NO. EQ739

WEIGHT: 154 LBS



MODEL: HPT400-B18

NOTE: WEIGHT IS APPROXIMATE. ACTUAL WEIGHT DEPENDS ON FINAL CONFIGURATION.

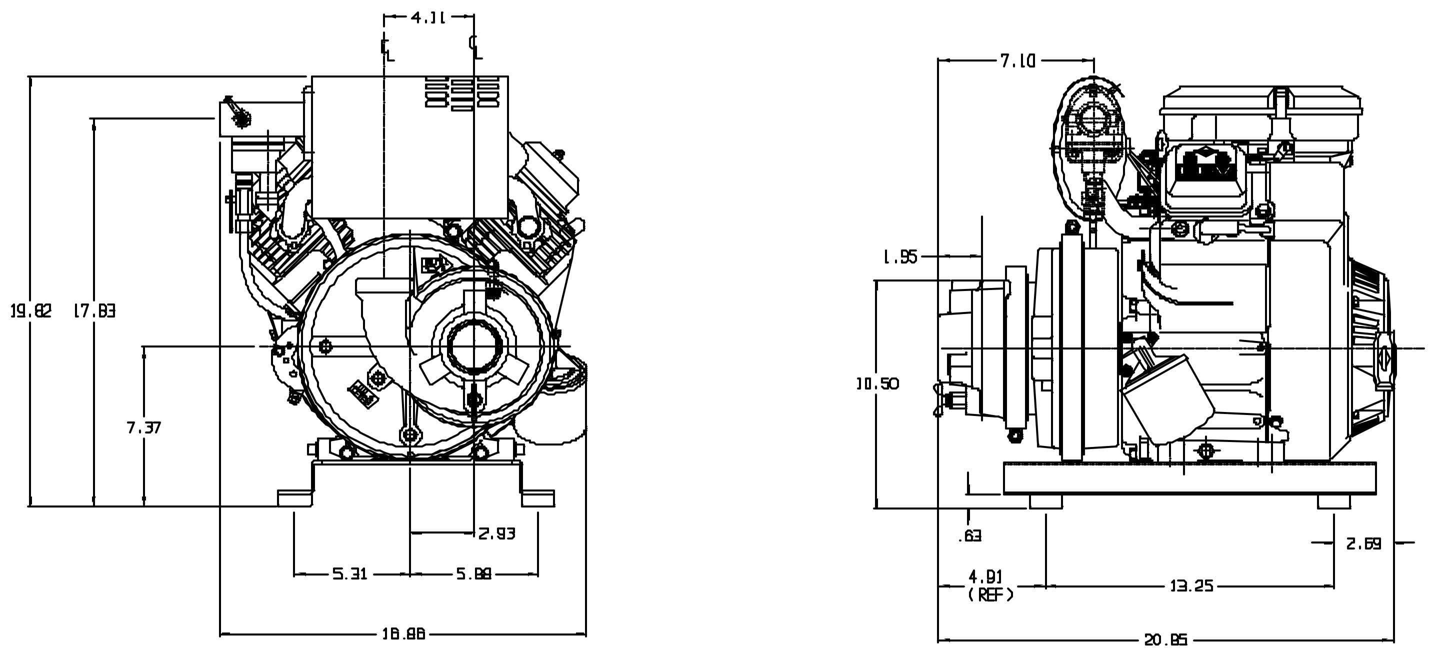
ECO NO	REV	CHANGED FROM	BY	DATE	APVD
[illegible]		RELEASED	CJ	3-4-[illegible]	JK

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

DRAWN CJ CHECKED JK DATE 3-4-[illegible] SIZE B SCALE: NONE

PLATE NO. EQ740

WEIGHT: 157 LBS



MODEL: HPX75-B18 AND HPX100-B18

NOTE: WEIGHT IS APPROXIMATE. ACTUAL WEIGHT DEPENDS ON FINAL CONFIGURATION.

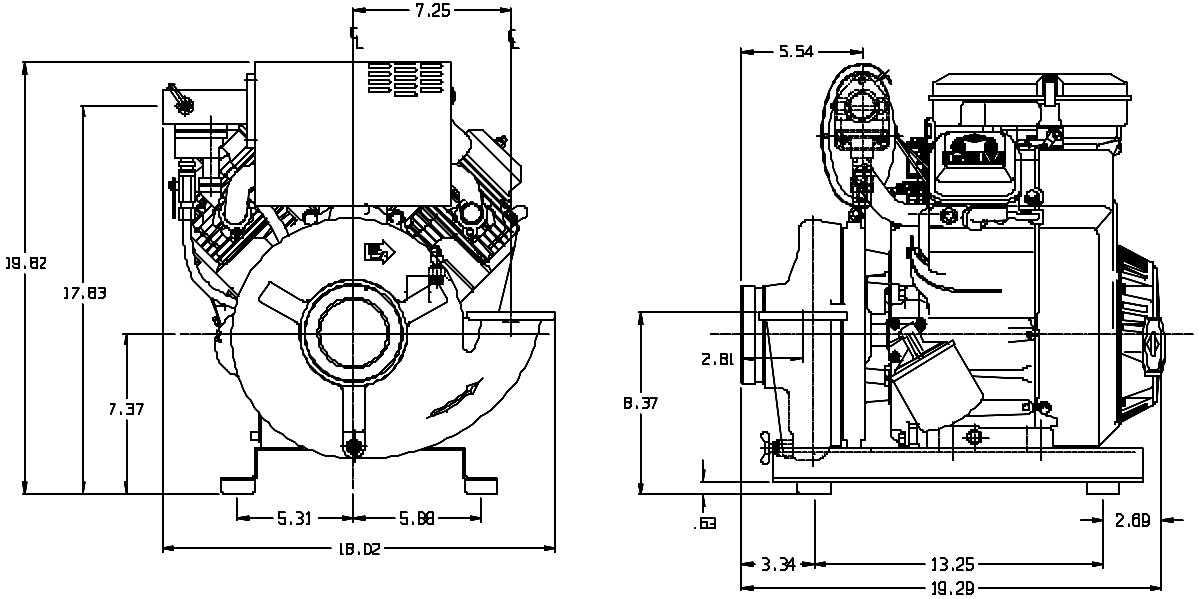
ECO NO	REV	CHANGED FROM	BY	DATE	APVD
1188-11		RELEASED	CJ	2-26-08	JK

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

DRAWN CJ | CHECKED JK | DATE 2-26-08 | SIZE B | SCALE: NONE

PLATE NO. EQ735

WEIGHT: 138 LBS



MODEL: HPX200-B18

NOTE: WEIGHT IS APPROXIMATE. ACTUAL WEIGHT DEPENDS ON FINAL CONFIGURATION.

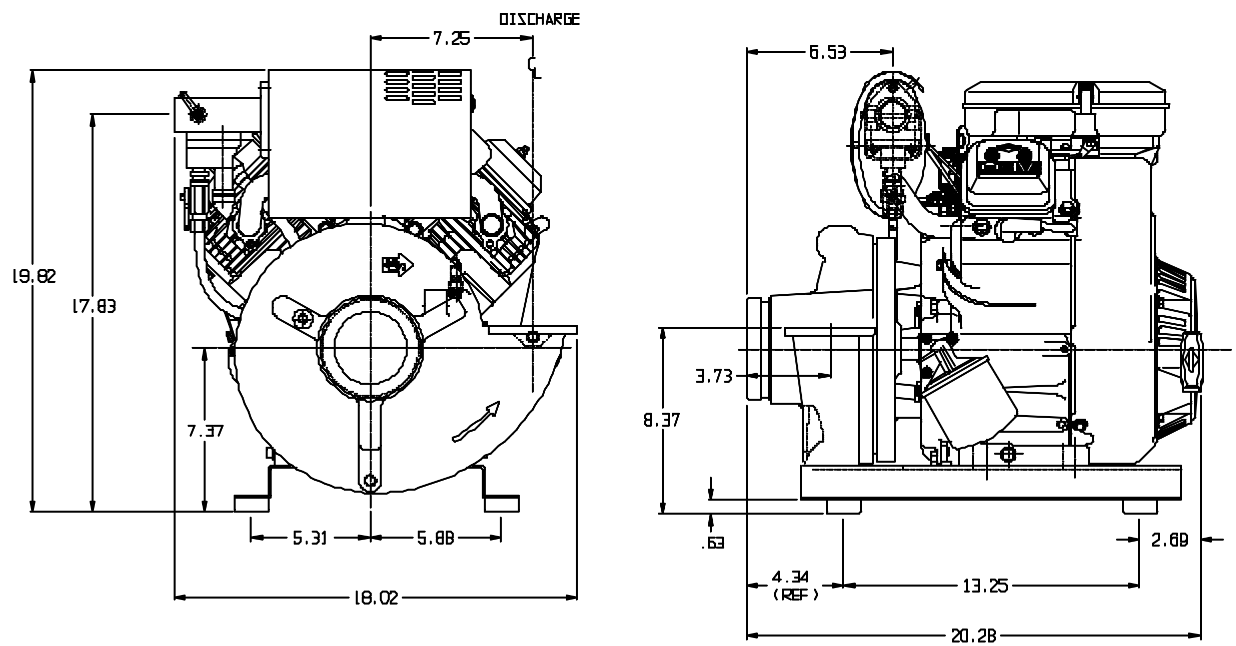
ECO NO	REV	CHANGED FROM	BY	DATE	APVD
IN08-11		RELEASED	CJ	2-28-08	JK

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

DRAWN CJ CHECKED JK DATE 2-28-08 SIZE B SCALE: NONE

PLATE NO. EQ734

WEIGHT: 140 LBS



MODEL: HPX300-B18

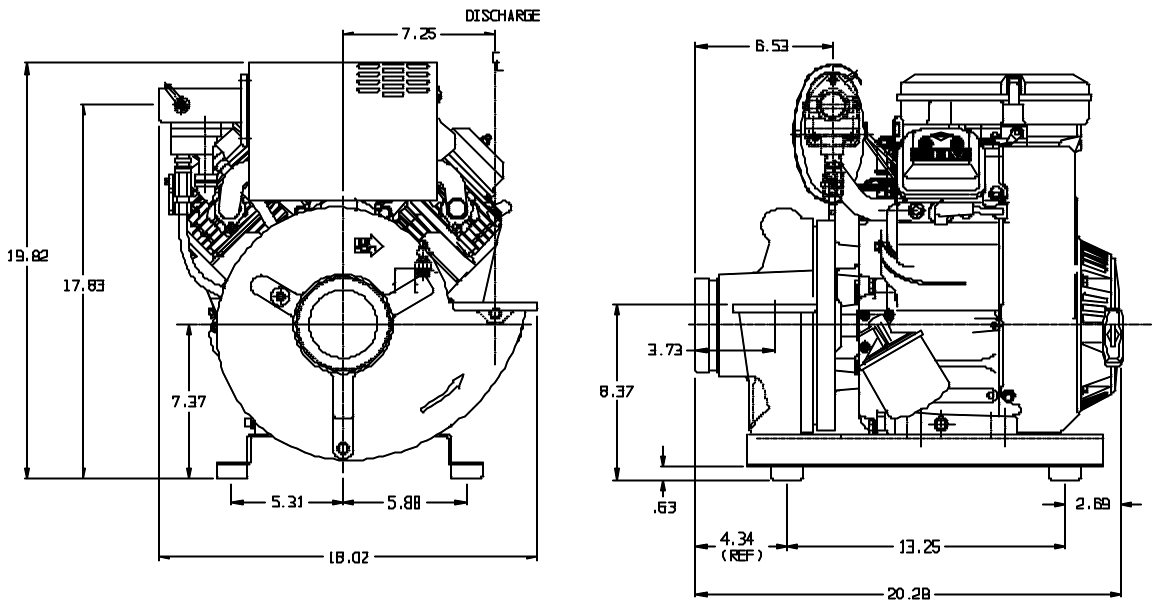
PLATE NO. EQ733

ECO NO	REV	CHANGED FROM	BY	DATE	APVD
[illegible]		RELEASED	CJ	2-28-00	JK

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

DRAWN CJ | CHECKED JK | DATE 2-28-00 | SIZE B | SCALE: NONE

WEIGHT: 140 LBS



MODEL: HPX400-B18

NOTE: WEIGHT IS APPROXIMATE. ACTUAL WEIGHT DEPENDS ON FINAL CONFIGURATION.

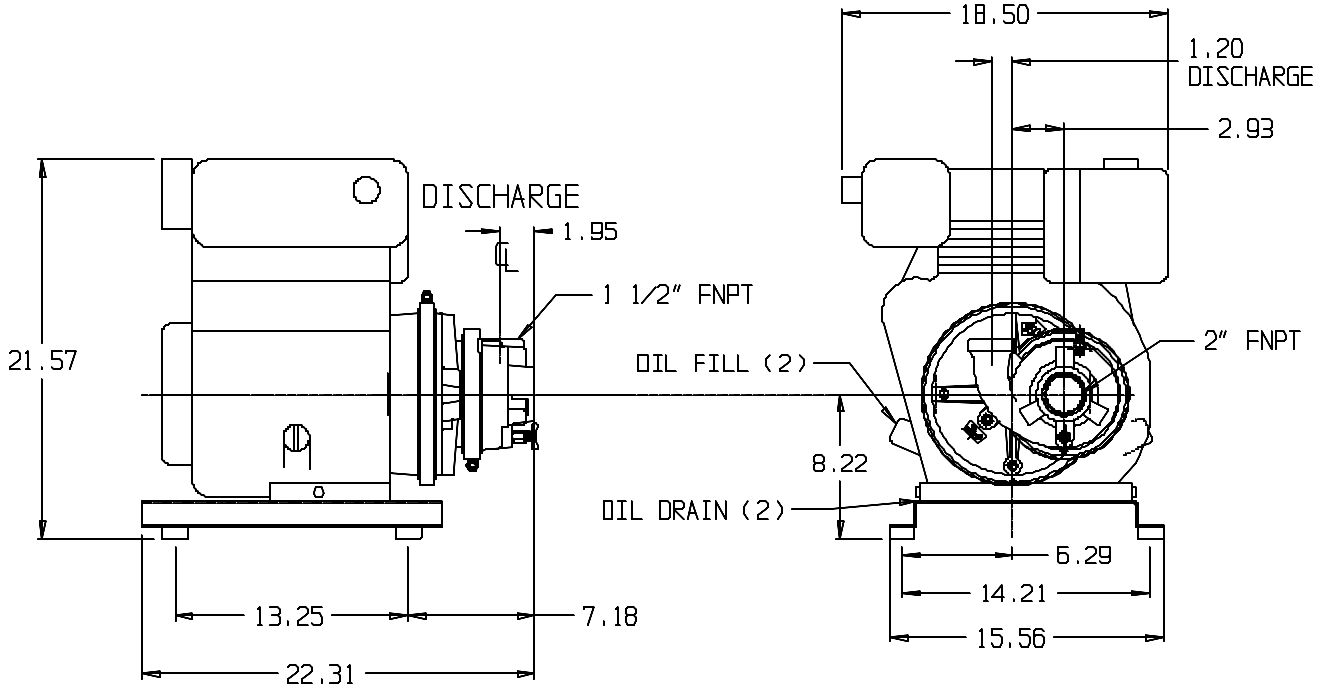
ECO NO	REV	CHANGED FROM	BY	DATE	APVD
		RELEASED	CJ		JK

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

DRAWN CJ | CHECKED JK | SCALE: NONE

PLATE NO. EQ736

WEIGHT: 149 LBS



MODEL: HPX75-YD10

NOTE: WEIGHT IS APPROXIMATE. ACTUAL WEIGHT DEPENDS ON FINAL CONFIGURATION.

ECO NO	REV	CHANGED FROM	BY	DATE	APVD
[illegible]		RELEASED	[illegible]	12-4-[illegible]	MS
[illegible]	A	CHANGED NAME, ADDED BASE	[illegible]	3-31-[illegible]	JK

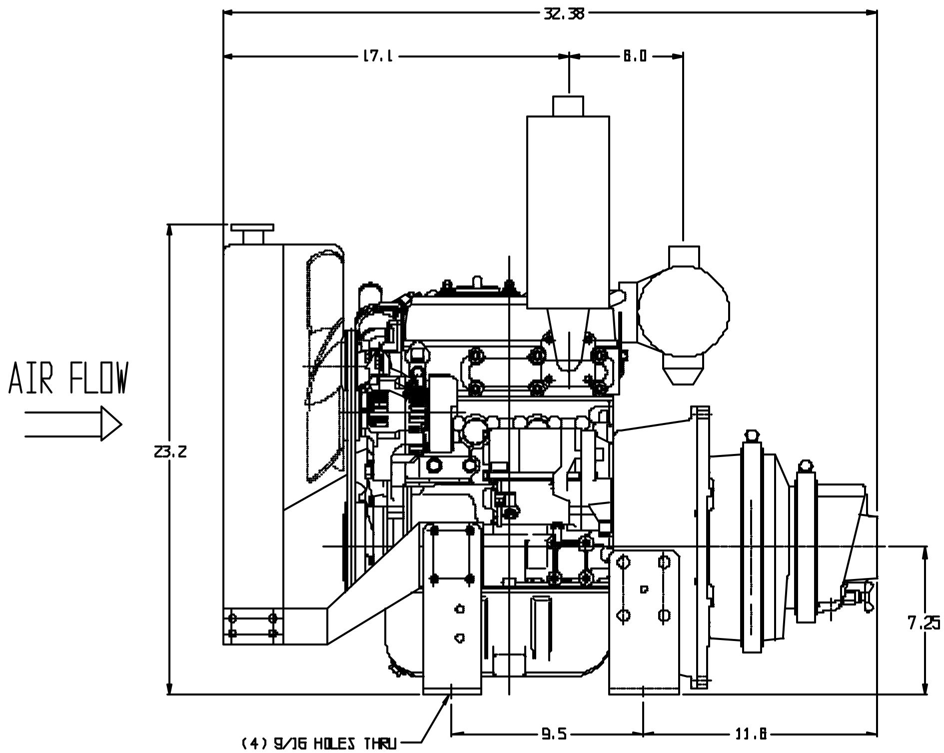
HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA

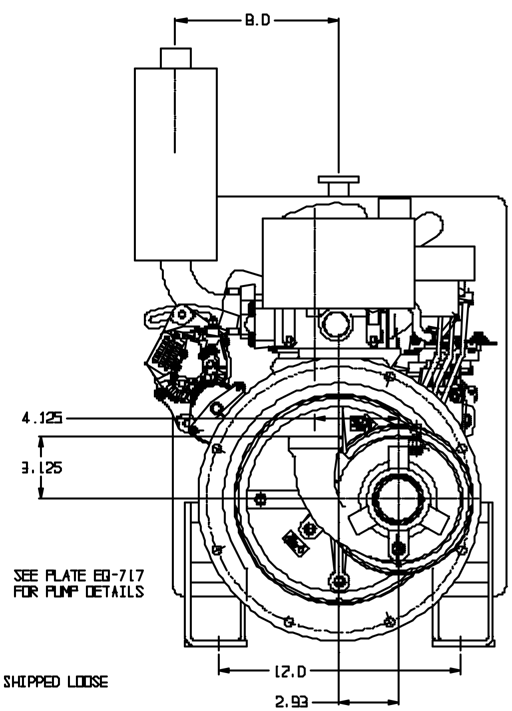
SCALE: NONE

PLATE NO. EQ731A

WEIGHT: 311 LB

BRIGGS & STRATTON DM950D DIESEL VANGUARD WITH HP100 PUMP





SEE PLATE EQ-717
FOR PUMP DETAILS

ELECTRIC PRIMER SHIPPED LOOSE

MODEL: HPX100-BD26

MOUNT: OPEN

HALE RESERVES THE RIGHT TO ALTER SPECIFICATIONS

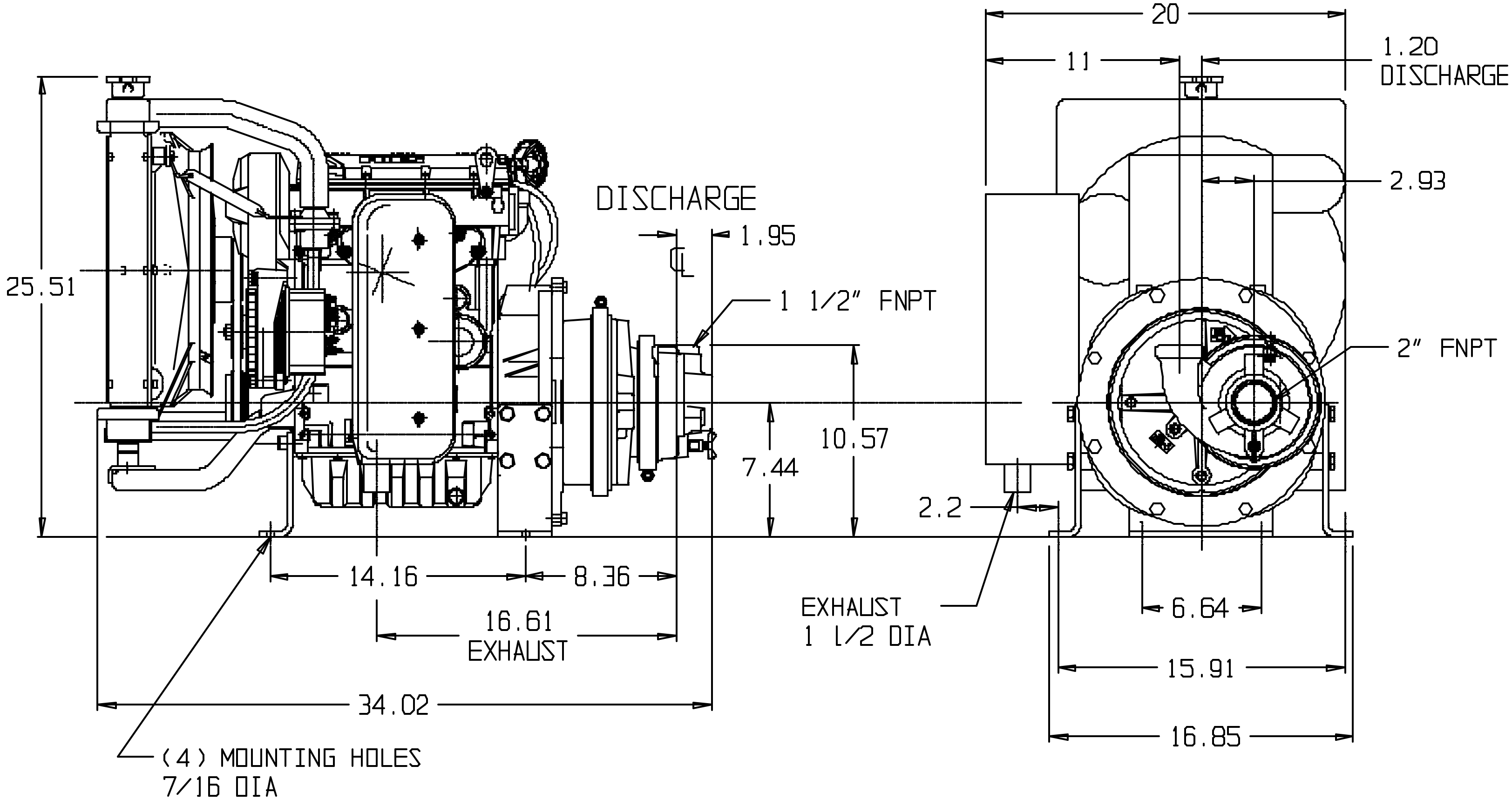
ECO NO	REV	CHANGED FROM	BY	DATE	APVD
[illegible]	.	RELEASED	KS	[illegible]	KS
[illegible]	A	CHANGED NAME	CJ	[illegible]	JK

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

DRAWN CJ
CHECKED
SIZE B
SCALE: NONE

PLATE NO. EQ721A

WEIGHT: 295 LBS



MODEL: HPX100-LD23

NOTE: WEIGHT IS APPROXIMATE. ACTUAL WEIGHT DEPENDS ON FINAL CONFIGURATION.

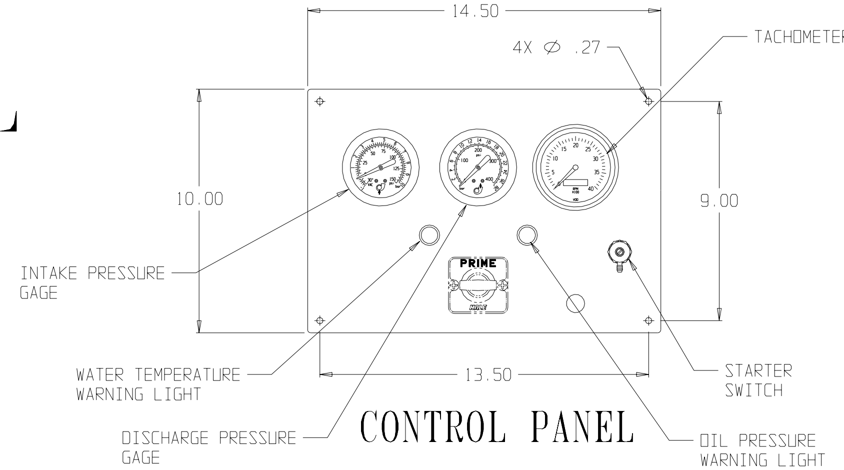
ECO NO	REV	CHANGED FROM	BY	DATE	APVD
[illegible]	.	RELEASED	CJ	[illegible]	MS
[illegible]	A	CHANGED NAME	CJ	[illegible]	JK

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

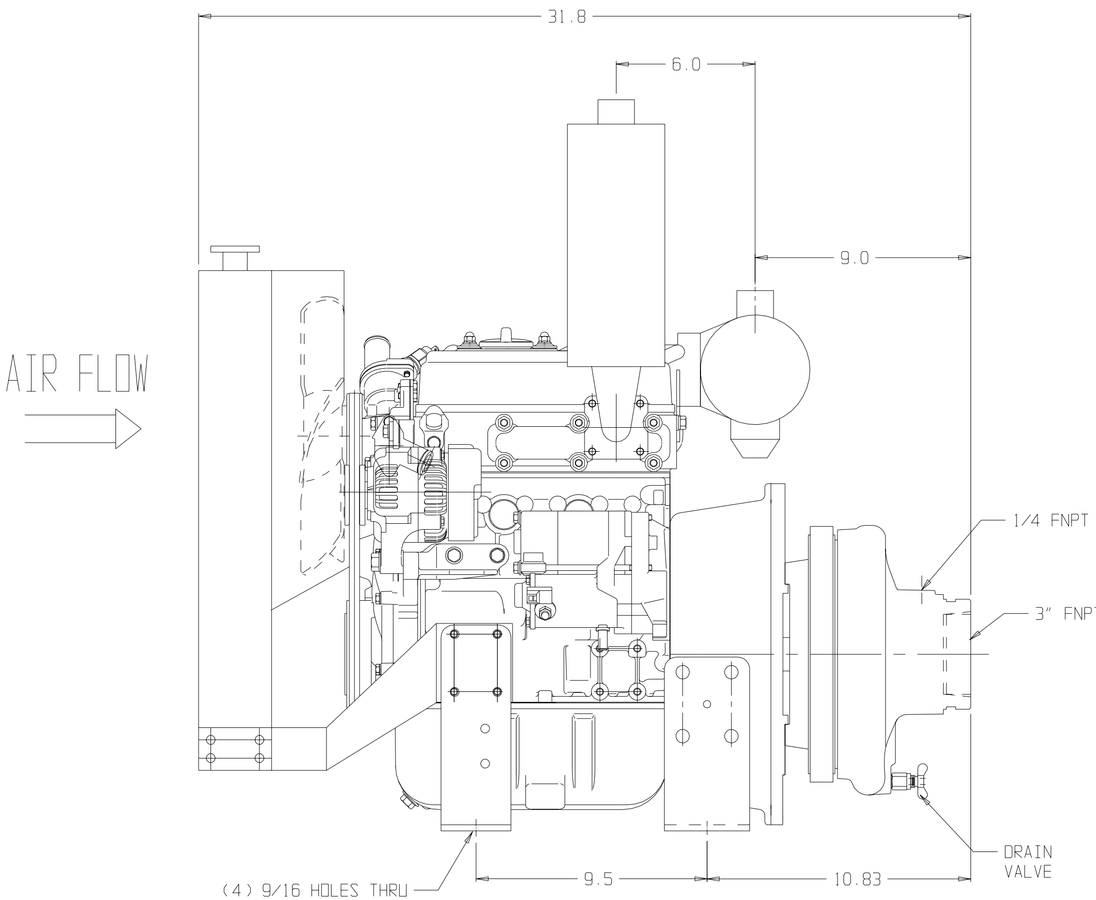
SCALE: NONE

PLATE NO. EQ715A

HPX200-BD26 DIESEL SLIP-ON PUMP



CONTROL PANEL



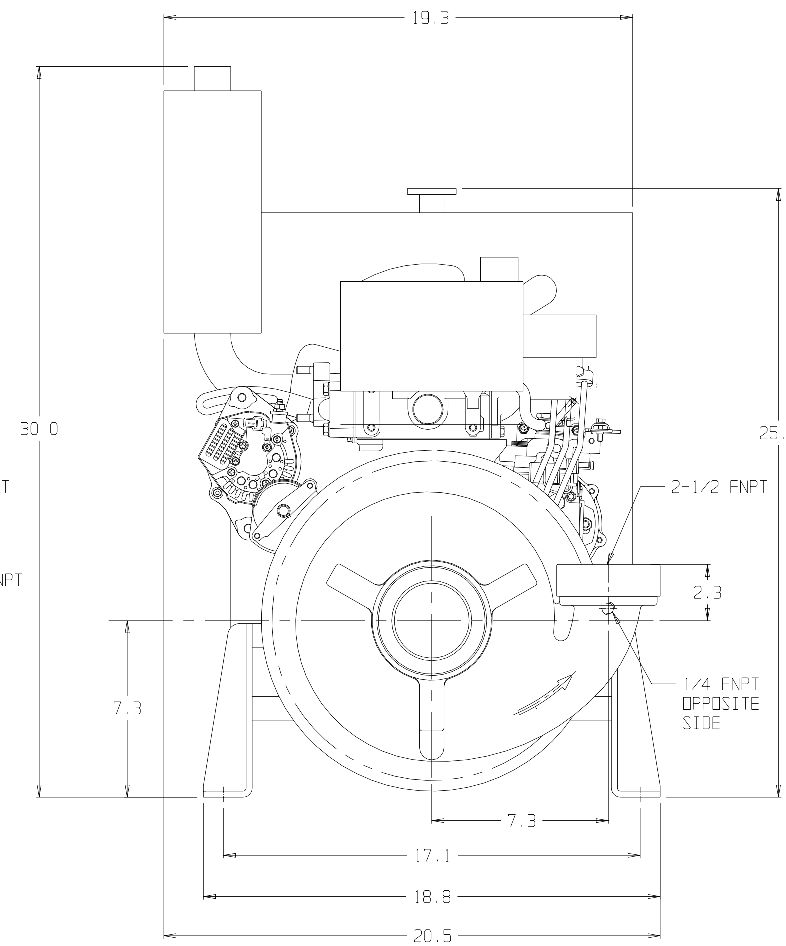


PLATE NO. EQ722C

ECO NO	REV	CHANGED FROM	BY	DATE	APVD
TN98-20	.	RELEASED	MS	3-6-98	MS
TN98-37	A	ADDED ENG MOUNTS	MS	6-11-98	MS
TN99-04	B	CHANGED PUMP NAME	JK	01-30-99	JK
02-089	C	UPDATED DIMENSIONS, ADDED PANEL	JBS	03-28-02	MAL

HALE PRODUCTS, INC.
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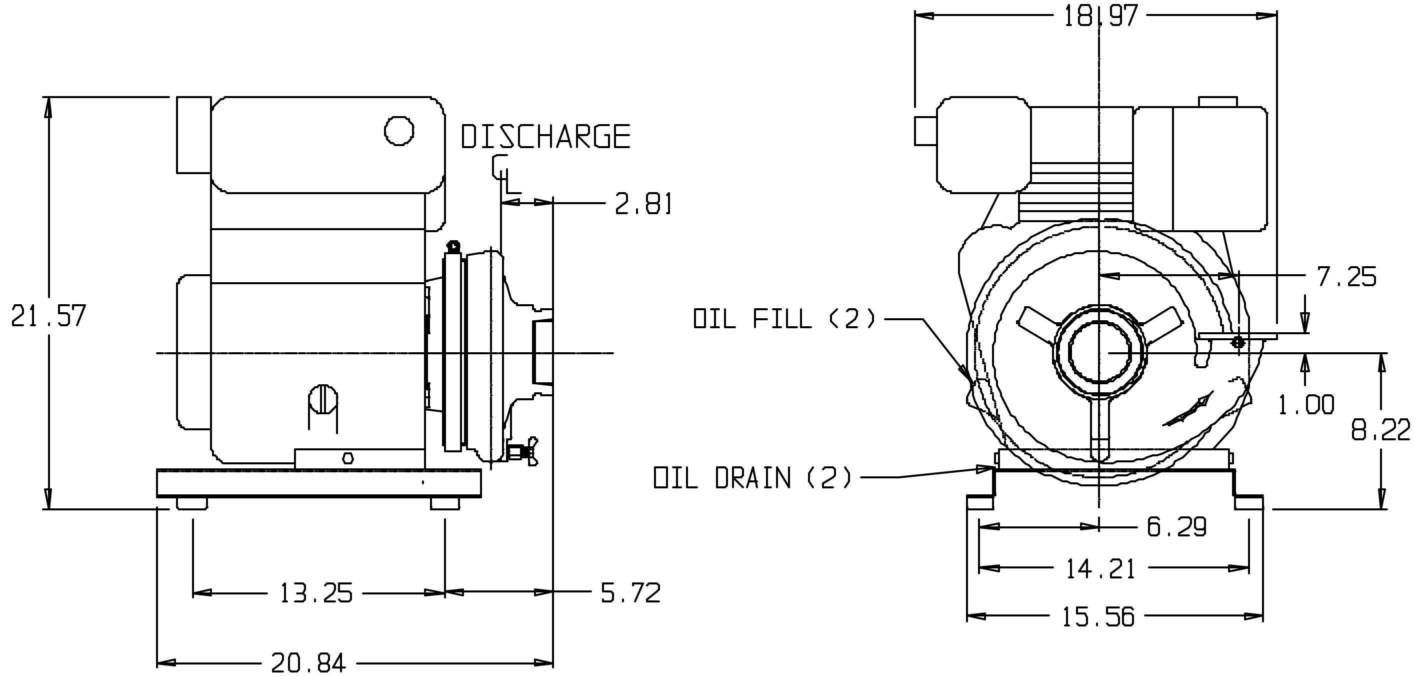
Conshohocken, PA 19428 USA

DRAWN	CJ	DATE 11-14-97	SIZE B	SCALE: NONE
CHECKED	MS			

WEIGHT: 130 LBS



MODEL: HPX200-YD10

NOTE: WEIGHT IS APPROXIMATE. ACTUAL WEIGHT DEPENDS ON FINAL CONFIGURATION.

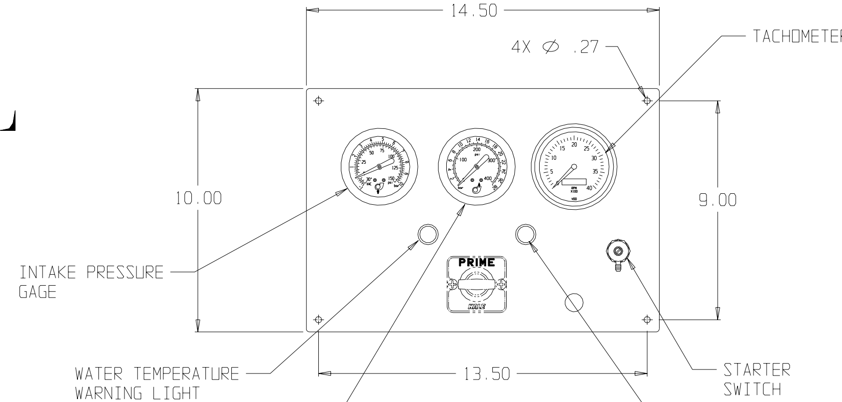
ECO NO	REV	CHANGED FROM	BY	DATE	APVD
[illegible]	.	RELEASED	CJ	[illegible]	JK

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

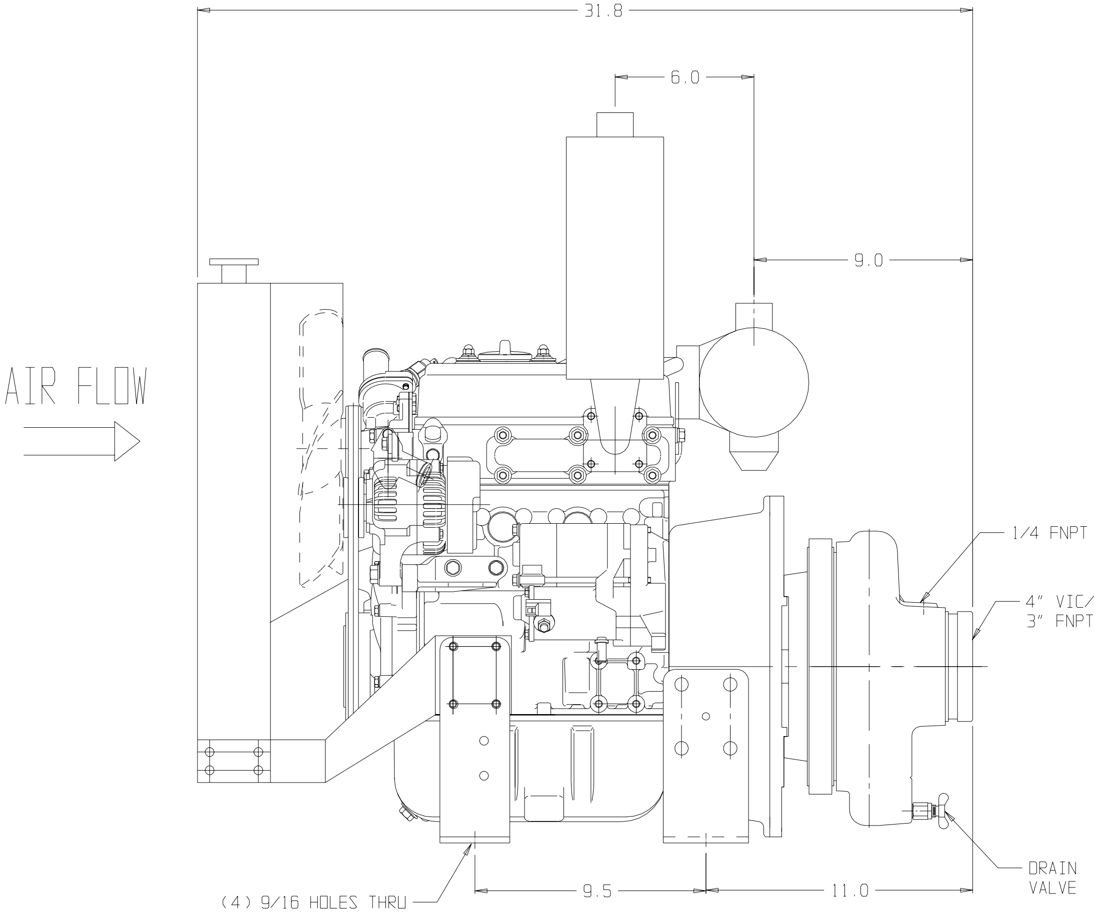
DRAWN CJ | CHECKED JK | SIZE B | SCALE: NONE

PLATE NO. EQ743

HPX300-BD26 DIESEL SLIP-ON PUMP



CONTROL PANEL



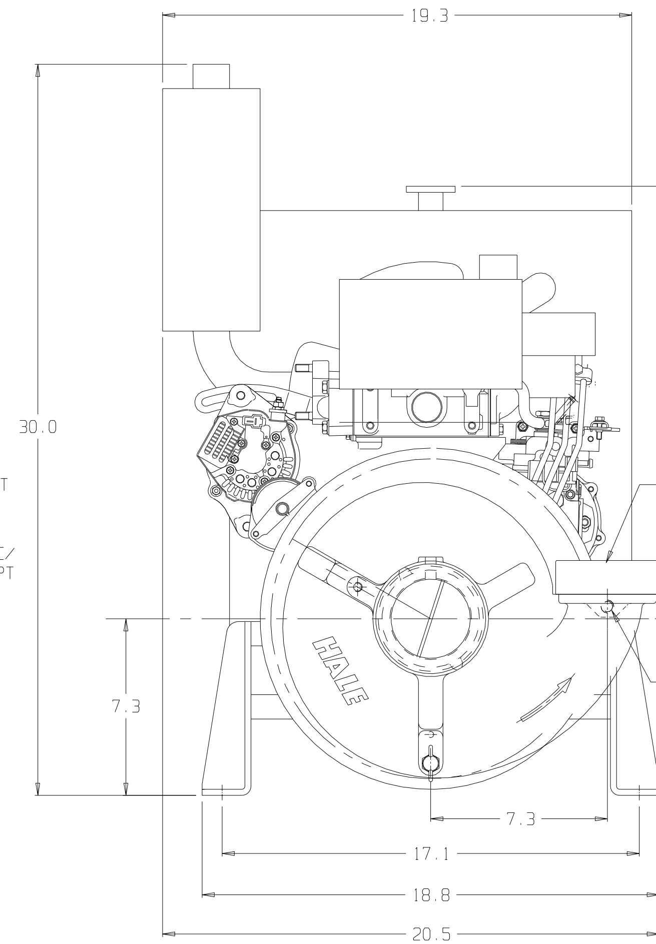


PLATE NO. EQ723A

ECO NO	REV	CHANGED FROM	BY	DATE	APVD
02-194	A	INITIAL RELEASE	JBS	06-27-02	MAL

HALE PRODUCTS, INC.
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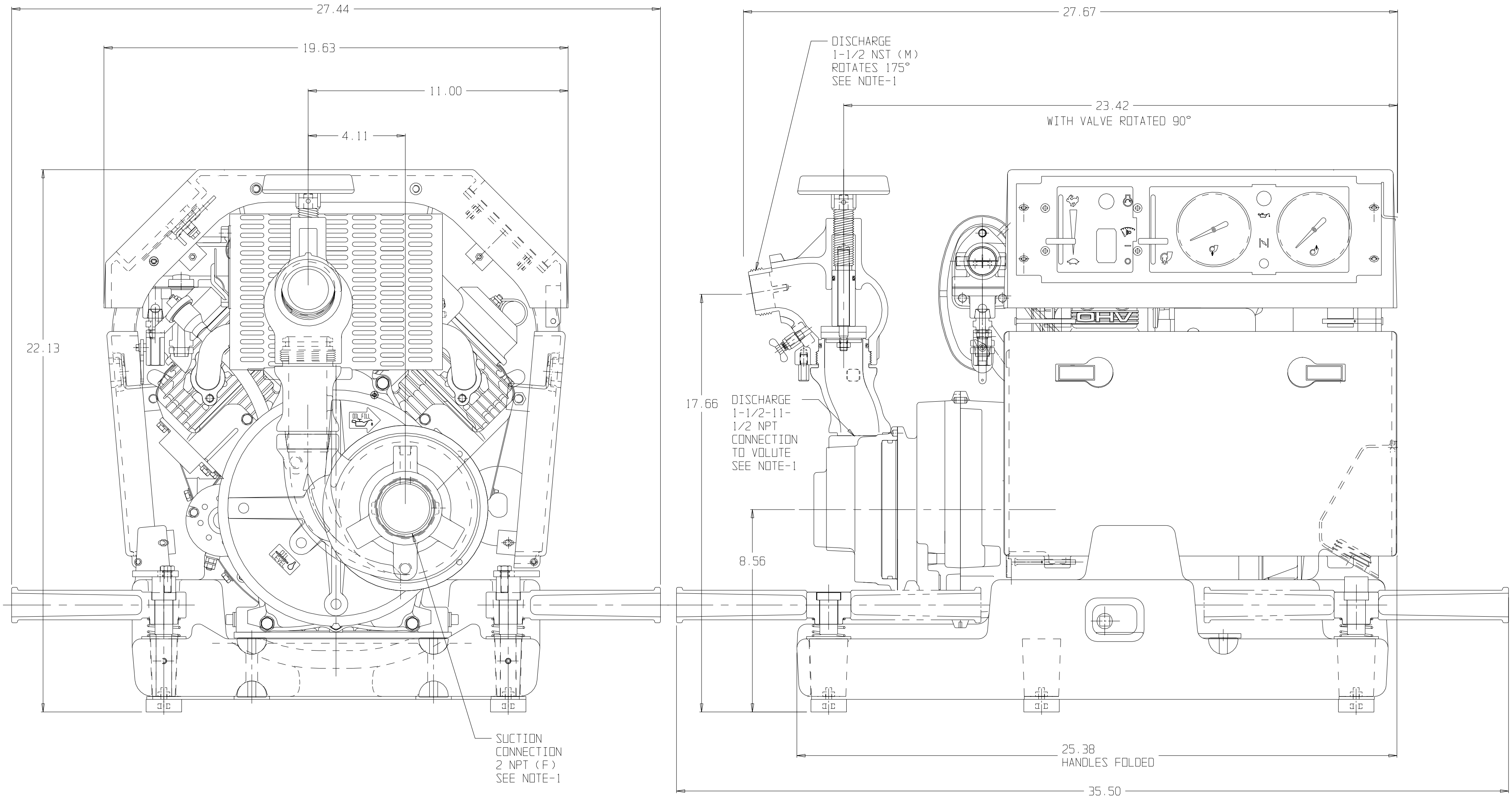
Conshohocken, PA 19428 USA

DRAWN JBS | CHECKED MAL | DATE 06-27-02 | SIZE B | SCALE: NONE



HP75-B18 SERIES MASTER LAYOUT

NOTE:
1. REFERENCE PL935 FOR OPTIONAL SUCTION/DISCHARGE ADAPTERS.

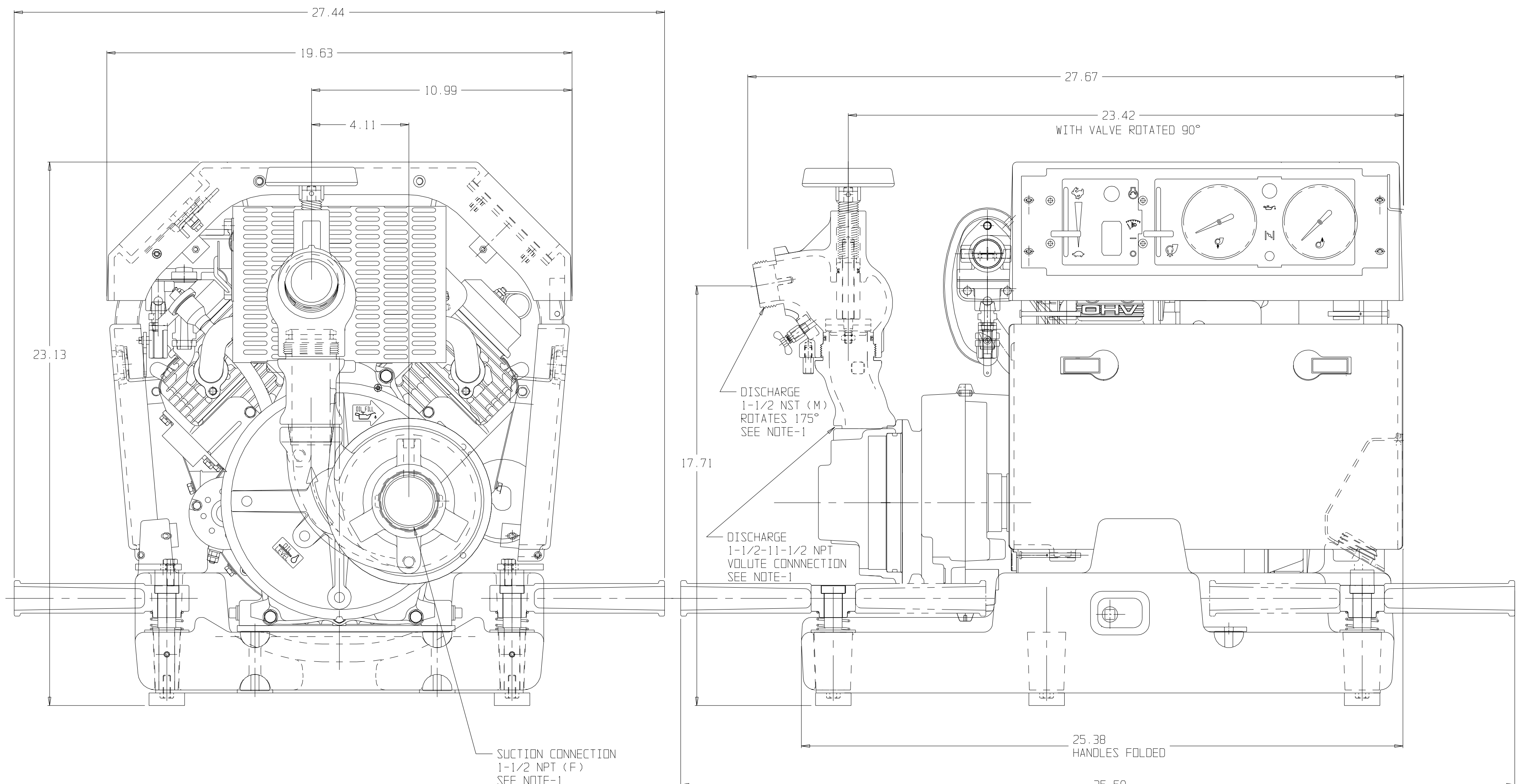
ECO NO	REV	CHANGED FROM	BY	DATE	APVD
01-005	A	RELEASED FOR PRODUCTION	TC	1-8-01	MAL

HALE

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

DRAWN	TC	DATE 1-3-01	SIZE D	SCALE: FULL
CHECKED	MAL			

EQ757AA



NOTE:
1. REFERENCE PL935 FOR OPTIONAL SUCTION/DISCHARGE ADAPTERS.

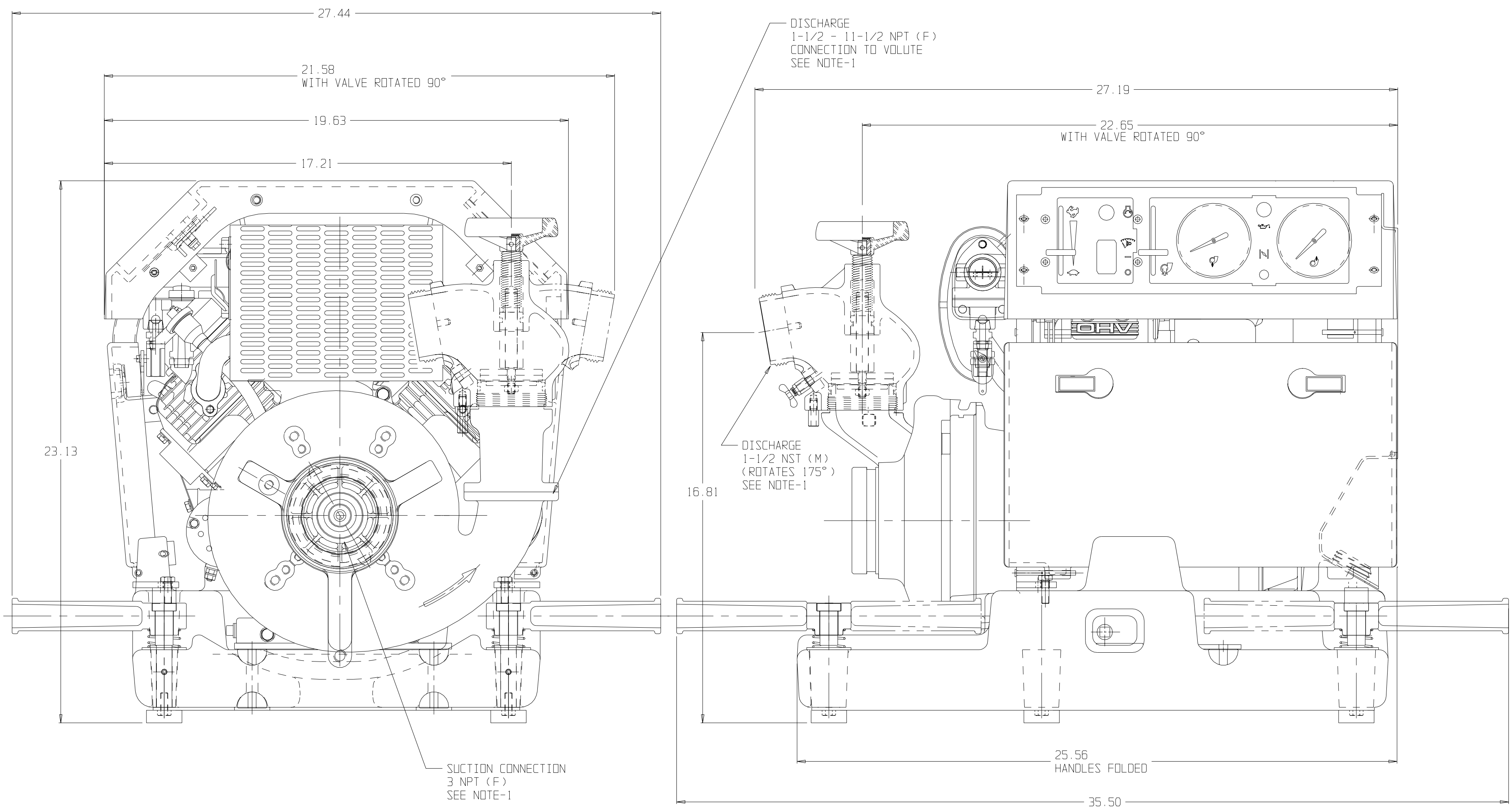
HP100-B18 SERIES MASTER LAYOUT

ECO NO	REV	CHANGED FROM	BY	DATE	APVD
01-005	A	RELEASED FOR PRODUCTION	TC	1-8-01	MAL

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

DRAWN	TC	DATE 1-3-01	SIZE D	SCALE: FULL
CHECKED	MAL			

EQ758AA



NOTE:
1. REFERENCE PL935 FOR OPTIONAL SUCTION/DISCHARGE ADAPTERS.

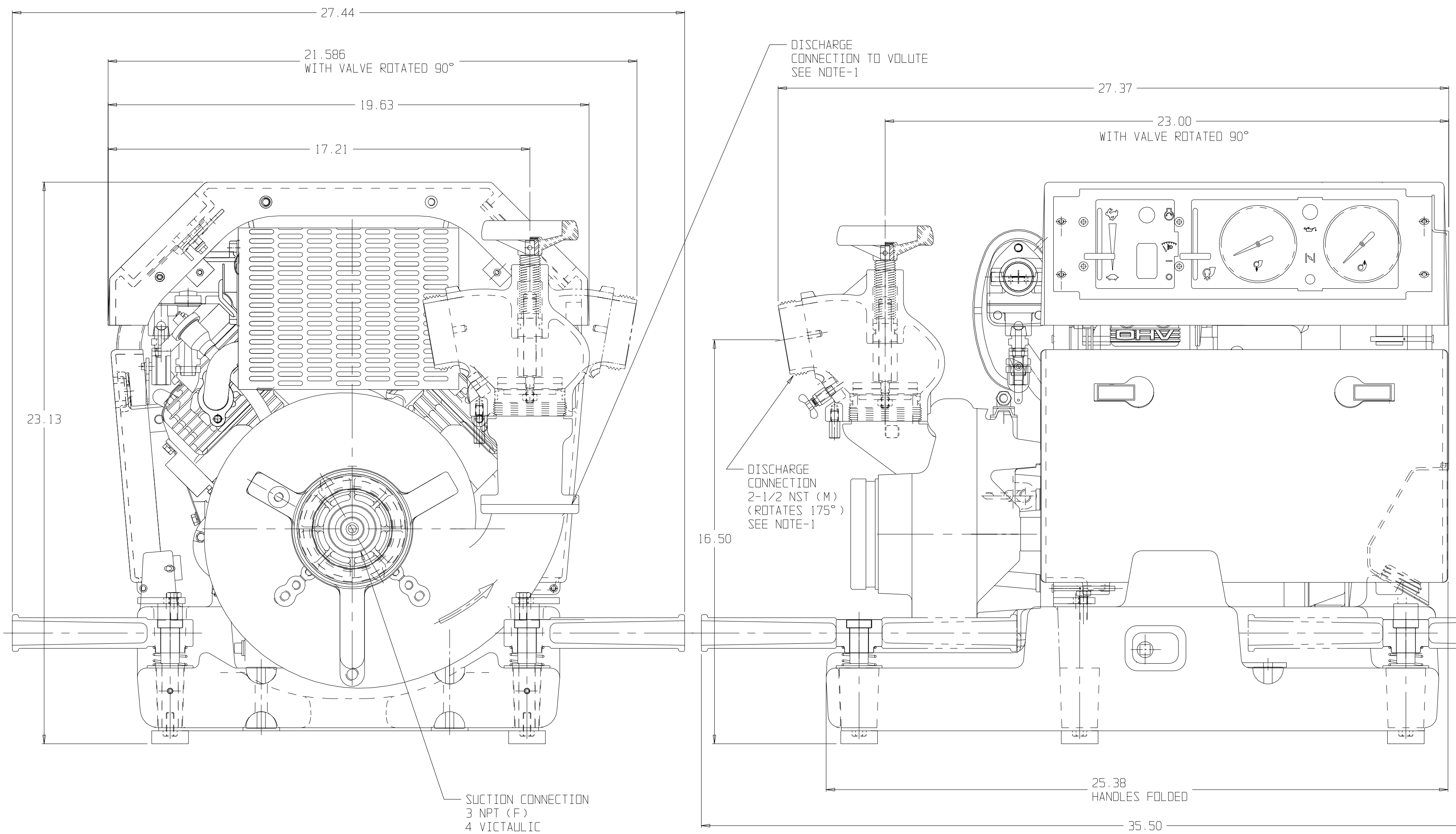
HP200-B18 SERIES MASTER LAYOUT

ECO NO	REV	CHANGED FROM	BY	DATE	APVD
01-005	A	RELEASED FOR PRODUCTION	TC	1-8-01	MAL

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

DRAWN TC | CHECKED MAL | DATE 1-3-01 | SIZE D | SCALE: FULL

EQ759AA



NOTE:
1. REFERENCE PLATE 935 FOR OPTIONAL SUCTION/DISCHARGE ADAPTERS.

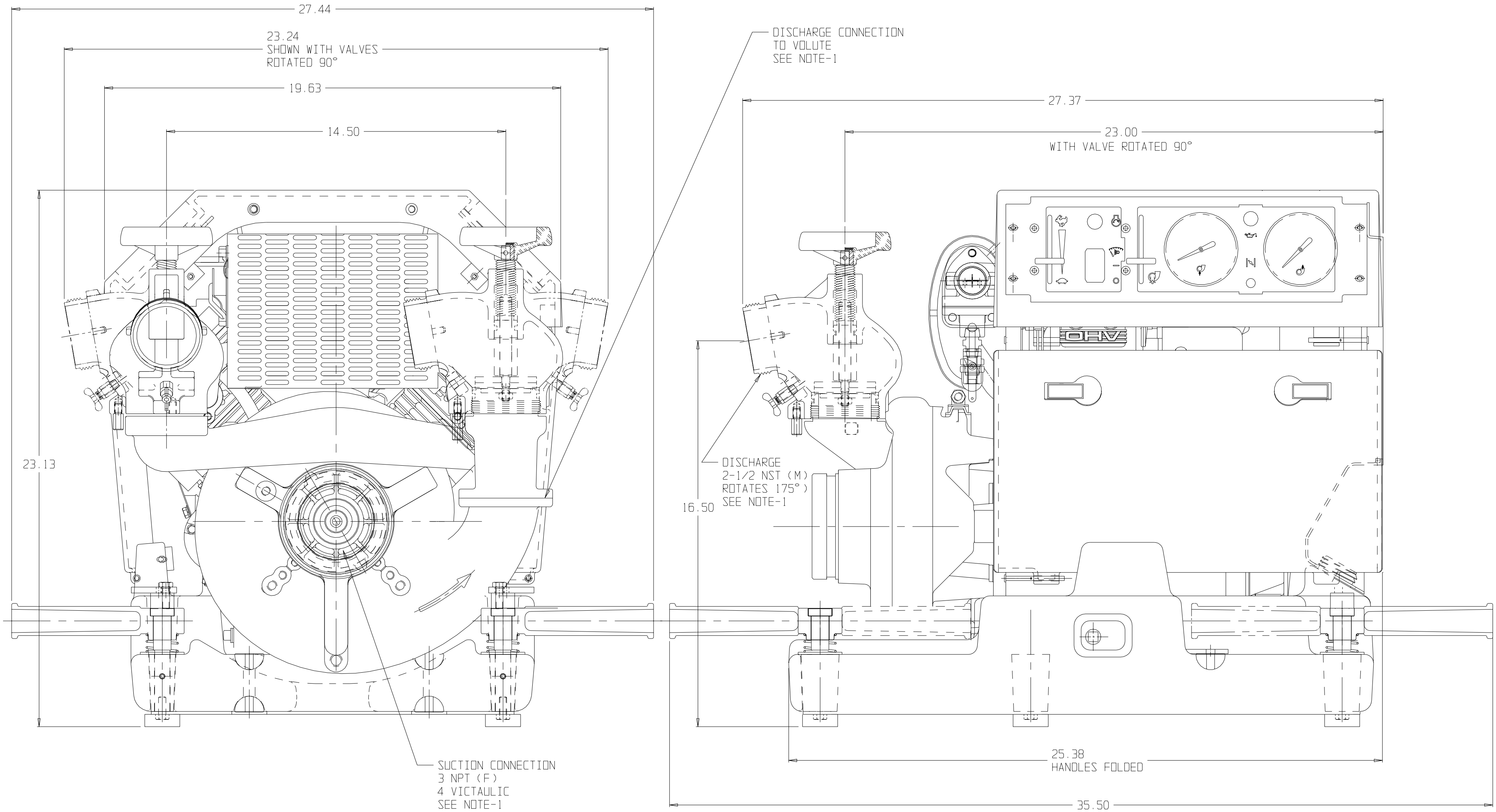
HP300-B18 SERIES MASTER LAYOUT

ECO NO	REV	CHANGED FROM	BY	DATE	APVD
01-005	A	RELEASED FOR PRODUCTION	TC	1-8-01	MAL

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

DRAWN TC | CHECKED MAL | DATE 1-3-01 | SIZE D | SCALE: FULL

EQ760AA



NOTE:
1. REFERENCE PLATE 935 FOR OPTIONAL SUCTION/DISCHARGE ADAPTERS.

HP400-B18 SERIES MASTER LAYOUT

ECO NO	REV	CHANGED FROM	BY	DATE	APVD
01-005	A	RELEASED FOR PRODUCTION	TC	1-8-01	MAL

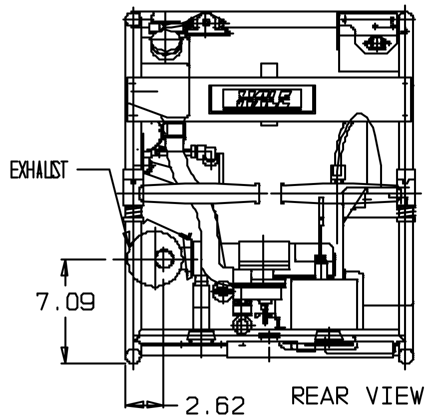
HALE

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

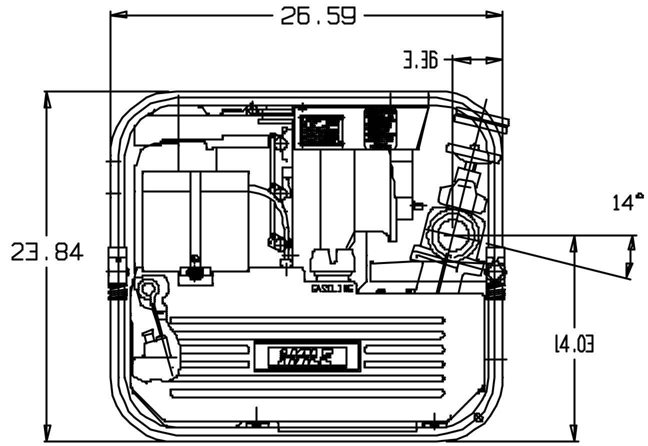
DRAWN	TC	DATE 1-3-01	SIZE D	SCALE: FULL
CHECKED	MAL			

EQ761AA

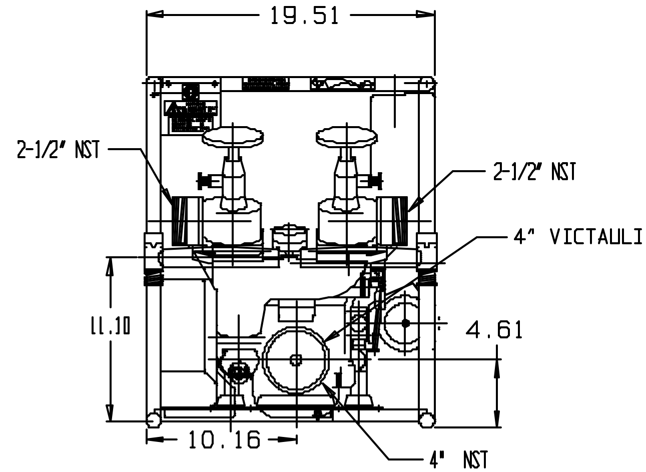
WEIGHT: 199 LBS



REAR VIEW WITH ENGINE REMOVED



OUTSIDE VIEW



FRONT VIEW WITH ENGINE REMOVED

MODEL: HP550

MOUNT: PORTABLE

WEIGHT IS APPROXIMATE. ACTUAL WEIGHT DEPENDS ON FINAL CONFIGURATION.

ECO NO	REV	CHANGED FROM	BY	DATE	APVD
INIT-54	.	RELEASED	CJ	5-28-07	MS

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

DRAWN CJ CHECKED MS DATE 5-28-07 SIZE B SCALE: NONE

PLATE NO. EQ648

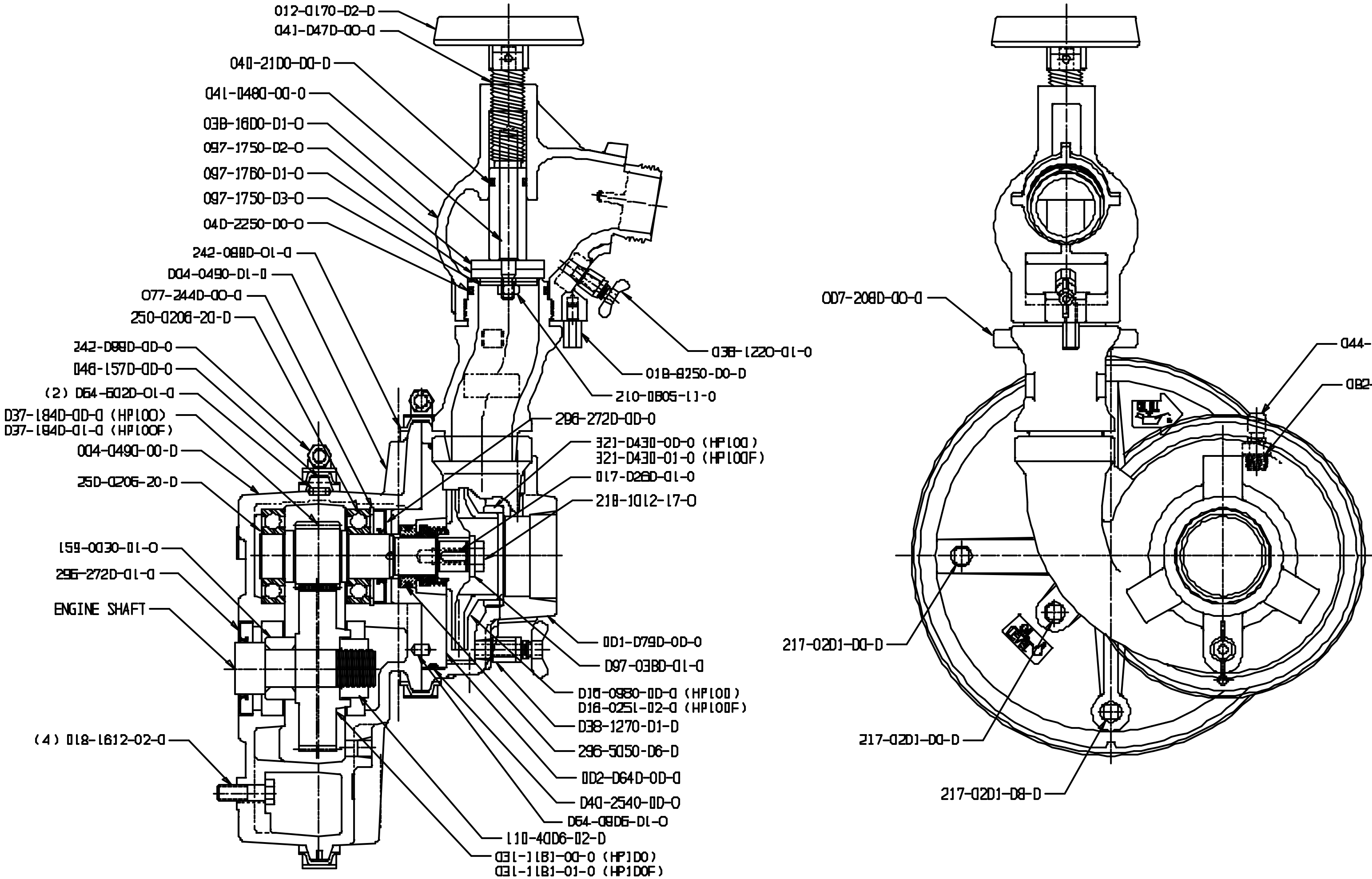
MOBILE EQUIPMENT SALES CATALOG

Pump End Parts Drawings

s

HALE

Class 1



HALE TYPE HP100 PORTABLE PUMP

PLATE NO. 773

ECO NO	REV	CHANGED FROM	BY	DATE	APVD
TN97-42	A	ADDED GEARS, SPACER AND NUT	MS	5-29-97	MS
IN97-78	B	CHANGED FROM 038-1600-00-0	CJ	7-24-97	MS

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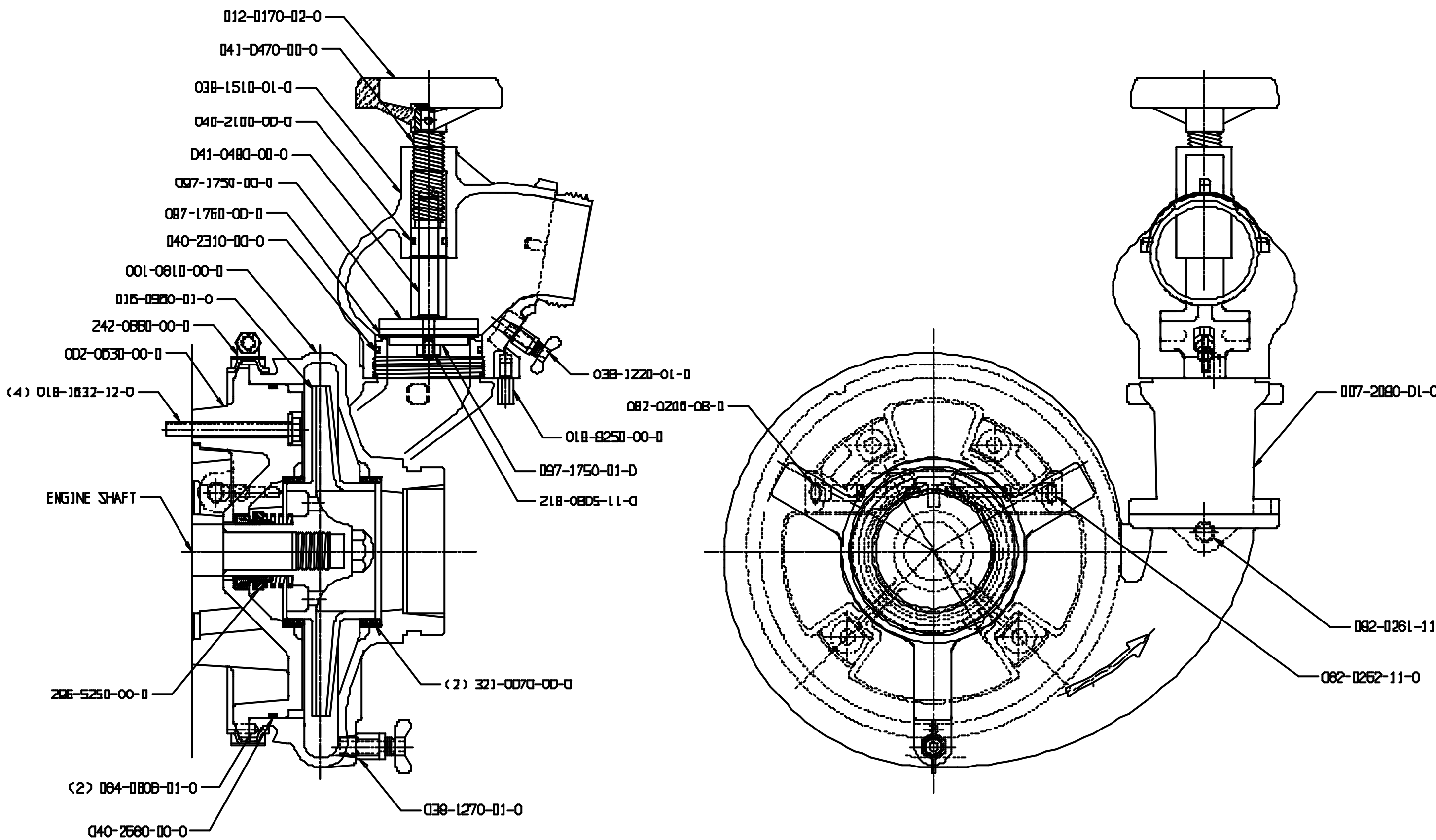
COPYRIGHT ©	DRAWN	FAS	DATE 11-29-95	SIZE B	SCALE: NONE
	CHECKED	MS			



HALE TYPE HP200 PORTABLE PUMP

PLATE NO. 774

ECO NO	REV	CHANGED FROM	BY	DATE	APVD
1N07-78	A	CORRECTED FROM 019-0880-00-0 CHANGED FROM 038-1510-00-0	CJ	1-24-07	MS

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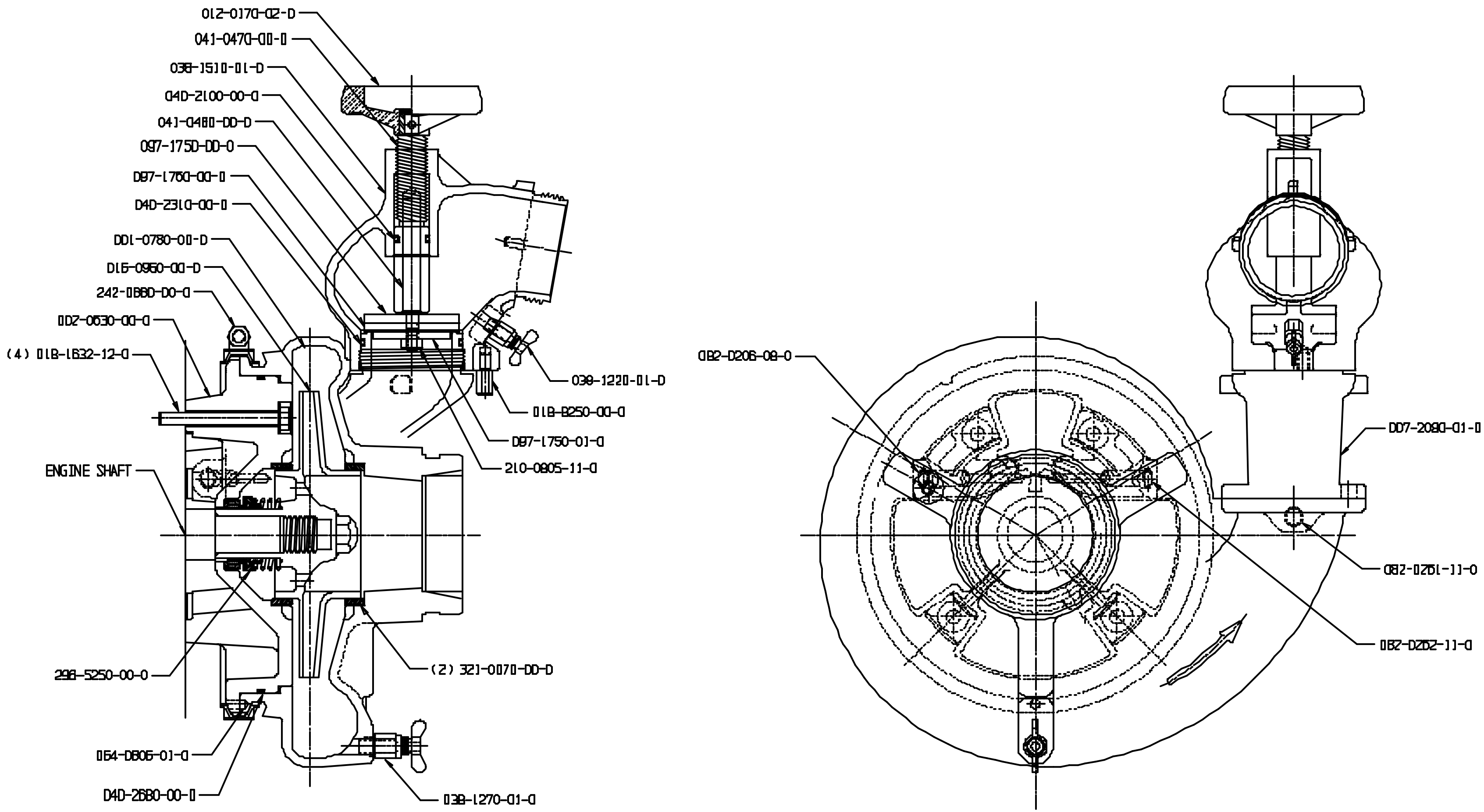
COPYRIGHT ©	DRAWN	FAS	DATE 11-20-03	SIZE A	SCALE: NONE
	CHECKED	MS			



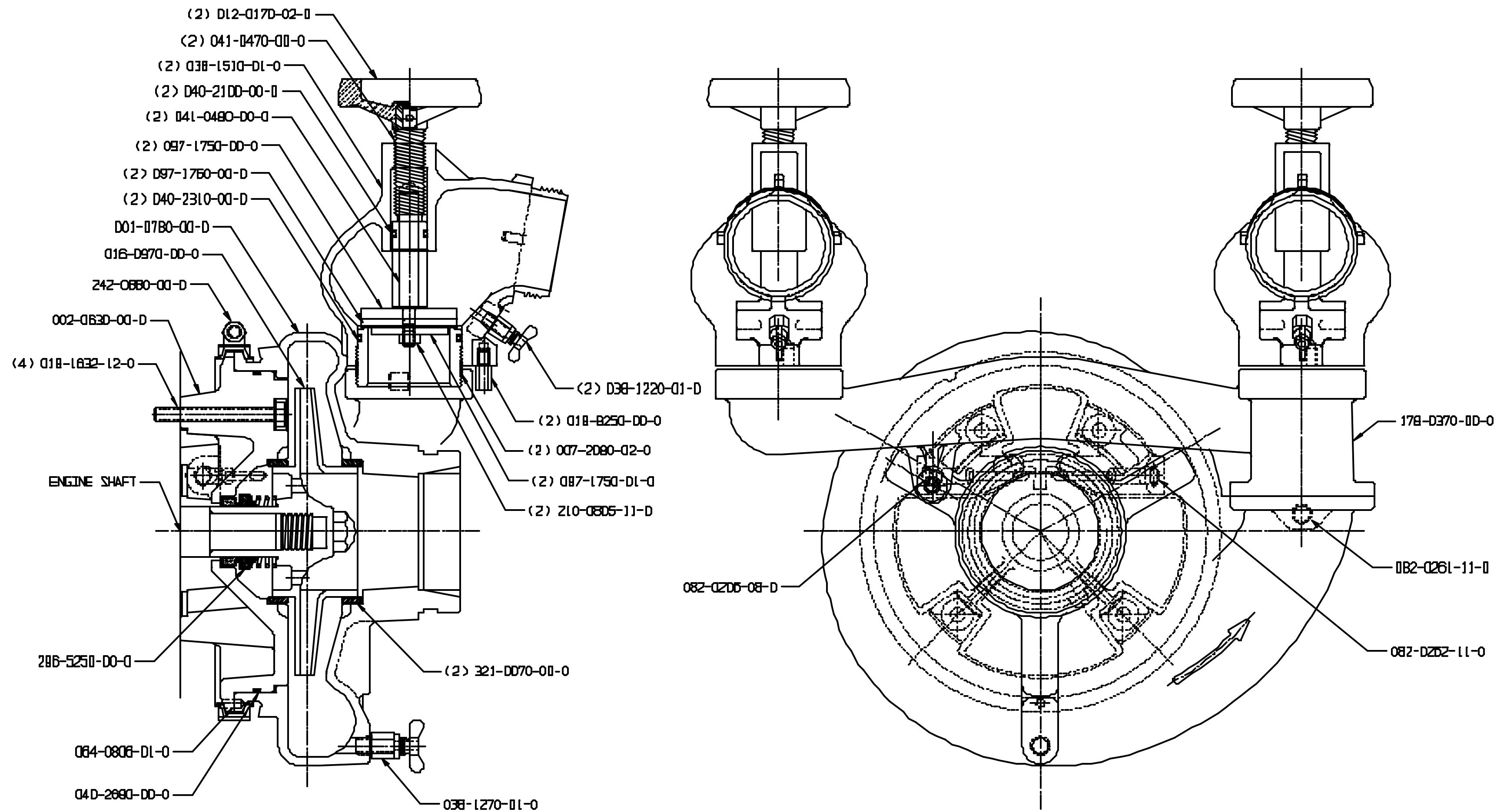
HALE TYPE HP300 PORTABLE PUMP

PLATE NO. 775

ECO NO	REV	CHANGED FROM	BY	DATE	APVD
T1197-78	A	CHANGED FROM D38-1510-00-0	CJ	7-24-97	MS

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

DRAWN FAS | CHECKED MS | DATE 11-20-88 | SIZE B | SCALE: NONE



HALE TYPE HP400 PORTABLE PUMP

PLATE NO. 776

ECO NO	REV	CHANGED FROM	BY	DATE	APVD
T097-78	A	CHANGES FROM [illegible]	CJ	7-24-97	MS

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

DRAWN FAS | CHECKED MS | DATE 7-24-97 | SIZE B | SCALE: NONE

MOBILE EQUIPMENT SALES CATALOG

Manuals

s

HALE

Class 1

1/8/04

HP SERIES
PORTABLE PUMPS
USER OPERATION AND MAINTENANCE MANUAL

Pump
Serial
Number ______________________

WARNING Failure to follow the operating, lubrication, and maintenance requirements set forth in this operating and maintenance 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. ● *A Unit of IDEX Corporation* ● *700 Spring Mill Avenue* ● *Conshohocken, PA 19428* ● *TEL: 610-825-6300* ● *FAX: 610-825-6440*

Class 1 ● ***607 NW 27th Avenue*** ● ***Ocala FL 34475 USA*** ● ***Tel: 352-629-5020 800-533-3569*** ● ***Fax: 352-629-2902*** ● ***www.class1.com***

MANUAL P/N 029-0020-24-0, REV E, © 2004 HALE PRODUCTS, INC., PRINTED IN U.S.A.

IDEX CORPORATION

Table of Contents

1 SAFETY

THIS SYMBOL ⚠ MEANS WARNING PERSONAL INJURY MAY OCCUR UNLESS INSTRUCTIONS ARE FOLLOWED CAREFULLY.

⚠ **WARNING**

1. **DO NOT** run engine in an enclosed area. Exhaust gases contain carbon monoxide, an odorless and deadly poison.

2. **DO NOT** check for spark with spark plug or spark plug wire removed. Use an approved tester.

3. **DO NOT** crank engine with spark plug removed. If engine is flooded, place throttle in FAST ( ) position and crank until engine starts.

4. **DO NOT** smoke when filling fuel tank.

5. **DO NOT** fill fuel tank while engine is running. Allow engine to cool for two minutes before refueling.

6. **DO NOT** operate engine when an odor of gasoline is present or other explosive conditions exist

7. **DO NOT** operate engine if gasoline is spilled. Move pump away from the spill and avoid creating any ignition until the gasoline has evaporated.

8. **DO NOT STORE, SPILL, OR USE GASOLINE NEAR AN OPEN FLAME,** or devices such as a stove, furnace, or water heater which utilize a pilot light or devices which can create a spark.

9. **DO NOT** refuel indoors where area is not well ventilated. Outdoor refueling is preferred.

10. Engine produces excessive noise. When pump is operating persons in the immediate vicinity must wear hearing protection.

11. **DO NOT OPERATE ENGINE WITHOUT A MUFFLER**. Inspect periodically and replace if necessary.

12. **DO NOT** operate engine with an accumulation of grass, leaves, dirt or other combustible material in the muffler area.

13. **DO NOT** run engine with air cleaner or air cleaner cover removed.

14. Automatic flow nozzles and tips are designed to work with a minimum

pressure of 7 BAR (100 PSIG). Under normal operation conditions these pumps may not provide the required pressure to use these nozzles properly. When selecting a pump and nozzle combination consideration must also be given to hose lengths and normal friction losses.

15. **TO PREVENT ACCIDENTAL STARTING** when servicing the engine or pump always disconnect the negative wire from battery terminal.

CAUTION

1. Engine is shipped without oil in the crankcase. Before placing pump into operation for the first time fill engine to proper level with SAE 30 Weight Detergent oil.

2. HP100 gearbox is shipped without oil. Before placing pump into operation for the first time fill gearbox to proper level with SAE 30 Weight Detergent oil.

3. **DO NOT** tamper with governor springs, governor links or other parts which may increase the governed engine speed.

4. **DO NOT** tamper with the engine speed selected by the original equipment manufacturer.

5. **DO NOT** touch hot mufflers, cylinders, or fins as contact may cause burns.

6. **DO NOT** place hands or feet near moving or rotating parts.

7. **DO** keep cylinder fins free of debris as this can affect engine speed.

8. Pull starter cord slowly until resistance is felt. Then pull cord rapidly to avoid kickback and prevent hand or arm injury.

9. The pump and motor assembly are vibration isolated. When making the permanent connections to the suction and discharge fittings DO NOT use hard piping. A short length of flexible piping is required to prevent damage to the pump and engine.

10. Always connect the black wire to the negative battery terminal last.

11. The pump and motor assembly are vibration isolated. When making the permanent connections to the suction and discharge fittings DO NOT use hard piping. A short length of flexible piping is required to prevent damage to the pump and engine.

12. Do not run pump for more than 45 seconds without suction established.

13. Petroleum solvents, such as kerosene, are not to be used to clean cartridge. They may cause deterioration of the cartridge. DO NOT OIL CARTRIDGE. DO NOT USE PRESSURIZED AIR TO CLEAN OR DRY CARTRIDGE.

14. For proper engine operation, keep controls and linkages clean and free of debris.

15. Periodically clean muffler area to remove all grass, paper, leaves, dirt or other combustible debris.

16. Sparking can occur if wire terminal does not fit firmly on spark plug. Reform terminal if necessary.

17. Exhaust system components may smoke during the initial break-in period. This smoking will stop after the pump is run several times.

2 EQUIPMENT DESCRIPTION

The HP Series Portable Pump line provides emergency services personnel around the world with portable pumps to fulfill many types of in-service applications. The pumps are available in configurations providing a wide range of pressures and flows to suit user requirements in a lightweight portable unit.

The pumps are available as four separate models, the Model HP100 Attack Pump, Model HP200 Combination Pump, Model HP300 Supply Pump and Model HP400 Transfer Pump. The HP100 Attack Pump Is rated to supply water at flows and pressures that are suitable for extinguishing fires. The HP200 Combination Pump is a dual purpose pump that provides the capability to attack fires and/or supply water from an emergency water source. The HP300 Supply Pump is used to supply water from an emergency water source. The HP400 Transfer Pump is a high volume pump that is suitable for transferring large volumes of water at low pressures.

A standard feature of each pump configuration includes pump ends made of strong corrosion resistant aluminum alloy held together with a stainless steel clamp. The pump engine is air cooled and the portable models are enclosed with high strength thermoplastic covers that ensure a clean appearance and quiet operation. The aluminum parts of the discharge valves are treated with a hard anodizing process to increase corrosion resistance and durability. The molded plastic fuel tank is an integral part of the pump base therefore there is only one item to carry, other than the required suction and discharge hoses, when the pump is to be placed into service. An aluminum skid plate on the bottom of the pump assembly provides extra puncture protection for the fuel tank.

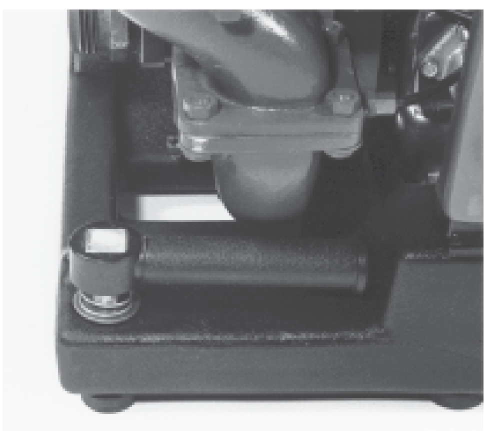
In addition to the standard portable HP series pumps an "X" model, without the plastic covers, carrying handles or sub-frame, is available that can be permanently mounted to the apparatus frame.

Also available is the "I" model, which has no plastic covers or subframe. The pump and engine are mounted to a steel skid base which can easily be fitted to optional carrying handles. The pump can also be permanently mounted and comes complete with a remote 3 gal (12 liter) fuel tank.

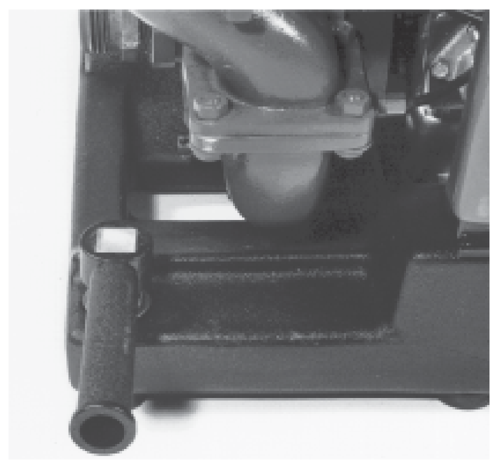
Each pump is powered by a reliable state-of-the-art air cooled, 18 HP, V-twin, Overhead Valve (OHV) engine. The engine has electric start with a recoil backup to ensure starting under all circumstances. The integral fuel tank provides 12 liters (3 gallons) of fuel and will permit the pump to run for 2 hours at rated performance conditions, but under many operating conditions longer run times can be obtained.

Each portable pump is equipped with four folding handles. Other than the stowed position there are two other positions of the handles to provide for increased mobility by two people when moving the pump. When not in use the handles fold away to provide a sleek appearance and prevent equipment or personnel from getting caught on them. Also when the handles are folded the pump is more compact and will fit in a smaller storage compartment.

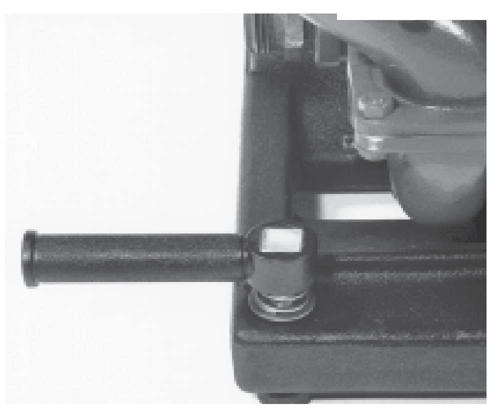
The discharge valve on the portable pump version swivels through 175° for



FOLDED FOR STORAGE



EXTENDED TO SIDE



EXTENDED TO END

PORTABLE PUMP HANDLE POSITIONS

ease of discharge hose connection. The unique valve permits the discharge to be directed in any direction without disturbing the position of the pump. The valve is a self checking type that automatically closes to form a positive seal when priming the pump.

Each portable pump is provided with a marine grade quick connect electrical socket. This socket is used to power the optional light mast for night time operations. The same electrical socket can also be used to connect a trickle charger to ensure the battery is charged and the pump is always in a ready state.

The HP series pump line has been designed to meet stringent requirements. The curves that follow are the expected performance that can be obtained from that specific pump model. All the tests were conducted at sea level.

NOTICE

Performance of HP Series pumps meets or exceeds NFPA1921 requirements. For complete NFPA1921 compliance, the pumping units must be marked with specific labels. Consult factory if these labels are required.

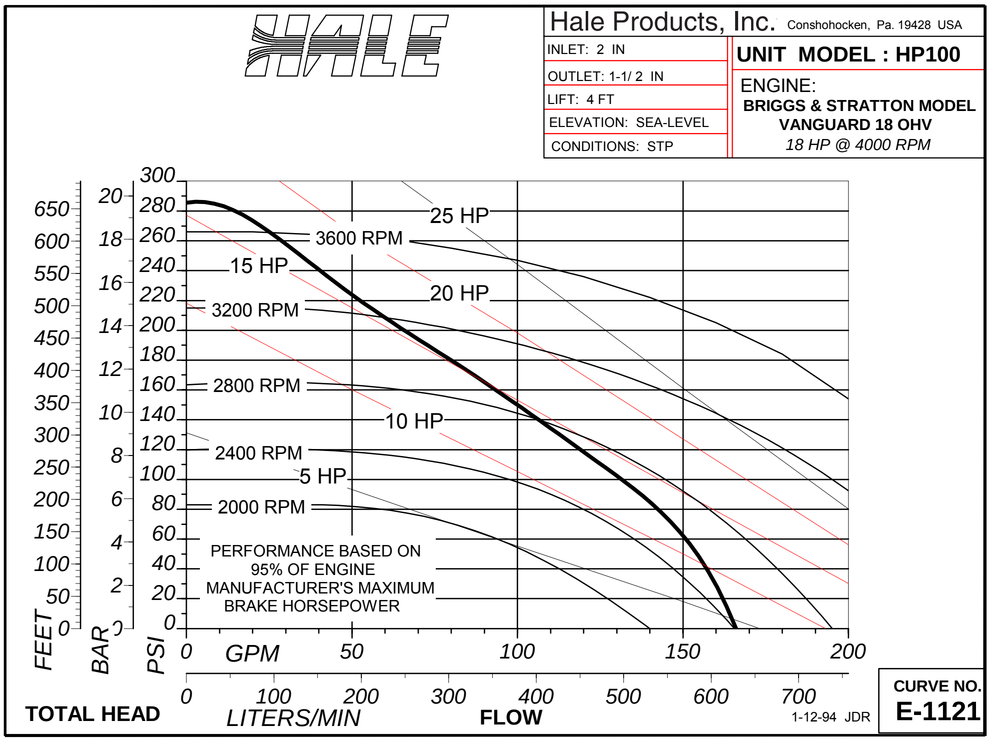
EQUIPMENT SPECIFICATIONS

ENGINE:

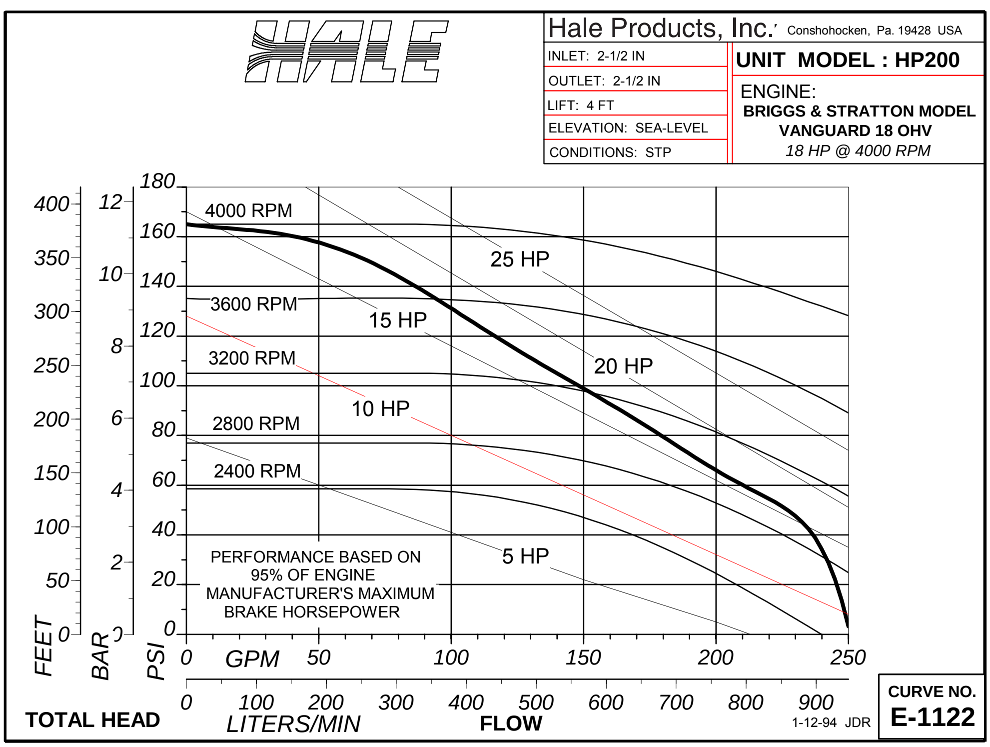
MAKE: BRIGGS AND STRATTON VANGUARD™
MODEL: 350447 Series
TYPE: Horizontal Shaft, Air Cooled, V-Twin, OHV
HORSEPOWER: 18 BHP (13.4 kW) at 4000 RPM
TORQUE: 40.7 N-m (30 ft-lb) Max. at 2600 RPM
BORE x STROKE: 72 x 77 mm (2.83 x 2.75 in)
DISPLACEMENT: 570 cc (34.75 cu in)
OIL CAPACITY: 1.4 liter (3.0 pint)
FUEL TANK: Cross linked Polyethylene
FUEL CAPACITY: 12 liters (3 gallons)
ELECTRICAL: 16 AMP Alternator
EMISSIONS: Meets 1994 California Air Resources Board (CARB) Standards

The serial number of each pump assembly is located on a tag attached to the engine shroud near the recoil starter pull handle. The following figure shows the serial number tag.

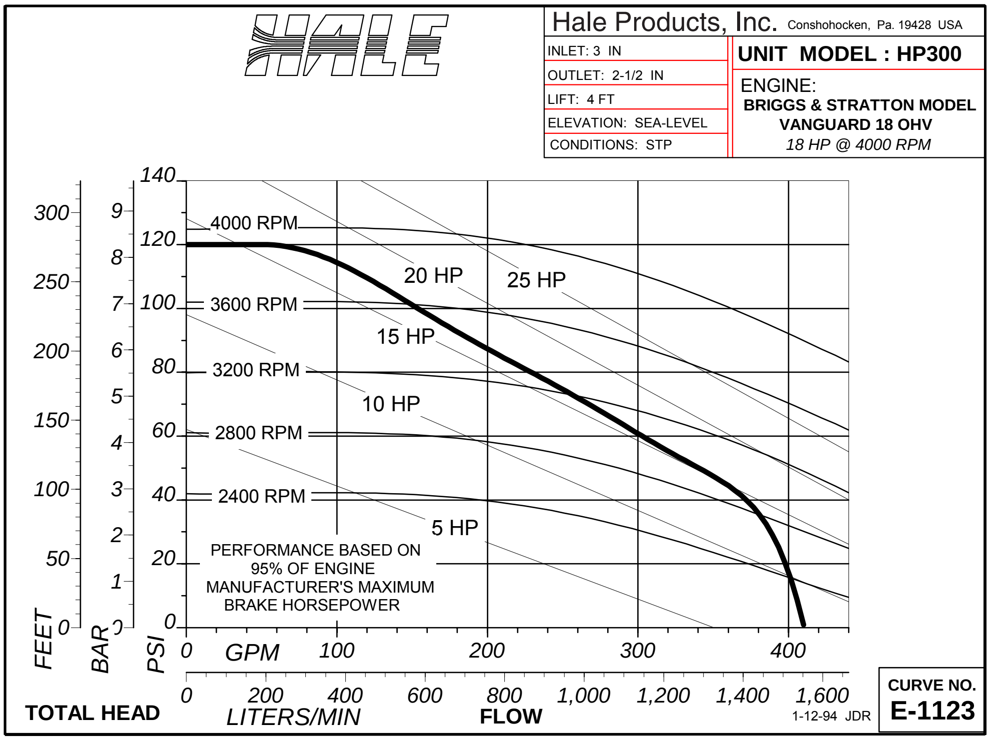
PUMP IDENTIFICATION TAG



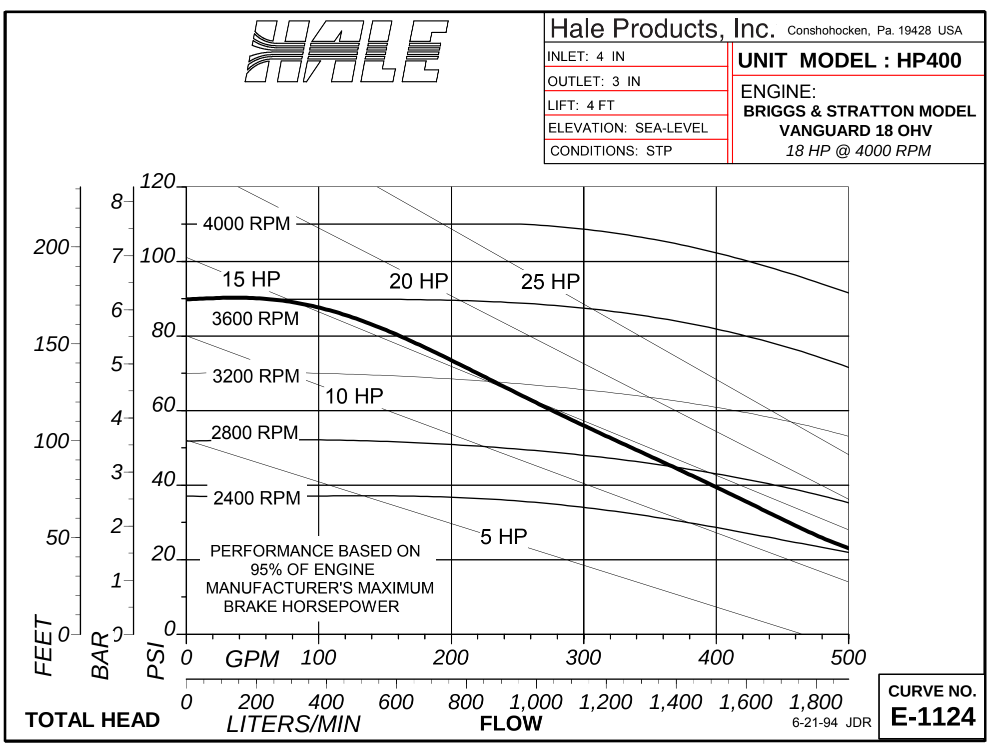
HP100 SERIES PERFORMANCE CURVE



HP200 SERIES PERFORMANCE CURVE



HP300 SERIES PERFORMANCE CURVE



HP400 SERIES PERFORMANCE CURVE

PUMP MODEL	100	200	300	400
TYPE	ATTACK	COMBINATION	SUPPLY	TRANSFER
SUCTION CONNECTION (Note 1)	2 inch NPT Female	3 inch NPT Female (4 inch Victaulic)	3 inch NPT Female (4 inch Victaulic)	3 inch NPT Female (4 inch Victaulic)
DISCHARGE CONNECTION (Note 1)				
HP PORTABLE	2 in. ISO Female	2-1/2 in. ISO Female	2-1/2 in. ISO Female	2-1/2 in.ISO Female
HP "X" SERIES	1-1/2 in. NPT Female	2-1/2 in. NPT Female (Hale 115 Flange)	3 in. NPT Female (Hale 115 Flange)	3 in. NPT Female (Hale 115 Flange)
BODY	ALUMINUM	ALUMINUM	ALUMINUM	ALUMINUM
IMPELLER				
MATERIAL	SILICON BRONZE	SILICON BRONZE	SILICON BRONZE	SILICON BRONZE
DIAMETER	123.83 mm (4.875 in.)	222.25 mm (8.75 in.)	203.20 mm (8.00 in.)	184.15 mm (7.25 in.)
SHAFT	STAINLESS STEEL	ENGINE SHAFT WITH BRONZE SLEEVE	ENGINE SHAFT WITH BRONZE SLEEVE	ENGINE SHAFT WITH BRONZE SLEEVE
BEARING	BALL	N/A	N/A	N/A
PRIMING	EXHAUST VENTURI	EXHAUST VENTURI	EXHAUST VENTURI	EXHAUST VENTURI
MAXIMUM FLOW AT RATED PRESSURE	568LPM @ 3.5BAR 150 GPM @ 50 PSI	852LPM @ 3.5BAR 225 GPM @ 50 PSI	1514LPM @1.4BAR 400 GPM @ 20 PSI	1893LPM @ 1.4BAR 500 GPM @ 20 PSI
MAXIMUM PRESSURE, BAR (PSI)	20 BAR (290 PSI)	11 BAR (165 PSI)	8 BAR (120 PSI)	6 BAR (90 PSI)
"X" SERIES				
LENGTH	635 mm (25 in.)	635 mm (25 in.)	635 mm (25 in.)	635 mm (25 in.)
WIDTH	438 mm (17-1/4 in.)	438 mm (17-1/4 in.)	438 mm (17-1/4 in.)	438 mm (17-1/4 in.)
HEIGHT	543 mm (21-1/4 in.)	543 mm (21-1/4 in.)	543 mm (21-1/4 in.)	543 mm (21-1/4 in.)
WEIGHT	75 kg (165 Lbs)	66 kg (146 Lbs)	67 kg (148 Lbs)	67 kg (148 Lbs)
PORTABLE SERIES				
LENGTH				
Handles Extended	892 mm (35-1/8 in.)	892 mm (35-1/8 in.)	892 mm (35-1/8 in.)	892 mm (35-1/8 in.)
Handles Folded	635 mm (25 in.)	635 mm (25 in.)	635 mm (25 in.)	635 mm (25 in.)
WIDTH				
Handles Extended	698.5 mm (27-1/2 in.)	698.5 mm (27-1/2 in.)	698.5 mm (27-1/2 in.)	698.5 mm (27-1/2 in.)
Handles Folded	498.5 mm (19-5/8 in.)	498.5 mm (19-5/8 in.)	498.5 mm (19-5/8 in.)	498.5 mm (19-5/8 in.)
HEIGHT	587 mm (23-1/8 in.)	587 mm (23-1/8 in.)	587 mm (23-1/8 in.)	587 mm (23-1/8 in.)
WEIGHT	88 Kg (194 Lbs)	80 Kg (176 Lbs)	80 Kg (176 Lbs)	84 Kg (185 Lbs)

Note 1: Standard threads machined into the pump body and valve for the particular model. When ordering pump specify suction and discharge adapter required for specific needs. With the exception of Storz adapters, the adapters will be factory installed prior to pump delivery

3 OPERATING CONTROL DESCRIPTION

Most of the controls and indicators necessary for the operation of the pump are located on the operator panel.
The pump operator should become thoroughly familiar with the location and function of all pump controls and indicators before attempting operation of the pump.
The "I" version uses engine mounted controls that are explained in the enclosed Briggs and Stratton engine manual.
The controls and indicators along with their functions are as follows:

1. **THROTTLE LEVER:** The throttle lever is located on the left side of the instrument panel and controls the speed at which the pump operates to obtain the required flow. The lever is a slide type "T"-handle that is infinitely adjustable from SLOW ( ) to FAST ( ).

OPERATING PANEL

2. **MASTER SWITCH:** The Master switch is located below the start button and is used to close the electrical circuits on the pump to enable operation. This is a rocker type switch which when the (❍) side is depressed energizes the electrical system to enable pump operation. When the (—)side is depressed the electrical system is disconnected and the pump stops.

3. **START BUTTON ( ):** The start button is located to the right of the throttle lever and is used to start the engine. Depressing the button after the master switch is placed in the on (—) position will engage the electric starter on the pump engine. After the button is released the button will return to the normal position to disengage the starter.

4. **PRIMING LEVER ( ):** The Priming Lever is a "T" type handle located to the right of the start switch and master switch and is used to engage the exhaust primer when the pump is started. Pulling the "T" handle down will engage the primer. Due to spring force

the handle must be held in the down position until the pump is primed. Once the pump is primed and pressure is showing on the discharge pressure gauge the "T" handle is released and returns to the up position by spring force for normal pump operation.
The base "I" version uses a knob (located above the throttle control) which is pulled to engage the primer.

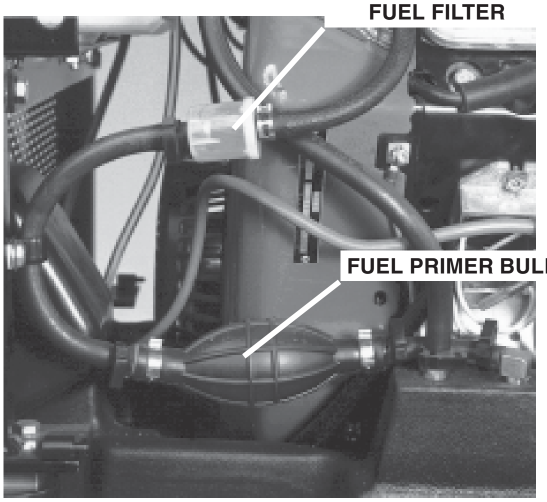
5. **SUCTION GAUGE:** The suction gauge is located in the center of the instrument panel and provides the operator with an indication of the water pressure on the suction side of the pump. The suction gauge is a compound gauge that reads from -1 to 10 BAR (30 in. Hg vac to 150 PSIG).

6. **LOW OIL PRESSURE LIGHT ( ):** The low oil pressure light is located to the right of the discharge gauge and is connected to the oil pressure switch located on the oil filter adapter. When the master switch is first energized the low oil pressure light will light to indicate the pump power is on. After the pump starts and oil pressure builds up the light will go out to indicate there is sufficient oil pressure in the engine. The engine is equipped with an oil pressure switch that activates the low oil pressure light when pressure drops to 0.2-0.4 kg/cm^2 (4-6 PSIG). If the light should light during normal operation the operator must shutdown the engine immediately to avoid engine damage.

7. **CHOKE CONTROL ( ):** The choke control is located below the oil light and is used to control the air fuel mixture in the carburetor when starting the engine. Pulling the choke control out will engage the choke. After the pump starts pushing in on the choke control will gradually disengage the choke and allow normal operation.

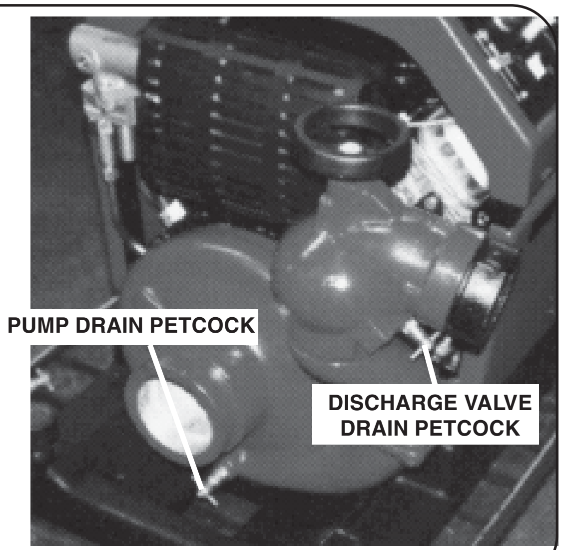
8. **DISCHARGE GAUGE:** The discharge gauge is located to the right of the priming lever and provides the operator with an indication of the pump discharge pressure. The gauge reads from 0 to 28 BAR (0 to 400 PSIG).

9. **FUEL PRIMER:** The fuel primer is located on the back side of the pump engine behind the protective cover of the HP series pumps. The fuel system requires priming only when starting the pump after fuel is put into the tank initially or if the pump has run out of fuel. Priming is accomplished by squeezing the fuel primer bulb until firm.



10. **RECOIL STARTER:** The recoil starter is located on the engine behind the protective grill. To gain access to the recoil starter the pump panel below the instrument panel must be opened on the portable models.

11. **PUMP DRAIN:** The pump drain is a petcock type valve located below the suction connection of the pump at the lowest point of the pump volute. This valve is used to drain all water from the pump after use and prior to storage.

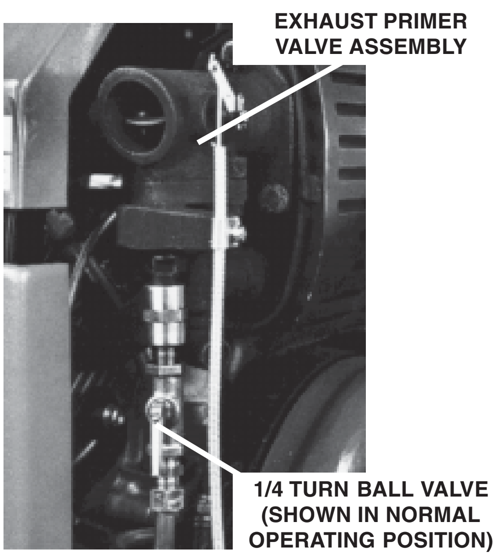


12. **DISCHARGE VALVE DRAIN:** The discharge valve drain is a petcock type valve located below the outlet of the discharge valve. This valve is used to relieve the pressure in the discharge hose before disconnecting the hose.

13. **LIGHT AND CHARGING SOCKET:** An optional marine grade light and charging socket is located on the top cover of the HP series portable pumps. This socket has a waterproof plug type cover that is removed to enable use of the optional light mast (Hale P/N 200-2100-02-0). The socket is also used to plug in the optional trickle charger (Hale P/N 200-0750-01-0) to maintain the charge on the pump's 12 volt battery.

14. **EXHAUST PRIMER ASSEMBLY:** The exhaust primer assembly is located on the outlet of the muffler. Located on the exhaust primer assembly is a 1/4 turn valve. Under normal operation conditions, when the pump is being operated from draft, the handle on the 1/4 turn valve will be in the open position (in-line with the tubing). When the pump is being

operated with a positive pressure source the valve must be closed to prevent water from being blown out of the exhaust pipe.



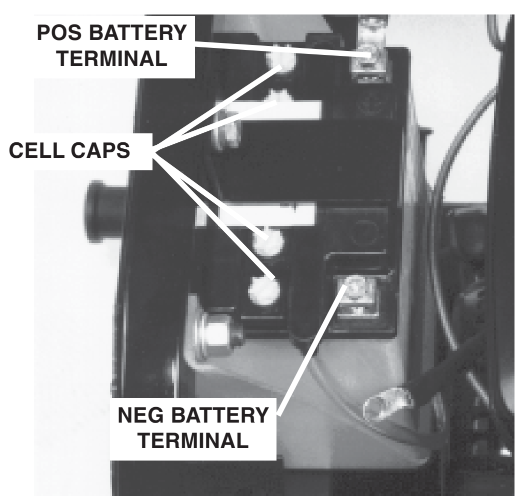
EXHAUST PRIMER ASSEMBLY

4 INITIAL CHECKOUT PROCEDURES

Upon receipt of the pump from the factory remove the pump and all accessories from the shipping container and check for damage. Note the serial number of the pump located on the engine air shroud near the recoil starter pull handle. Record this number on the warranty registration card located at the back of this manual and return warranty registration.

PORTABLE PUMP BATTERY ACTIVATION

After unpacking all pump components open the top cover on the pump and remove the battery from its holder. The battery is a dry charged battery and is shipped dry. Remove the covers from each cell of the battery and fill each cell with electrolyte. Replace the covers on each cell and tighten. Return the battery to its holder and clamp in place.



PORTABLE PUMP BATTERY

CAUTION: Always connect the black wire to the negative battery terminal last.

Connect the red cable to the positive (+) terminal and connect the black cable to the negative (-) terminal. Make sure that the plastic overflow tube on the battery is directed down to the lowest point of the pump.

"X" SERIES PUMP INSTALLATION

1. After unpacking all pump components remove the mounting bolts and shock absorbing feet from the four corners of the pump. Retain these bolts and feet for securing the pump during installation.

2. To assist in pump mounting a mounting dimension drawing is included at the back of this manual. Mark location of the mounting holes in accordance with this drawing.

3. Drill 9.5 mm (3/8 inch) diameter holes at the four corners of the pump to insert the bolts to hold the pump in place. Place pump at proper location on the apparatus making sure the shock absorbing feet are under each corner.

Insert the bolts and secure in place with lockwashers and nuts provided.

4. When the pump is mounted and if access is not provided to fill the fuel tank install optional fill tube and vent extension as required.

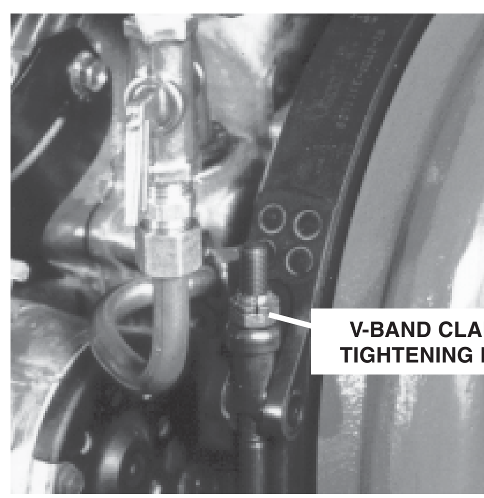
> **NOTE:** The fuel tank on the HP series pump is already vented, therefore a vented fuel cap is not required

5. Locate and install the instrument panel on the apparatus. A dimensional drawing is provided of the instrument panel to locate the mounting holes. (NOTE: Approximately 2 meters (6 feet) of wire and control cables is provided with the pump. When locating the instrument panel the installer must take this into account.) Make electrical connection from the instrument panel to the pump with the jumper wires provided.

6. Connect throttle lever and choke control to the engine. Secure in place with the clamps provided. After the connections are made ensure the controls work smoothly. There may be excess cable after the connections are made. Make a loose coil of the cable and secure in place with wire ties.

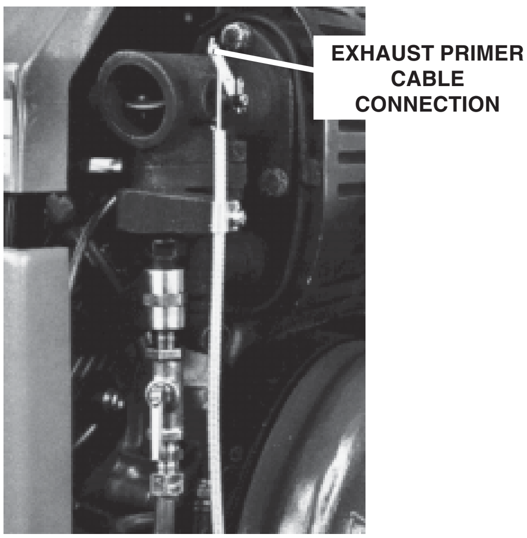
> **CAUTION:** The pump and motor assembly are vibration isolated. When making the permanent connections to the suction and discharge fittings DO NOT use hard piping. A short length of flexible piping is required to prevent damage to the pump and engine.

7. Make piping connections to the discharge flange as required. When making the piping connections it may be necessary to turn the pump volute for proper alignment. To turn the pump volute:
   a. Loosen and remove the "V"-band clamp using a 1/2 inch or 13 mm deep well socket.
   b. Remove the volute from the pump body.
   c. Locate and remove the positioning roll pin from the pump body.
   d. Return the volute to the pump body and install "V"-band clamp.
   e. Turn the volute as necessary when



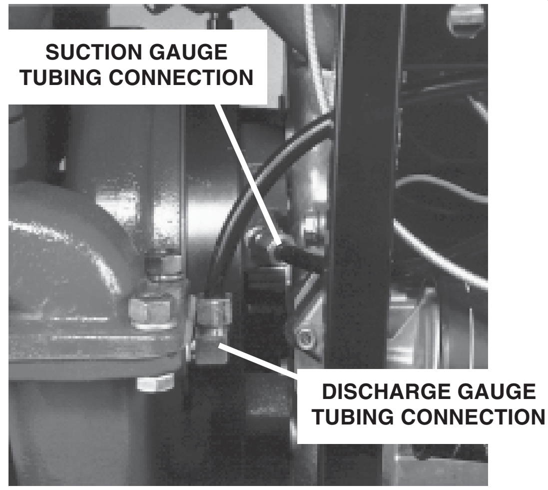
making discharge piping connection.
f. After the discharge connection is complete tighten the "V"-band clamp to prevent leakage.

8. Connect the exhaust priming lever cable to the exhaust primer.



9. Connect tubing for the suction and discharge gauges. Use the 1/4 inch diameter tubing provided with the pump for gauge connections. If a longer length of tubing is required use 1/4 inch diameter tubing rated at the maximum operating pressure of the pump. Connections to the gauges and pump are compression type. Make sure the gauge lines are connected to the proper connection on the pump body.

10. Make piping connection to the



suction fitting as required. When making this connection ensure there are a minimum of restrictions such as elbows and couplings. Also, to protect the pump from debris a strainer shall be installed in the suction connection.

> **CAUTION:** Always connect the black wire to the negative battery terminal last.

11. Connect the pump electrical system to a 12 volt battery to provide power to start the pump. Always connect the positive battery cable first.

> **NOTE:** The pump may be connected to the apparatus battery or a separate battery may be used.

INITIAL OPERATION CHECKOUT

After activating the battery on the portable pump, or installing the "X" series pump, prior to placing the pump into operation the following items must be checked.

WARNING: DO NOT smoke when filling fuel tank.

WARNING: DO NOT fill fuel tank while engine is running. Allow engine to cool for two minutes before refueling.

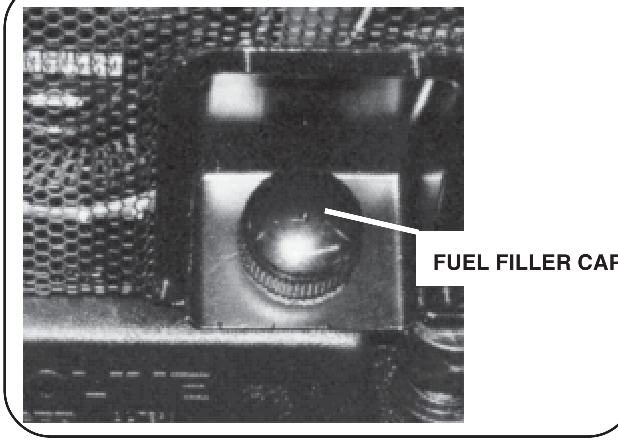
WARNING: DO NOT operate engine when an odor of gasoline is present or other explosive conditions exist

WARNING: DO NOT STORE, SPILL, OR USE GASOLINE NEAR AN OPEN FLAME, or devices such as a stove, furnace, or water heater which utilize a pilot light or devices which can create a spark.

WARNING: DO NOT refuel indoors where area is not well ventilated. Outdoor refueling is preferred.

1. **CHECK FUEL LEVEL:** Remove fuel filler cap to check fuel level. Fill tank as necessary and replace cap. DO NOT fill the fuel tank to the point of overflowing. The tank is designed to provide sufficient expansion space when the tank is full. When refilling the fuel tank ensure the pump is level to prevent overfilling or fuel being spilled on the ground.

FUEL RECOMMENDATIONS: Use clean, fresh, lead-free



gasoline. The engine will operate satisfactorily on any gasoline intended for automotive use. A minimum of 85 octane is recommended. **DO NOT MIX OIL WITH GASOLINE.** Leaded gasoline may be used if lead-free is not available.

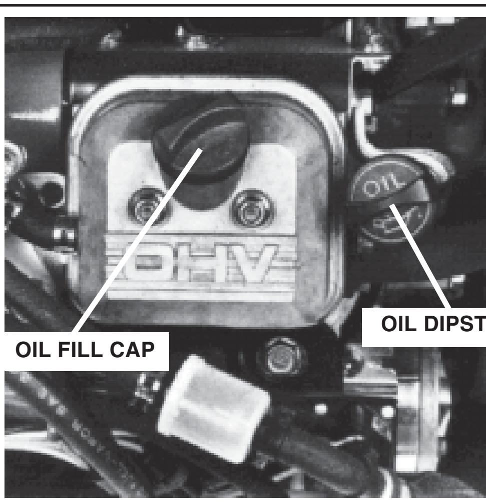
NOTE: The use of gasoline which contains alcohol, such as gasohol is not recommended. If gasoline with alcohol must be used, it MUST NOT contain more than 10 percent Methanol and MUST be removed from the engine during storage.

2. **PRIME FUEL SYSTEM:** When initially placing the pump into operation gain access to the fuel primer bulb, located behind the pump cover on the portable pump, and squeeze until firm. Replace cover after fuel system is primed.

CAUTION: The pump is shipped without oil in the engine crankcase. Before placing pump into operation for the first time fill engine crankcase to proper level with SAE 30 Weight Detergent oil.

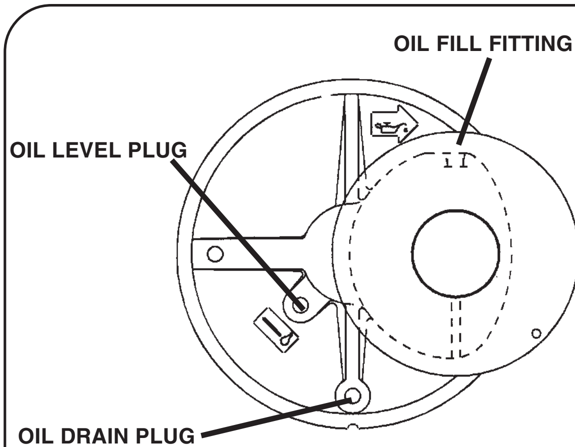
3. **FILL ENGINE WITH OIL:** When received the engine crankcase doesnot contain oil. Remove oil dipstick or cap on valve cover and fill with 3.5 pints of SAE 30 Oil. Check oil level by removing the oil dipstick and wiping oil from dipstick with clean cloth. Screw dipstick firmly into place until cap bottoms on tube. Remove to check oil level. If necessary add additional oil to bring oil up to the proper level. Dipstick assembly must be firmly assembled into tube when engine is operating .

CAUTION: The HP100 is shipped without oil in the gearbox. Before placing pump into operation for the first time fill gearbox to proper level with SAE 30 Weight Detergent oil.



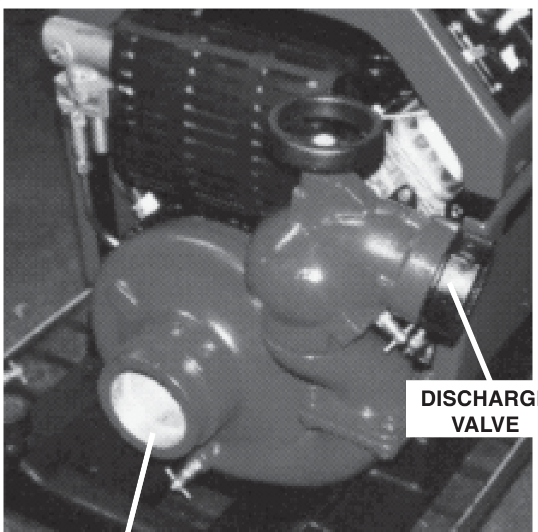
4. **FILL HP100 GEAR BOX WITH OIL:** The HP100 is shipped without oil in the gear box. Add oil to proper level in accordance with procedures listed in section 8. Replace oil level plug.

5. **CONNECT SUCTION HOSE:** Ensure the hose connections are tightened with a spanner and a strainer is placed at the end of the hose to prevent debris from entering the pump and causing irreparable damage. Place end of suction hose in water source. Make sure the end of the suction hose does not become submerged in the mud or silt on the bottom. Also make sure the suction hose has no bends or loops that are higher than the suction connection of the pump that would trap air and prevent priming of the pump.



6. **CONNECT DISCHARGE HOSE:** After connecting discharge hose ensure the discharge valve is closed. Remove all kinks and sharp bends from the discharge hose.

7. **CLOSE PUMP DRAINS:** Make sure the pump and discharge valve drains are closed.



5 STARTING PROCEDURES

The following procedures will be followed to start the pump and establish water flow.

> **WARNING: DO NOT** run engine in an enclosed area. Exhaust gases contain carbon monoxide, an odorless and deadly poison.

> **WARNING:** Engine produces excessive noise. When pump is operating persons in the immediate vicinity must wear hearing protection.

1. **CLOSE VALVES:** Make sure all pump drains and discharge valves are closed

2. **SET THROTTLE LEVER:** Move throttle lever upward to fast ( ) position.

3. **CHOKE ENGINE:** Pull choke knob ( ) out fully to close choke on carburetor.

> **NOTE:** A warm engine requires less choking than a cold engine. When starting a warm engine little or no choke will be required.

4. **ENERGIZE ELECTRICAL SYSTEM:** Place Master Switch to the ON (—) position. Check to make sure oil light is lit. This indicates the battery is good and the pump is ready to start. If the oil light is not lit check the battery connections and ground connections. It may be necessary to start the pump using the recoil starter if the oil light does not light.

5. **START ENGINE:** Depress start push button ( ) and hold until engine starts. When engine starts, open choke gradually by pressing in on choke knob.

> **NOTE:** The best starter life is provided by using short starting cycles of several seconds. Prolonged cranking (more than 15 seconds per minute) can damage the starter motor. If the engine does not start in 15 seconds release starter button. Allow starter to cool two minutes.

If the engine does not start using the electric starter, the recoil starter must be used.

a. Open pump cover on instrument panel side of the pump if applicable.

b. Locate recoil starter handle and pull slowly until resistance is felt then pull rapidly to overcome compression, prevent kickback and start engine.

c. Once the engine starts open choke gradually by pressing in on choke knob.

For the "I" version, turn the key switch and release when the pump has started.

6. **PRIME PUMP:** Hold priming lever () down to prime the pump and establish suction. Monitor suction and discharge gauges to determine when suction is established. Once suction is established release the priming lever and make sure the lever returns to the up position.

> **CAUTION:** Do not run pump for more than 45 seconds without suction established.

> **NOTE:** When the pump is connected to a positive pressure source priming is not required. When using the pump with a positive pressure connected to the inlet ensure the 1/4 turn valve on the exhaust primer assembly is in the closed position prior to starting the pump.

7. **ESTABLISH DISCHARGE:** Once suction is established as indicated by the gauges, open the pump discharge valve by rotating handle counterclockwise.

8. **ADJUST THROTTLE:** Adjust throttle lever to obtain the desired discharge pressure on the discharge gauge.

> **CAUTION:** Exhaust system components may smoke during the initial break-in period. This smoking will stop after the pump is run several times.

COLD WEATHER STARTING HINTS

1. Be sure to use the proper oil for the temperature expected.

2. Set speed control at part-throttle position.

3. A warm battery has much more starting capacity than a cold battery.

4. Use fresh winter grade fuel.

> **NOTE:** Winter grade gasoline

6 SHUTDOWN AND STORAGE PROCEDURES

To enhance pump life the following procedures shall be used when shutting down the pump.

1. **SLOW ENGINE:** Move throttle lever to the slow ( ) position.

2. **SECURE DISCHARGE:** Close pump discharge valve by rotating handle clockwise.

3. **SECURE ELECTRICAL POWER:** Turn master switch to the off (⊙) position.

> **NOTE:** Do not choke carburetor to stop the engine. Fire may result if choke is used to stop engine.

Prior to placing the pump in storage after each use the following must be accomplished. This procedure is extremely important if the pump has been run in salt water or freezing conditions will be encountered.

1. **MAKE HOSE CONNECTIONS:** Connect suction hose and place end in a **CLEAN WATER** source. Then connect discharge hose and prepare to operate pump.

2. **ENERGIZE PUMP:** Start engine and establish water flow through pump.

3. **FLUSH PUMP:** Run pump for 2 minutes to ensure clean water has circulated through the pump.

4. **DE-ENERGIZE PUMP:** After water has circulated through the pump for 2 minutes turn the master switch to the off position.

5. **UNDO HOSE CONNECTIONS:** Disconnect suction hose and discharge hose. Drain hoses and place in proper storage area

6. **DRAIN PUMP:** Open drain valves and allow all water to drain from the pump body.

7. **CLOSE VALVES:** Once all water is drained from the pump close the discharge valve and drain valve.

8. **CHECK FLUID LEVELS:** Check oil level and fuel level and refill as necessary.

9. **CLEAN PUMP:** Clean any debris from the outside of the engine and pump.

Also, wipe the pump covers down with a clean damp cloth. If necessary use a mild soap and water solution to clean plastic covers.

10. **STORE PUMP:** Return pump to storage compartment and secure in place.

7 MAINTENANCE SCHEDULE

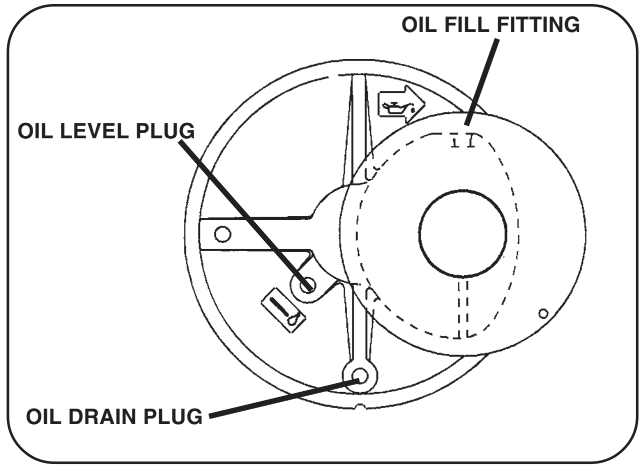
MAINTENANCE INTERVALS

To prolong pump life and ensure reliable operation the pump user shall perform the maintenance described in the following section on a regular basis. The table that follows provides a listing of the minimum maintenance intervals. Following the chart are detailed maintenance procedures.

MAINTENANCE OPERATION	Every 8 Hours or Daily	25 Hours or Weekly	50 Hours or Monthly	100 Hours or Yearly	Yearly
ENGINE MAINTENANCE					
Check Oil Level	●				
Change Oil † (NOTE 1)			●		
Change Oil Filter				●	
Clean Foam Air Cleaner Pre-Cleaner (NOTE 2)		●			
Service Air Cleaner Cartridge (NOTE 2)				●	
Clean Cooling System (NOTE 2)				●	
Clean Debris Gard (NOTE 2)	●				
Inspect Spark Arrester				●	
Replace In-Line Fuel Filter					●
Replace Spark Plug				●	
Check Valve Clearance					●
PUMP MAINTENANCE					
Check Oil Level (NOTE 3)	●				
Change Gear Oil (NOTE 3)			●		
Leak Test					●
† : Change oil after first 8 hours.					
NOTE 1: Change oil every 25 hours when operating under heavy load or in high ambient temperature.					
NOTE 2: Clean more often under dusty conditions or when airborne debris is present.					
NOTE 3: HP100 Model Pump Only.					

8 PUMP MAINTENANCE

The HP Series portable pumps are designed to provide years of reliable service with a minimum of maintenance on the pump end. The pump must be cleaned and flushed out after each use. Failure to clean and flush the pump may degrade pump performance. The only maintenance that is usually required on a regular basis is to hydrostatically test the pump each year.



LEAKTEST

A leak test of the pump must be performed each year. The leak test will be conducted at the pump working pressure.

> **WARNING: TO PREVENT ACCIDENTAL STARTING** when servicing the engine or pump always disconnect the negative wire from battery terminal.

CHECK OIL LEVEL (HP100 GEARBOX)

The HP100 pump has a gearbox that requires routine maintenance. The oil should be checked in the gearbox every eight hours of operation and after each use of the pump. The following procedures are used to check the oil level in the HP100 gearbox.

1. Place pump on a level work surface to gain access to the gearbox.

2. Locate the oil fill fitting, the oil level plug and the oil drain plug on the pump gearbox.

3. Loosen oil level plug with wrench and begin to remove slowly. If the oil is at the proper level there should be a slight trickle of oil from around the plug.

4. Replace plug and tighten. If oil needs refilling remove oil fill fitting, vent and oil level plug. Add new gear oil (SAE 30) through oil fill fitting until oil starts to flow from oil level plug. Replace and tighten oil level plug.

5. Replace oil fill fitting and vent.

6. Return pump to storage or operation.

CHANGE GEARBOX OIL (HP100)

The oil in the gearbox of the HP100 should be changed after every 50 hours of operation. The following procedures shall be used to change the gearbox oil.

1. Place pump on clean level work surface and gain access to the pump gearbox.

2. Place container under oil drain plug to catch waste oil.

3. Using a wrench remove oil drain plug.

NOTE: The oil may not flow freely from the gear case at first. To facilitate oil flow remove oil fill fitting.

4. Replace oil drain plug after all oil has drained from the gearbox.

NOTE: Dispose of waste oil in accordance with local ordinances.

5. Obtain proper grade of oil (SAE 30).

6. Remove oil level plug from gearbox.

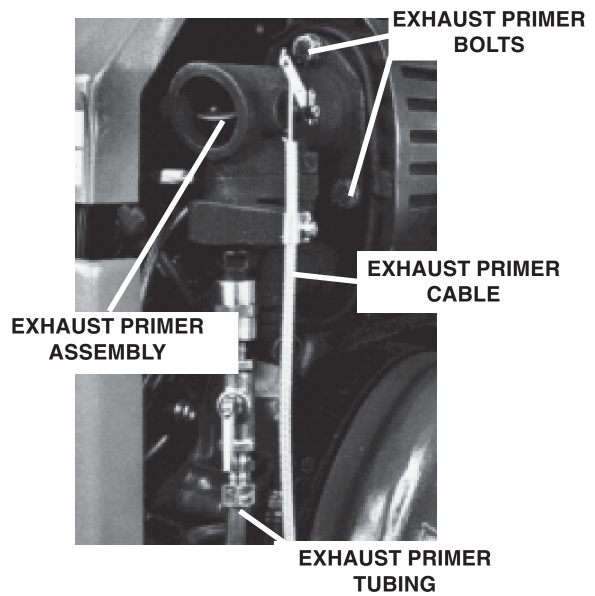
7. Place funnel in oil fill fitting and slowly pour oil into gearbox until oil starts to flow from the oil level hole.

8. Replace oil level plug, oil fill fitting and vent.

9. Return pump to storage or operation.

EXHAUST PRIMER MAINTENANCE

The exhaust primer should be cleaned after every 100 hours of operation or when priming of the pump appears sluggish. The following procedures shall be used to clean the exhaust primer.



WARNING: TO PREVENT ACCIDENTAL STARTING when servicing the engine or pump always disconnect the negative wire from battery terminal.

1. Place pump on clean work surface and gain access to the exhaust primer.

2. Disconnect Negative battery terminal to prevent accidental starting of the pump.

3. Unsnap and remove the muffler heat shield.

4. Disconnect cable from the actuating lever to the butterfly. Disconnect all tubing from the exhaust primer.

5. Remove hex head screws that hold the exhaust valve to the muffler. Remove the exhaust valve to a clean work surface.

6. Place exhaust valve assembly on bench with ejector body facing up. Remove hex head screws and separate the ejector body from the exhaust valve body.

7. Remove check valve ball from ejector body.

8. Using wire brush and tip cleaners carefully remove carbon from ejector nozzle and check valve assembly.

9. Insert check valve ball into ejector body. Using a new gasket (P/N 046-0850-01-0) assemble ejector body to exhaust valve body using hex head screws.

10. Install exhaust valve assembly to the muffler using new gasket (P/N 046-6240-01-0) and hex head screws.

11. Connect hoses and cables that were disconnected back to the exhaust valve assembly.

12. Ensure priming lever on instrument panel moves freely after assembly. If lever does not move freely the conduit or cable may be dirty or damaged. Clean or replace as necessary.

13. Replace the heat shield on the muffler and snap in place.

14. Reconnect the negative battery terminal.

15. Return pump to ready condition.

9 ENGINE MAINTENANCE

General Information
This is a twin cylinder, overhead valve, air cooled engine. All drilled/tapped holes and fasteners on this engine are ISO metric. however, where equipment attaches to engine, SAE standards apply.

WARNING: TO PREVENT ACCIDENTAL STARTING when servicing the engine or pump always disconnect the negative wire from battery terminal.

CHECK OIL LEVEL

The oil level should be checked after each 8 hours of operation. Use the following procedure to check the oil level:

1. Place pump on level surface.
2. On portable pump, undo latches and open top cover to gain access to dipstick.
3. Unscrew oil dipstick cap, remove oil dipstick and wipe oil from dipstick.
4. Screw dipstick firmly into place until cap bottoms on tube.
5. Unscrew oil dipstick cap, remove oil dipstick and check oil level. Proper oil level is when oil is visible on the dipstick end between the "ADD" and "FULL" marks.
6. Screw dipstick firmly into place until cap bottoms on tube. Cap must be tight while pump is operating.
7. Close pump cover and latch in place.

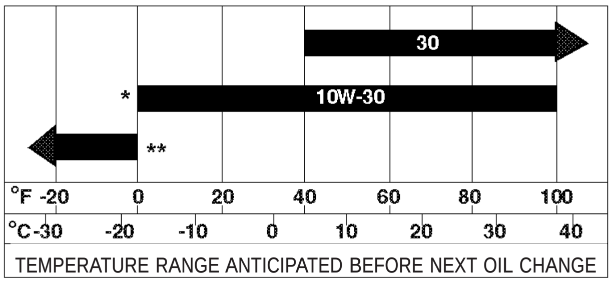
CHANGE OIL

Change oil after the first 8 hours of operation. Then, under normal operating conditions, change oil every 50 hours of operation or monthly, whichever occurs first.

NOTE: Oil should be changed every 25 hours of operation if the engine is operated under heavy load, or in high ambient temperatures.

When changing oil use a high quality SAE 10W-30 or SAE 30 weight detergent oil classified “For Service SC, SD, SE, SF or SG”. Detergent oils keep the engine cleaner and retard the formation of gum and varnish deposits. No special additives should be used with recommended oils. The following table provides the recommended viscosities of oil to use based on the anticipated operating temperature range.

RECOMMENDED SAE VISCOSITY GRADES



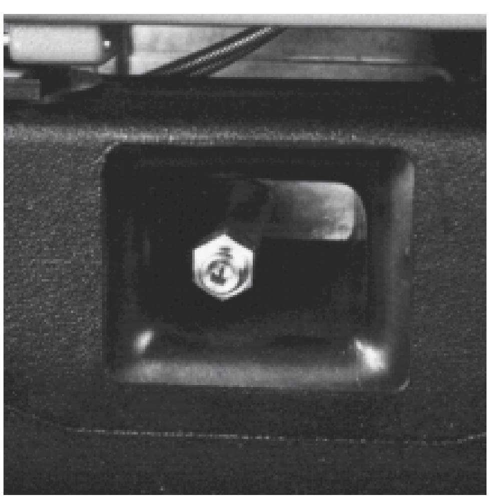
* 10W-40 oil may be used if 10W-30 is not available.

** Use synthetic oil having 5W-20, 5W-30 or 5W-40 viscosity. If not available, a petroleum based oil may be used having 5W-20 or 5W-30 viscosity.

Change oil using the following procedures:

1. Place the pump assembly in a work area where access can be made to the oil drain fitting. Ensure the pump is level. Disconnect Negative battery cable to prevent accidental starting of the pump.

2. Place container under oil drain fitting to catch waste oil as it drains from the pump.



OIL DRAIN FITTING

3. The oil drain fitting is a hex fitting with a pipe plug. Use adjustable wrench to hold hex fitting while removing the pipe plug with an allen wrench.

4. Once all oil is drained from the crankcase replace pipe plug in oil drain fitting and tighten with allen wrench.

NOTE: Dispose of waste oil in accordance with local ordinances.

5. Remove oil fill cap on valve cover or dipstick and place on a clean surface.

6. Using a funnel to prevent spills, refill crankcase with the proper grade of oil.

NOTE: The engine will require a minimum of 3 pints (1.4 liters) if the oil filter is not replaced and 3.5 pints (1.6 liters) if the oil filter is replaced.

7. Check oil level and replace dipstick or oil fill cap.

8. Reconnect negative battery cable. Start pump and run for 30 seconds. Shut down the pump and

check oil level. Refill crankcase as necessary.

9. Check area around pump for oil leaks.

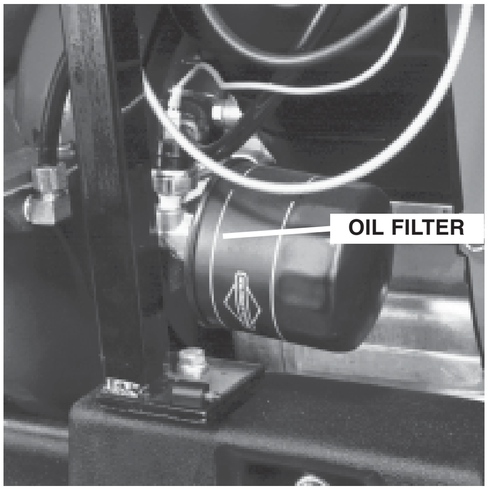
10. Return pump to storage area.

REPLACE OIL FILTER

The oil filter should be replaced after every 100 hours of pump usage or yearly.

WARNING: TO PREVENT ACCIDENTAL STARTING when servicing the engine or pump always disconnect the negative wire from battery terminal.

NOTE: The engine oil should be changed whenever the oil filter is replaced.



OIL FILTER ASSEMBLY

Replace the oil filter using the following procedures:

1. Place the pump assembly in a work area where access can be made to the oil drain fitting. Ensure the pump is level.

2. On portable pump unlatch and remove covers to gain access to engine. Disconnect the negative battery cable to prevent accidental starting.

3. Place container under oil drain fitting to catch waste oil as it drains from the pump.

4. The oil drain fitting is a hex fitting with a pipe plug. Use adjustable wrench to hold hex fitting while removing the pipe plug with an allen wrench.

5. Once all oil is drained from the crankcase replace pipe plug in oil drain fitting and tighten with allen wrench.

NOTE: Dispose of waste oil in accordance with local ordinances.

6. Using oil filter wrench remove and dispose of old oil filter.

NOTE: Before installing new filter, lightly oil filter gasket with fresh clean engine oil.

7. Oil the filter gasket and screw the new oil filter on by hand until gasket contacts filter adapter then tighten an additional 1/4 to 1/2 turn.

8. Remove oil fill cap on valve cover or oil dipstick and place on a clean surface.

9. Using a funnel to prevent spills, refill crankcase with the proper grade of oil.

NOTE: The engine will require a minimum of 3 pints (1.4 liters) if the oil filter is not replaced and 3.5 pints (1.6 liters) if the oil filter is replaced.

10. Check oil level and replace dipstick or oil fill cap.

11. Replace covers and remove pump from work area.

12. Reconnect the negative battery cable. Start pump and run for 30 seconds. Shut down the pump and check oil level. Refill crankcase as necessary.

13. Check area around pump for oil leaks.

14. Return pump to storage area.

DUAL ELEMENT AIR CLEANER

The air cleaner consists of a foam pre-cleaner and a paper cartridge. The foam pre-cleaner should be serviced after every 25 hours of pump operation or weekly. The paper cartridge should be serviced after every 100 hours of pump operation or yearly.

WARNING: TO PREVENT ACCIDENTAL STARTING when servicing the engine or pump always disconnect the negative wire from battery terminal.

NOTE: Service air cleaner more often when operating under dusty conditions.

1. On the portable pump, unlatch and open the pump top cover to gain access to the air cleaner. Disconnect negative battery cable.

2. Remove air cleaner cover assembly by releasing the latches on either side of the cover and lift cover off pump.

3. Remove nut holding retainer plate, cartridge and foam pre-cleaner to top of engine.

4. Remove retainer plate and foam pre-cleaner from cartridge.

5. Service foam pre-cleaner:

   a. Wash in liquid detergent and water.

   b. Squeeze dry in a clean cloth.

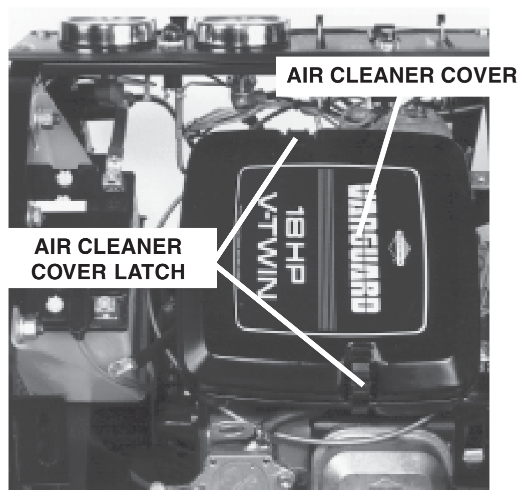
   c. Saturate in engine oil. Squeeze in clean, absorbent cloth to remove all excess oil.

6. Service cartridge:

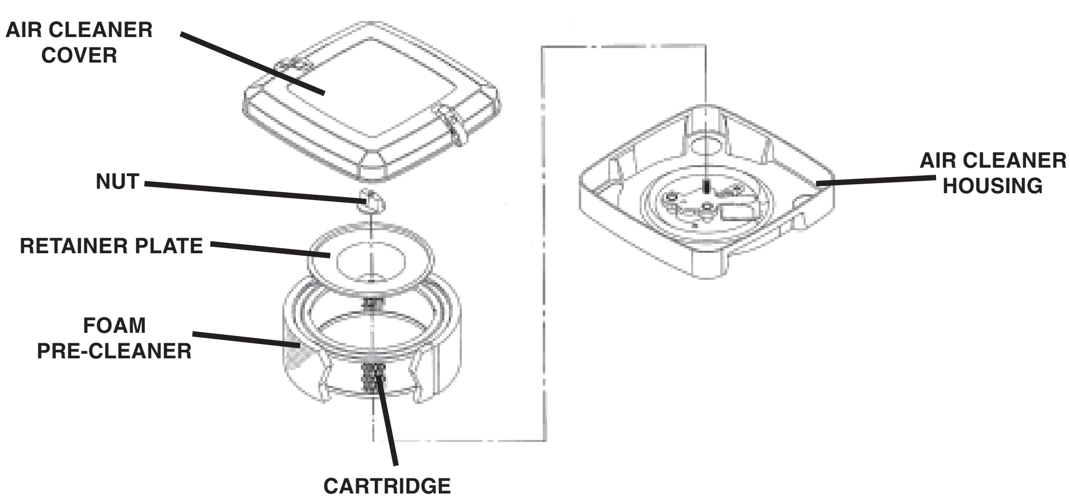
   a. Clean by tapping gently on flat surface.

   b. If very dirty, replace, or wash in a low or non-sudsing detergent and warm water solution. Rinse thoroughly with flowing water from mesh side until water runs clear. Let cartridge air dry thoroughly before using.

CAUTION: Petroleum solvents, such as kerosene, are not to be used to clean cartridge. They may cause deterioration of the cartridge. DO NOT OIL CARTRIDGE. DO NOT USE PRESSURIZED AIR TO CLEAN OR DRY CARTRIDGE



AIR FILTER COVER REMOVAL



AIR FILTER COMPONENTS

7. Reinstall pre-cleaner and retainer ring on cartridge.

8. Reinstall foam pre-cleaner, cartridge and retainer plate assembly in air cleaner housing on top of engine. Secure in place with nut.

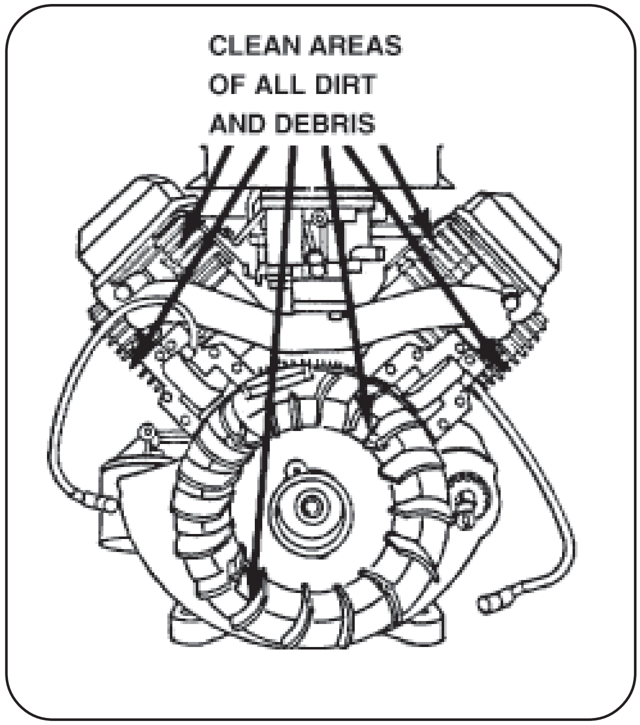
9. Reinstall air cleaner cover on top of pump and latch in place.

WARNING: DO NOT run engine with air cleaner or air cleaner cover removed.

10. Reconnect negative battery cable and close pump cover as necessary.

CLEAN COOLING SYSTEM

If the pump is operated in an area where there is loose debris such as grass, papers, leaves or dirt the rotating screen and the air cooling system may become clogged after prolonged service. After every 100 hours of operation or yearly remove the pump covers and blower housing and clean the areas shown in the illustration to prevent engine damage caused by overheating and/or over-speeding. Clean more often if necessary.



CLEAN DEBRIS GUARD

If the pump is operated in a dry area where there is loose debris such as grass, papers, leaves or dirt this debris must be removed from the debris guard daily or more often if needed to prevent engine damage caused by overheating and/or over-speeding.

CAUTION: For proper engine operation, keep controls and linkages clean and free of debris.

CAUTION: Periodically clean muffler area to remove all grass, paper, leaves, dirt or other combustible debris.

CLEAN SPARK ARRESTER SCREEN

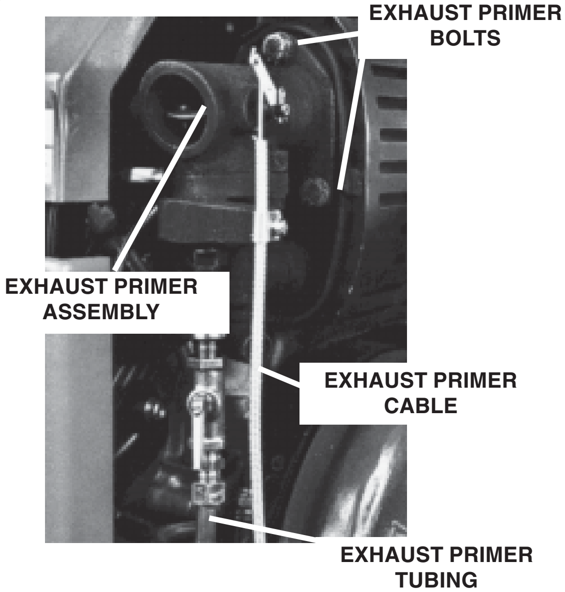
The engine muffler is equipped with a spark arrester screen assembly. Remove this assembly every 50 hours of pump operation or monthly for cleaning and inspection.

WARNING: TO PREVENT ACCIDENTAL STARTING when servicing the engine or pump always disconnect the negative wire from battery terminal.

To remove the spark arrestor screen make sure the pump and muffler are cool and proceed as follows:

1. Remove heat shield from muffler assembly and locate the exhaust primer assembly.

2. Disconnect negative battery cable to prevent accidental starting of the pump.



SPARK ARRESTOR SCREEN ACCESS

3. Disconnect primer tubing and primer control cable as necessary.

4. Remove the three bolts that hold the exhaust primer assembly on the muffler. Remove the exhaust primer assembly.

5. Remove the spark arrestor screen assembly from the muffler.

6. Clean the spark arrestor screen assembly with a stiff wire brush.

7. Inspect spark arrestor screen assembly for damage and deterioration. If the screen is damaged replace the screen.

8. Install new gasket along with the Spark arrestor screen assembly on the muffler.

9. Install another new gasket and the exhaust valve primer assembly. Secure with the three bolts.

10. Connect exhaust primer control cable and primer tubing as required.

11. Install the heat shield on the muffler.

12. Connect negative lead to battery.

13. Return pump to storage or operation.

REPLACE SPARK PLUGS

Replace the spark plugs every 100 hours of operation or yearly.

To replace the spark plugs ensure the pump is cool and proceed as follows:

1. Unlatch and remove pump engine covers to gain access to the pump engine.

2. Disconnect negative battery lead.

3. Remove spark plug wire from spark plug.

4. Using spark plug wrench remove spark plug.

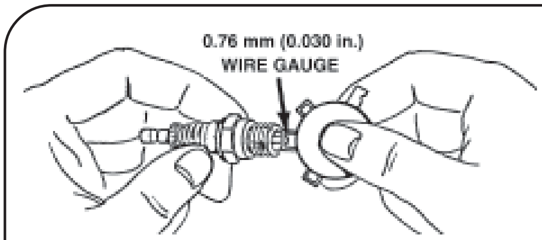
NOTE: Do not blast clean spark plug. Spark plug should be cleaned by scraping or wire brushing and washing with a commercial solvent.

NOTE: In some areas, local law requires the use of a resistor spark plug to suppress ignition signals. If the engine was originally equipped with a resistor spark plug, be sure to use the same type of spark plug for replacement. The following is a list of the recommended sparkplugs.

Spark Plug Type	Champion	Autolite
Resistor	RC12YC	3924

Spark Plug Gap .... 76 mm (.030 in.)

5. Obtain new spark plug and check gap using a wire gauge. The proper gap is 0.030 in (0.76 mm).



SPARK PLUG GAP CHECKING

6. Insert the new spark plug into hole and screw in being careful not to cross thread.

7. Reconnect spark plug wire to spark plug.

CAUTION: Sparking can occur if wire terminal does not fit firmly on spark plug. Reform terminal if necessary.

8. Reconnect negative battery lead.

9. Install pump covers and latch in place.

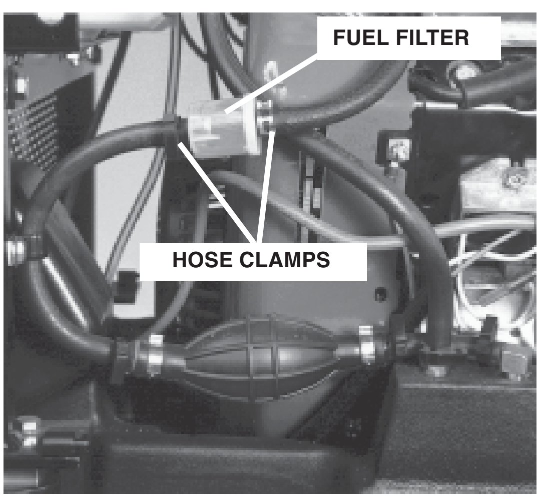
REPLACE FUEL FILTER

A clogged or dirty fuel filter can adversely affect engine performance. The fuel filter should be replaced each year or more often as engine performance dictates. The following procedures are to be used to replace the fuel filter.

WARNING: TO PREVENT ACCIDENTAL STARTING when servicing the engine or pump always disconnect the negative wire from battery terminal.

1. Unlatch and open (or remove) pump covers on portable pump to gain access to the fuel filter. Disconnect negative battery cable.

2. Locate fuel filter.



FUEL FILTER REPLACEMENT

3. Using pliers remove clips holding the fuel filter in the fuel line.

4. Place a container under the fuel filter to catch any excess fuel that may be in the lines.

5. Remove the fuel filter from the fuel lines.

6. Place new clips on the fuel lines.

7. Insert the new fuel filter in the fuel line and push fuel hoses onto connectors.

8. Using pliers, slide clips towards the fuel filter to clamp hoses in place.

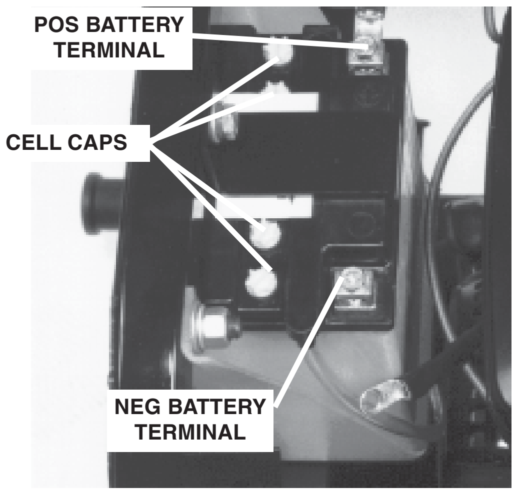
9. Close (or replace) pump covers on portable pump and latch.

PORTABLE PUMP BATTERY CHECK

To ensure reliable operation of the pump the battery must be checked annually to ensure sufficient power is available to start the engine. To accomplish the battery check the following procedures shall be used.

1. Open covers to pump, where applicable, and locate the battery.

2. Disconnect the cables from the positive and negative terminals.



PORTABLE PUMP BATTERY

Always remove the negative terminal first.

3. Check the specific gravity of each cell with a hydrometer. All cells should have a specific gravity of 1.250 with no more than 0.50 variation between any two cells. If the specific gravity is less than 1.225 or varies by more than 0.50 between any two cells replace the battery.

4. Connect battery load test instrument to the terminals and place battery under simulated starting load with the test instrument. The meter should read 9 volts or more when the simulated starting load is applied. If the meter does not read 9 volts, replace the battery.

NOTE: Dispose of used battery in accordance with local ordinances.

5. Reconnect the cables to the positive and negative terminals. Always connect the negative terminal last.

6. Replace pump covers as necessary.

7. Return pump to storage area for operation.

10 WARRANTY POLICY

Hale Products, Inc., herein referred to as “Hale”, warrants products of its manufacture to be free from defects in material and workmanship, under normal use and service, for a period of two years or 2000 hours of usage, whichever comes first. Products used for rental or contracting purposes are warranted for a period of six months or 2000 hours of usage, whichever comes first. This limited warranty is effective only if the equipment or apparatus is used as directed, is not subjected to misuse, negligence or accident, and is not altered, treated or repaired by someone other than Hale or its designee. Items not manufactured by Hale shall bear only the limited warranties offered by their respective manufacturers.

The exclusive remedy for breach of this warranty shall be to give Hale written notice thereof and to request a Returned Goods Authorization. Upon receipt of the Returned Goods Authorization, the buyer will return the non-conforming material to Hale F.O.B. its plant within thirty days after the buyer has received the Returned Goods Authorization. Thereupon Hale at its own election shall repair or replace the same or repay the price thereof. No proximate, incidental, consequential or other damages shall be recoverable.

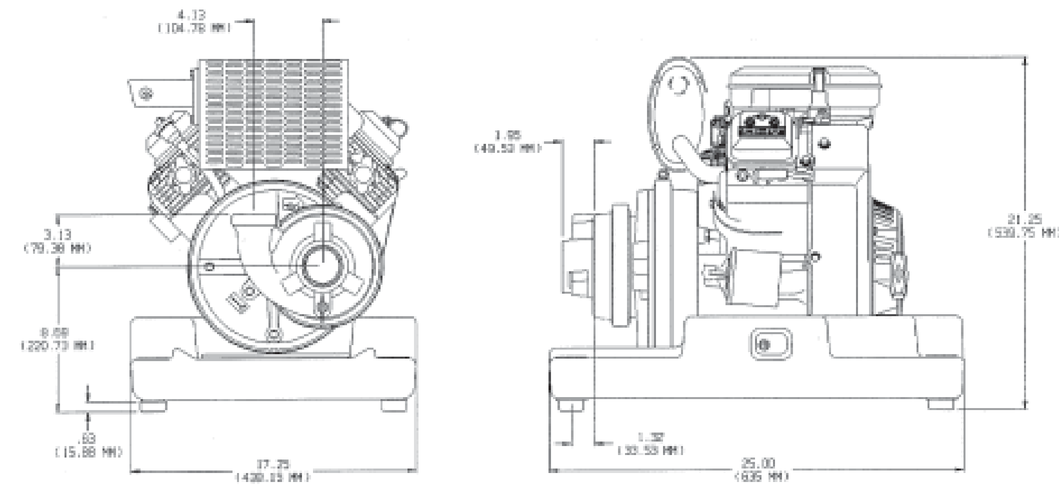
Hale shall not be liable for consequential damages or contingent liabilities including; but not limited to, loss of life, personal injury, loss of crops, loss due to fire or water property damage, and consequential trade or other commercial loss arising out of the failure of Manufacturer’s product.

HALE MAKES NO WARRANTIES OF FREEDOM FROM PATENT INFRINGEMENT, OF MERCHANTABILITY, OF FITNESS FOR A PARTICULAR PURPOSE OR ARISING FROM A COURSE OF DEALING OR USAGE OF TRADE OR OTHER LIKE OR DIFFERENT EXPRESS OR IMPLIED WARRANTIES EXCEPT AS MADE ABOVE.

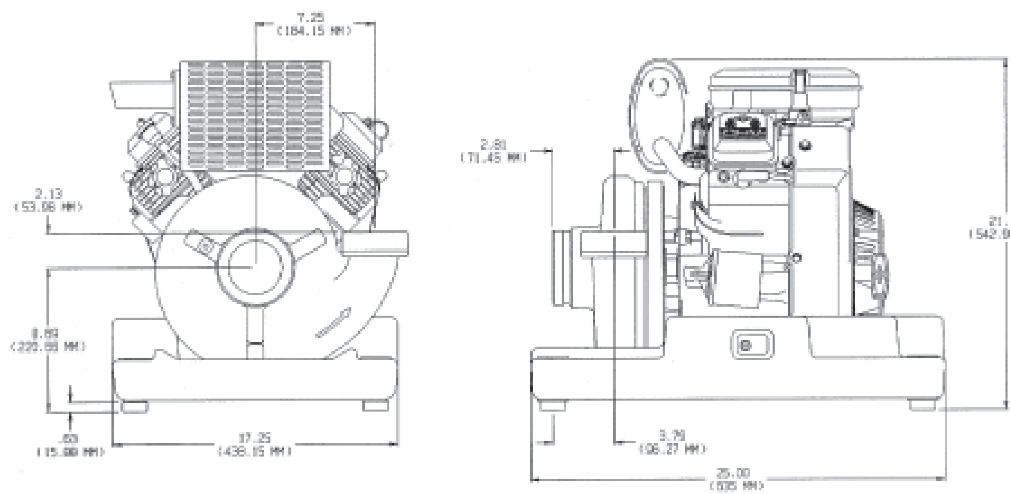
11 MOUNTING DIMENSIONS

"X" SERIES PUMP MOUNTING DRAWINGS

The following pages contain drawings to assist in the mounting of "X" Series pumps on apparatus. The drawings are not to scale but will assist the installer in locating mounting holes for the pumps.

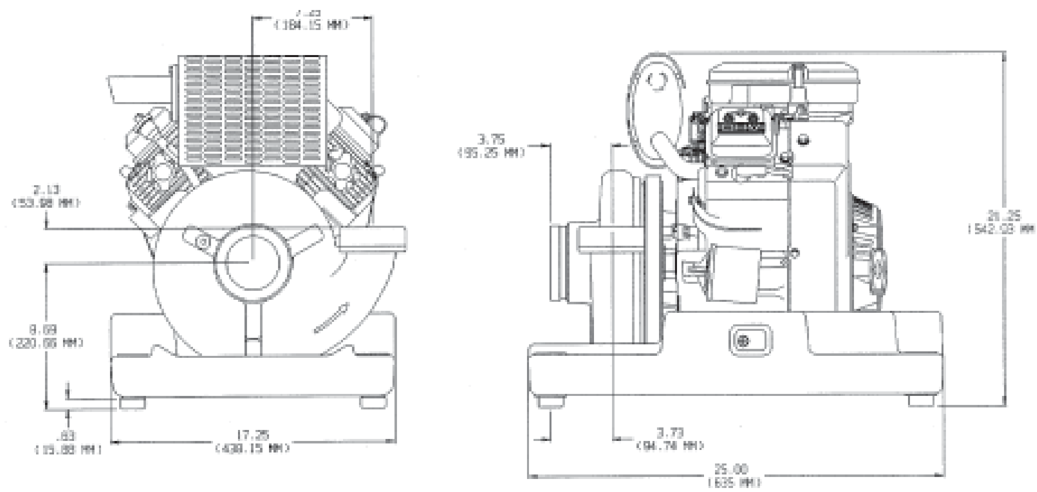


100X

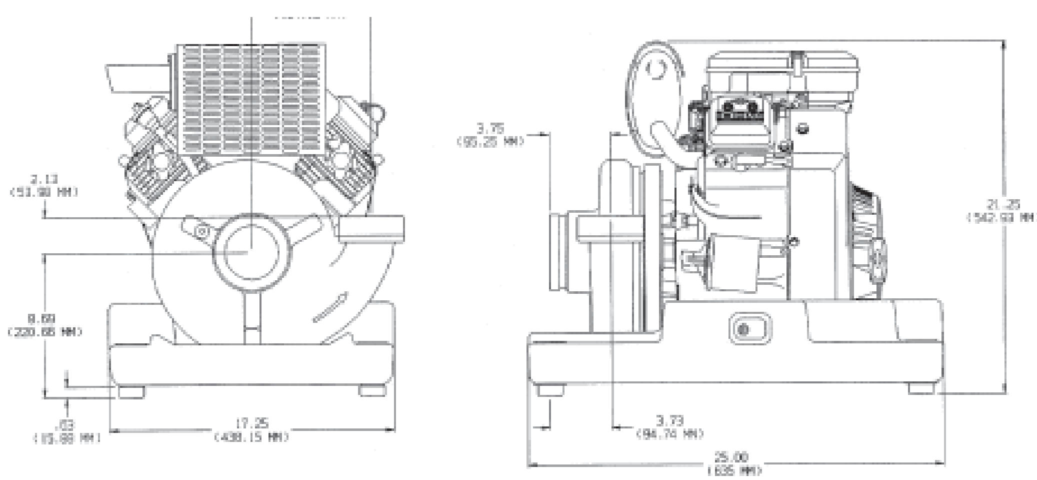


200X

"X" Series Pump Mounting Dimensions

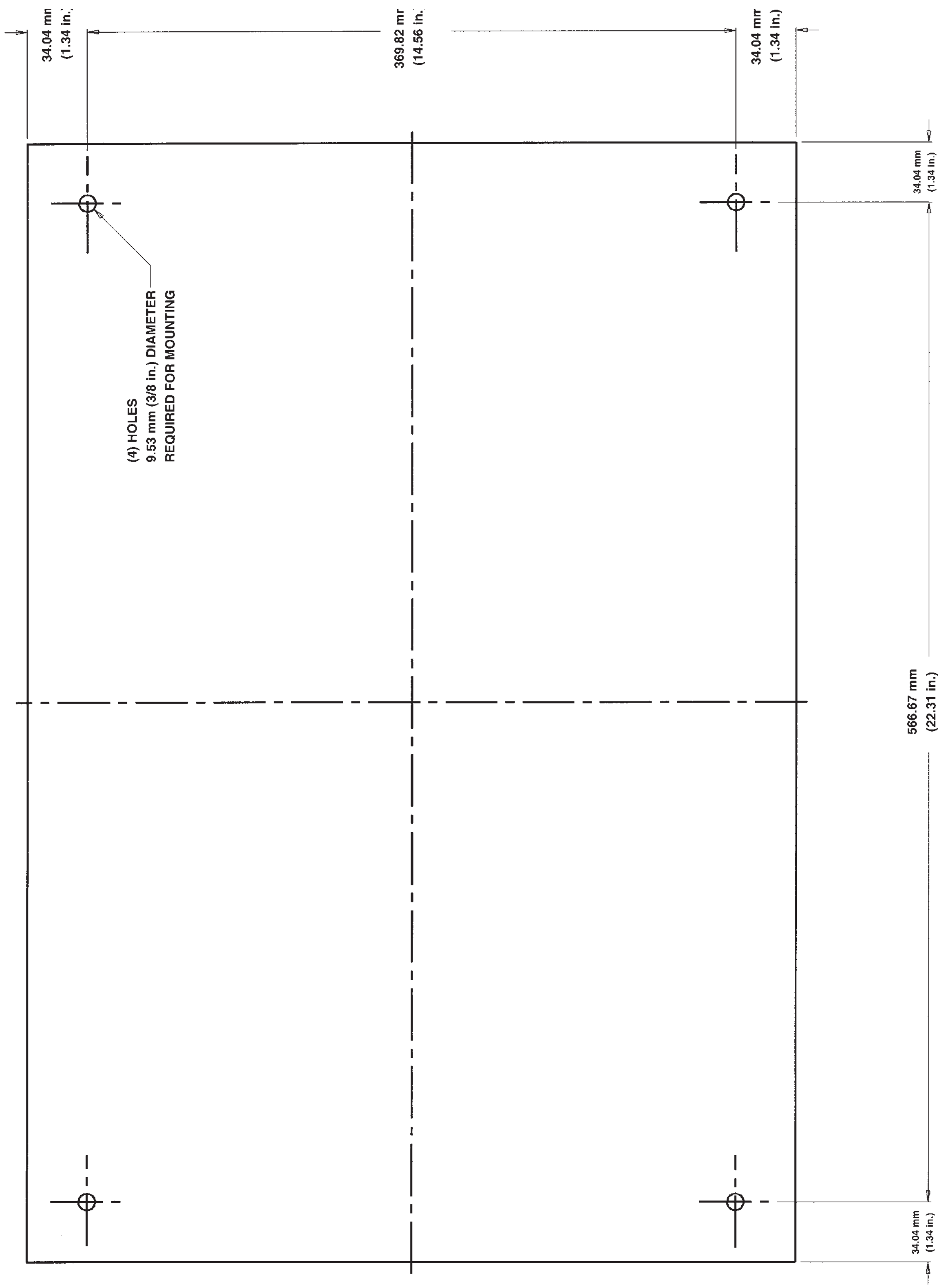


300X

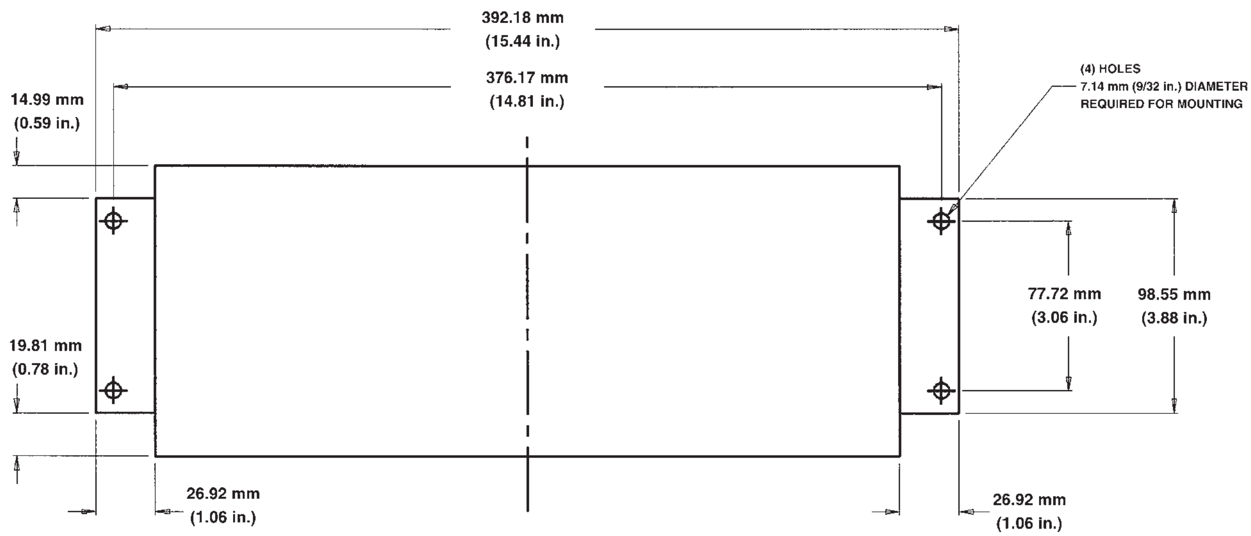


400X

"X" Series Pump Mounting Dimensions



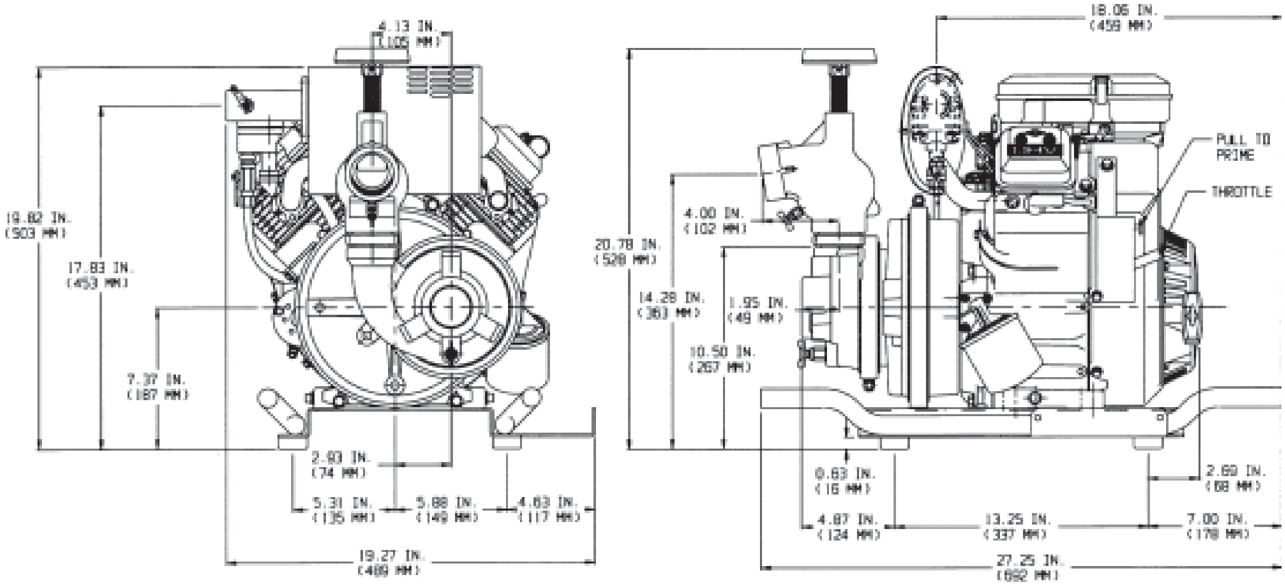
"X" Series Pump Base Mounting Hole Location Dimensions



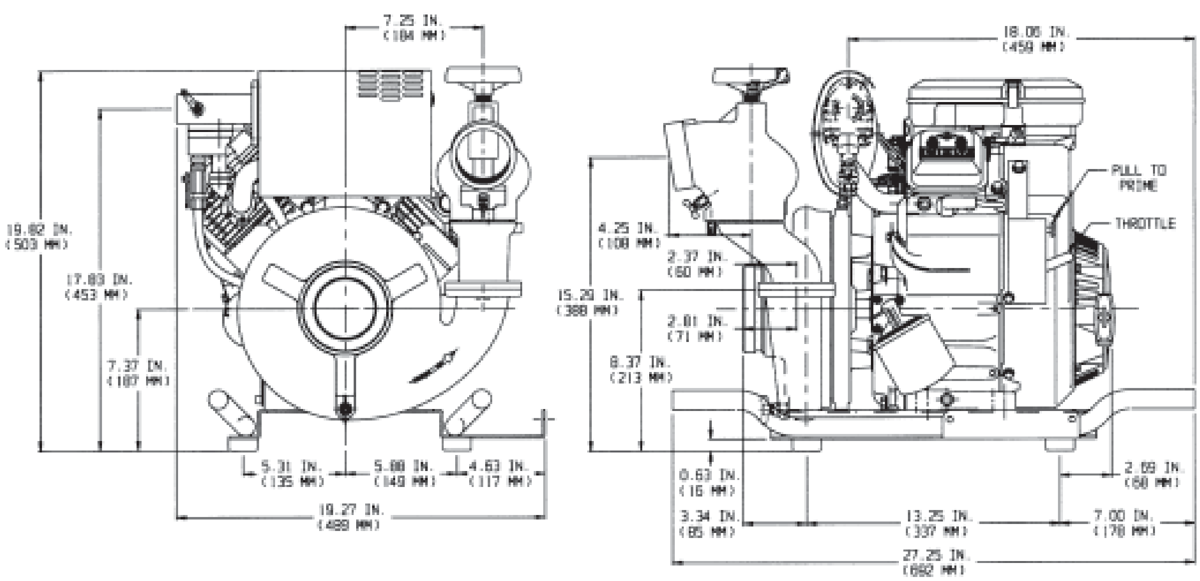
"X" Series Pump Control Panel Mounting Hole Location Dimensions

"I" SERIES PUMP MOUNTING DRAWINGS

The following pages contain drawings to assist in the installation of "I" Series pumps on apparatus. The drawings are not to scale but will assist the installer in locating mounting holes and determining compartment size for the pumps.

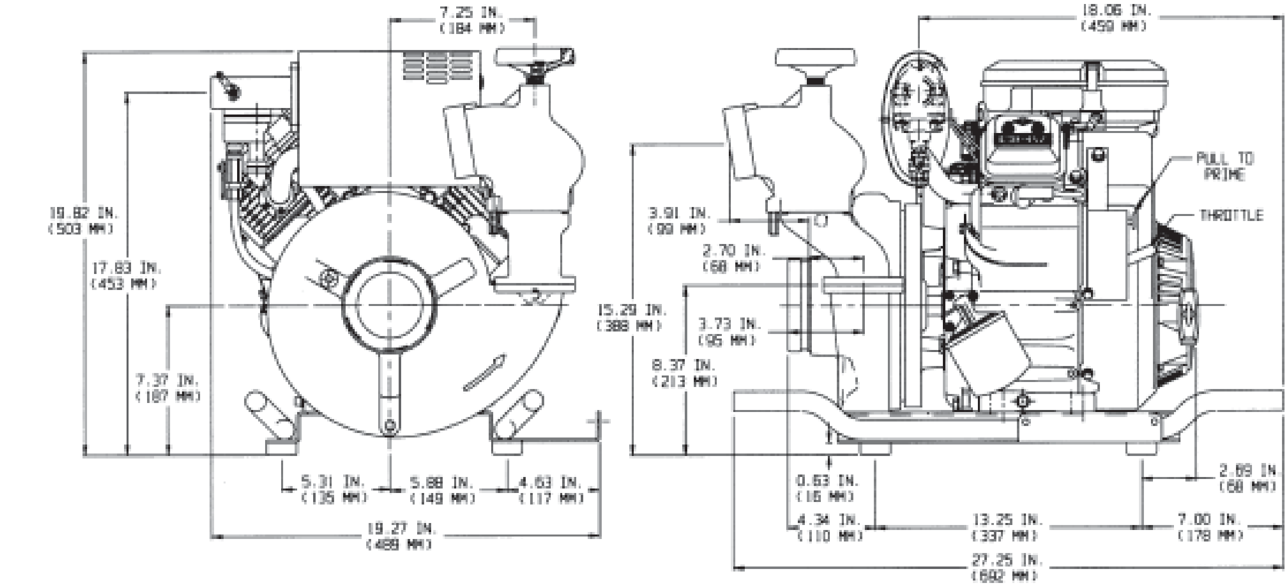


HP100I

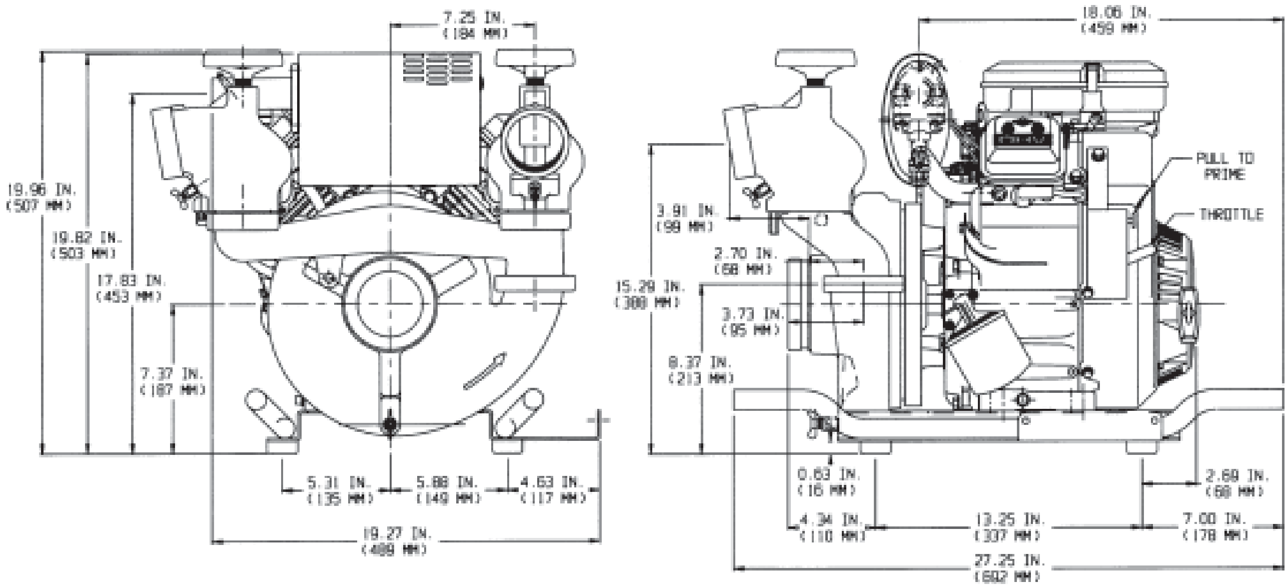


HP200I

"I" Series Pump Dimensions



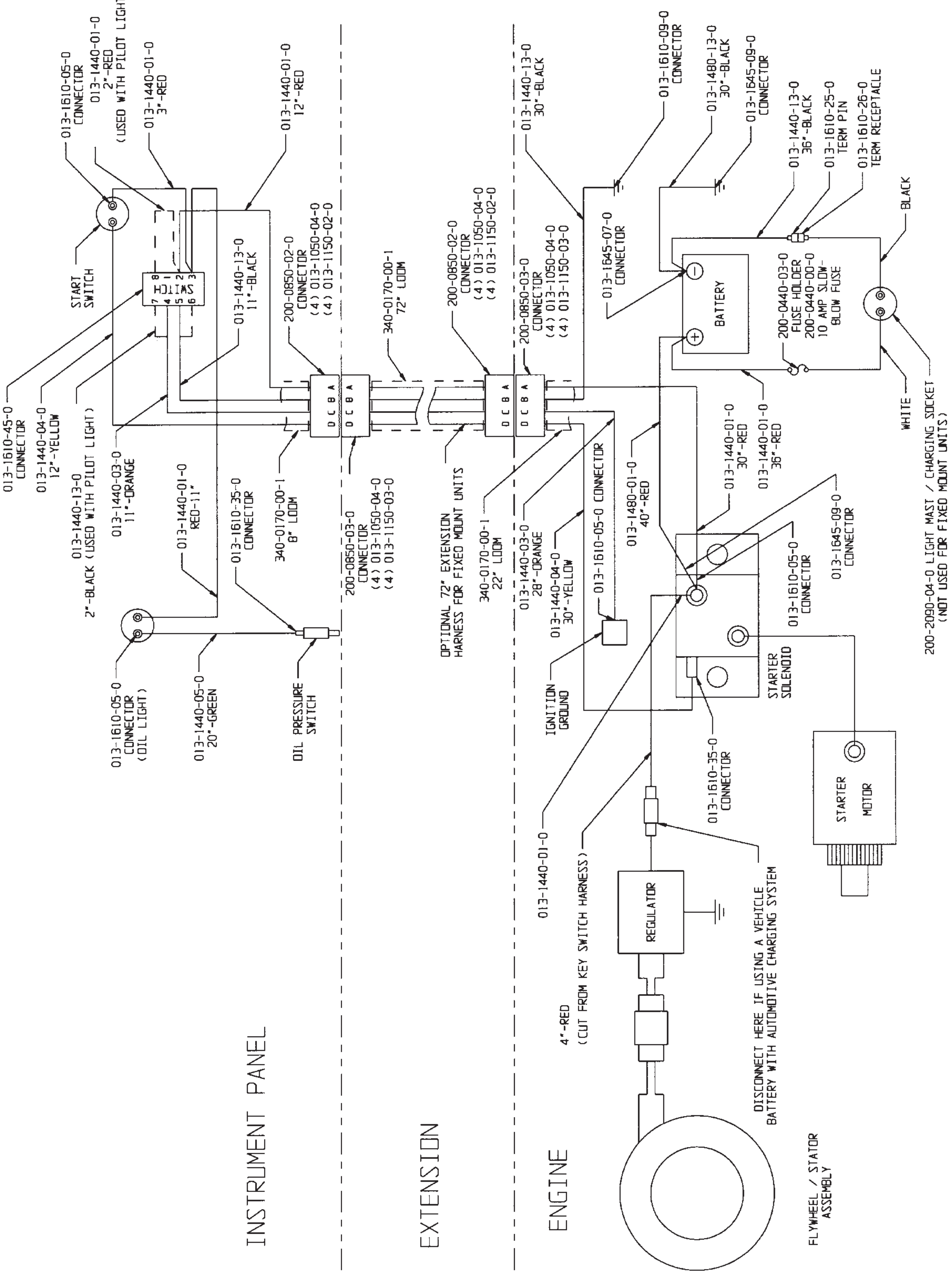
HP300I



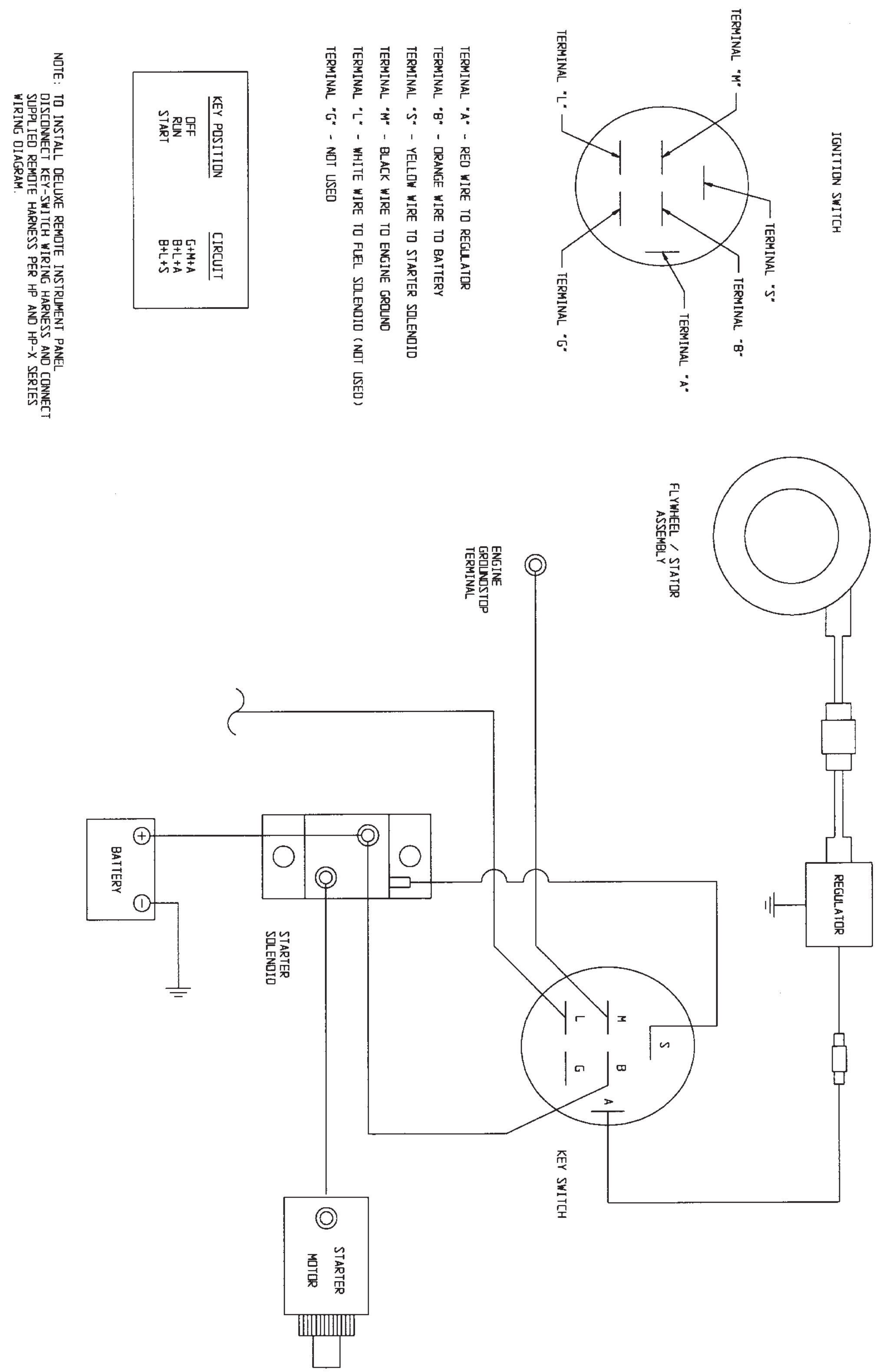
HP400I

"I" Series Pump Dimensions

12 ELECTRICAL WIRING DIAGRAMS



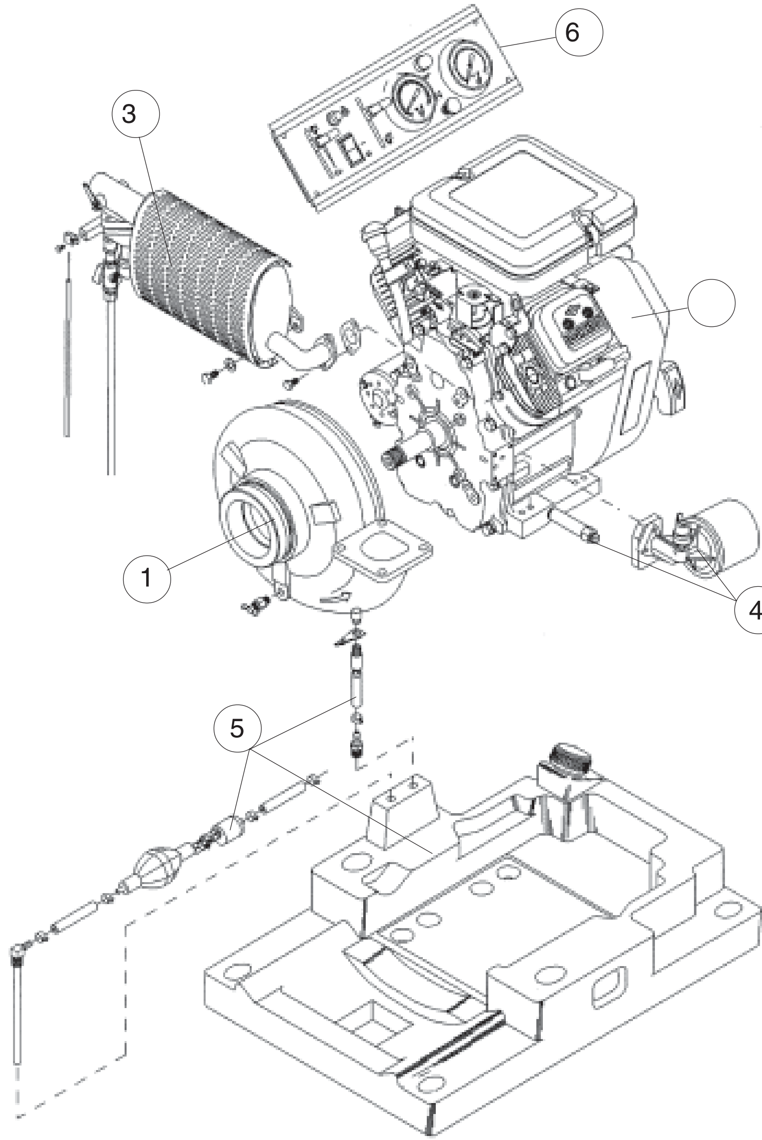
HP and HP"X" Series Electrical Wiring Diagram



HP"I" Series Electrical Wiring Diagram

13 PARTS LIST

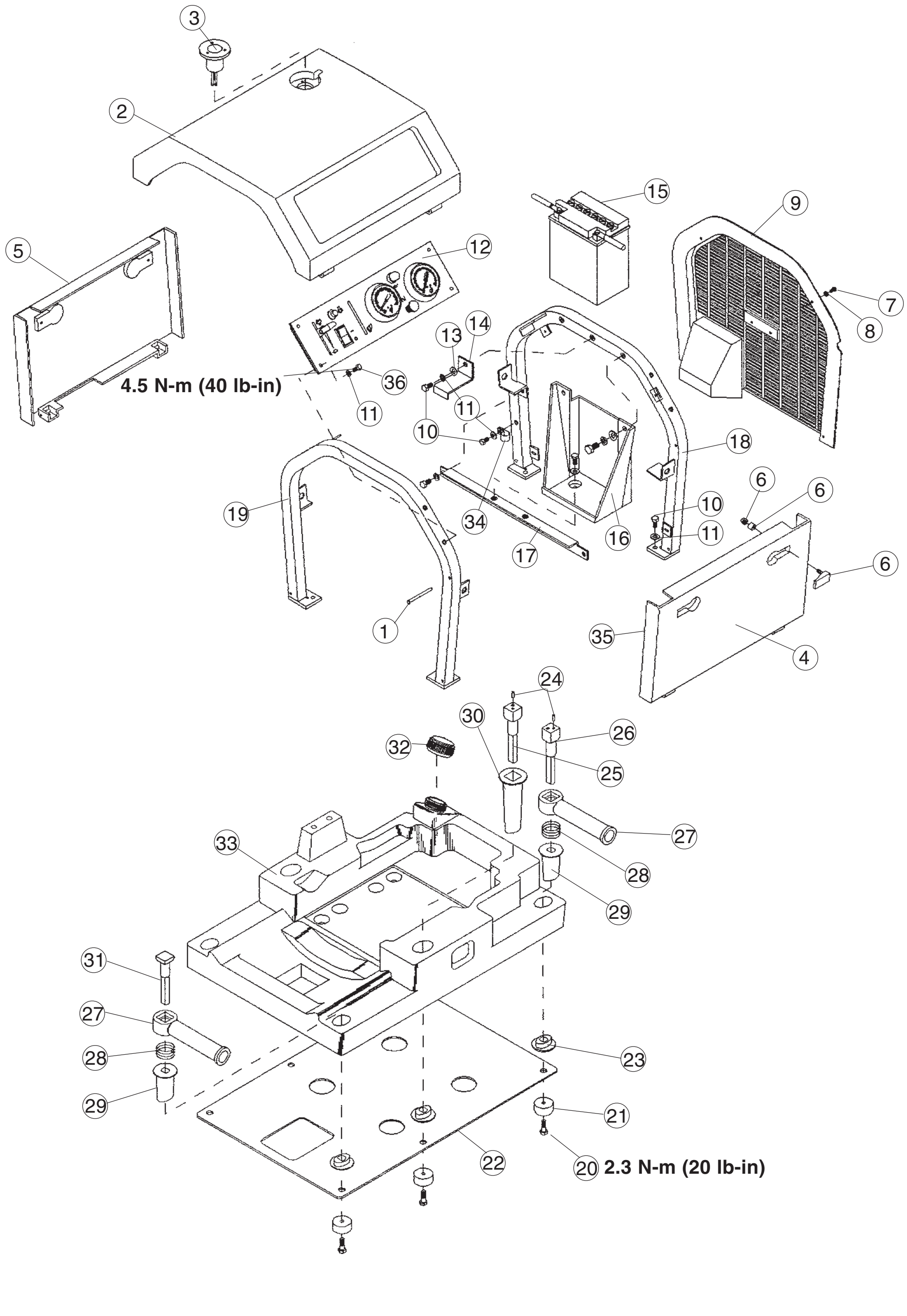
The following pages contain exploded views of the HP Portable, "X" Series and "I" Series pumps. Each part of the pump is identified on the illustration with an index number. Located in the list on the page next to the illustration are the Hale Products Inc. part numbers for the component parts. When repairing the pump refer to these exploded views to identify the part numbers of components requiring replacement.



PL-1: HP SERIES PUMP COMPONENT IDENTIFICATION

PL-1: HP SERIES PUMP COMPONENT IDENTIFICATION

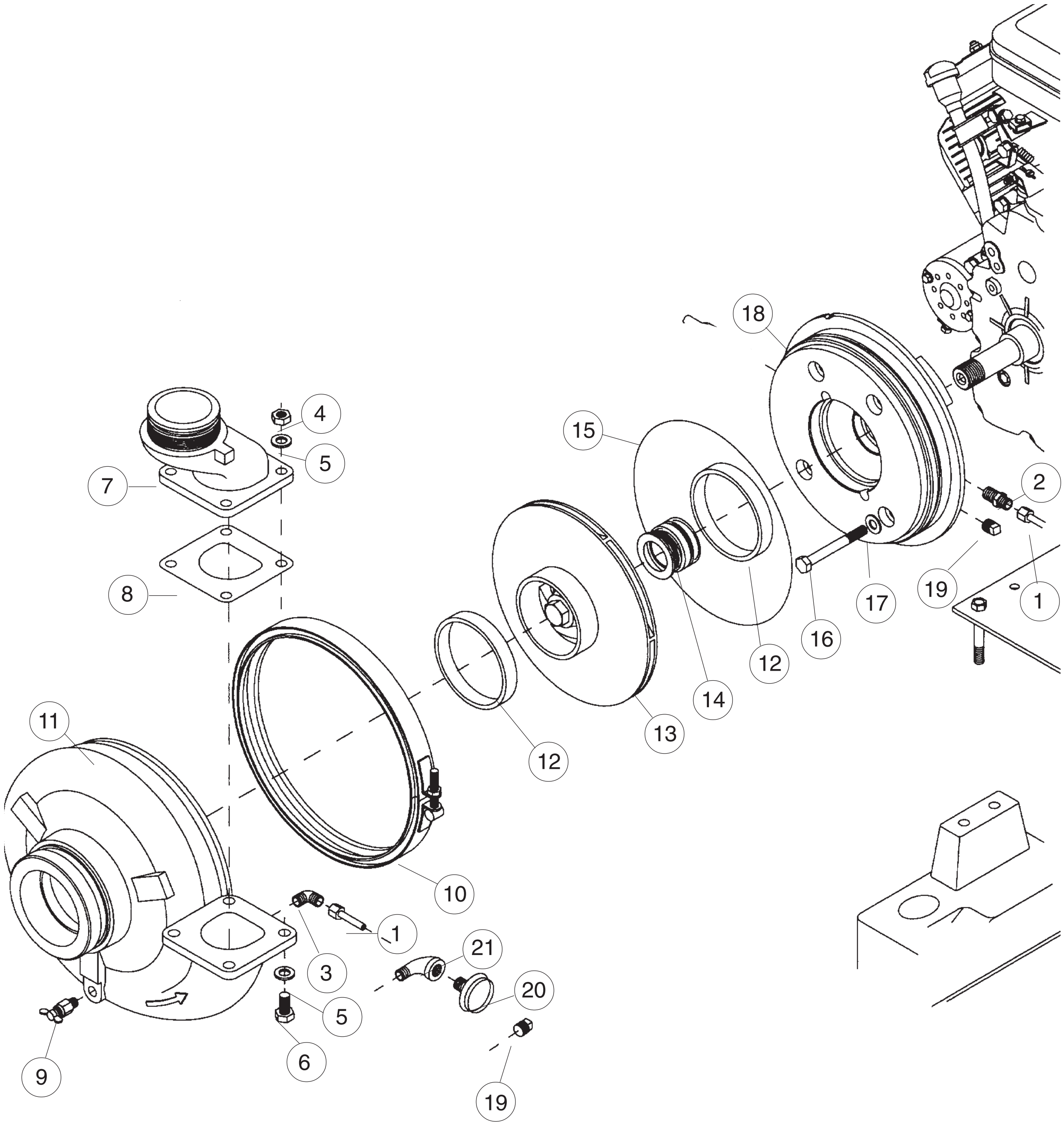
ITEM	PART NUMBER	DESCRIPTION	QTY	UNIT
	545-4050-00-0	HP100 PORTABLE PUMP		EA
	545-4050-02-0	HP100X PORTABLE PUMP		EA
	545-4060-00-0	HP200 PORTABLE PUMP		EA
	545-4060-02-0	HP200X PORTABLE PUMP		EA
	545-4070-00-0	HP300 PORTABLE PUMP		EA
	545-4070-02-0	HP300X PORTABLE PUMP		EA
	545-4080-00-0	HP400 PORTABLE PUMP		EA
	545-4080-02-0	HP400X PORTABLE PUMP		EA
1		HP SERIES PUMP END (FOR DETAILS SEE: PL-3 FOR HP200, HP300 AND HP400: PL-4 FOR HP100)	1.0	EA
2	045-0680-00-0	B&S MODEL 350447-0080 ENG (B35) (FOR MOUNTING DETAILS SEE PL-8)	1.0	EA
3	538-1520-00-0	EXHAUST PRIMER ASSEMBLY (FOR DETAILS SEE PL-7)	1.0	EA
4		OIL FILTER AND DRAIN ASSEMBLY (FOR DETAILS SEE PL-11)	1.0	EA
5	503-1340-00-0	FUEL SYSTEM (FOR DETAILS SEE PL-10)	1.0	EA
6	168-0070-13-0	HP X SERIES INSTRUMENT PANEL ASSEMBLY (FOR DETAILS SEE PL-9)	1.0	EA



PL-2: HP SERIES PORTABLE PUMP COVERS AND CARRYING HANDLES

HP SERIES PORTABLE PUMP COVERS AND CARRYING HANDLES

ITEM	PART NUMBER	DESCRIPTION	QTY	UNIT
1	064-6320-01-0	HINGE/RELEASE PIN	6.0	EA
2	070-0020-24-0	PORTABLE PUMP COVER	1.0	EA
3	200-2090-04-0	LIGHT MAST/CHARGING SOCKET	1.0	EA
4	070-0030-28-0	PORTABLE PUMP SIDE PANEL	1.0	EA
5	070-0030-31-0	PORTABLE PUMP SIDE PANEL	1.0	EA
6	242-0250-01-0	SIDE PANEL SWELL LATCH	6.0	EA
7	218-0406-48-0	SCREW M4-.7 X 12 PHILLIP HD SST	8.0	EA
8	097-1900-00-0	WASHER-#8 300 SERIES SST FLAT	6.0	EA
9	070-0030-29-0	REAR GRILL	1.0	EA
10	218-0810-12-0	SCREW M8-1.25 X 20 H.H. SST	7.0	EA
11	097-0560-02-0	WASHER 5/16, 300 SER SST LOCK	6.0	EA
12	168-0070-10-0	INSTR. PANEL ASSEMBLY (FOR DETAILS SEE PL-9)	1.0	EA
13	097-0810-01-0	WASHER-5/16 STL ZINC PL FLAT	16.0	EA
14	047-0170-08-0	BATTERY HOLD-DOWN	1.0	EA
15	200-0600-00-0	BATTERY	1.0	EA
16	047-0030-10-0	BATTERY BASE	1.0	EA
17	019-0740-01-0	BATTERY SUPPORT BRACKET	1.0	EA
18	547-0910-01-0	FRAME MEMBER-REAR	1.0	EA
19	547-0910-00-0	FRAME MEMBER-FRONT	1.0	EA
20	218-0812-12-0	SCREW M8-1.25 X 25 H.H. SST NYLOCK	6.0	EA
21	097-0520-00-0	1-FZZ-264A RUBBER PAD #1019-2W	6.0	EA
22	047-0200-02-0	UNIT MOUNTING BASE	1.0	EA
23	048-1180-03-0	HANDLE SLEEVE BASE	6.0	EA
24	064-0612-12-0	03-64H-06S PIN	5.0	EA
25	019-0390-07-0	HANDLE SPRT BRKT	2.0	EA
26	019-0390-04-0	HANDLE SPRT BRKT	2.0	EA
27	512-0080-02-0	HANDLE ASSEMBLY	4.0	EA
28	042-0500-01-0	HANDLE SPRING	4.0	EA
29	048-1180-01-0	HANDLE SLEEVE	4.0	EA
30	048-1180-02-0	HANDLE SLEEVE-CENTER	2.0	EA
31	019-0390-05-0	HANDLE SPRT BRKT(FR)	2.0	EA
32	008-0300-02-0	FUEL TANK CAP-2"	1.0	EA
33	108-0560-00-0	FUEL TANK PORTABLE PUMP	1.0	EA
34	242-0380-00-0	TUBING CLAMP	1.0	EA
35	101-1470-09-0	LABEL, HP OPERATING INSTRUCTIONS	1.0	EA
36	218-0612-02-0	SCREW M6-1.25 X 20 HH SST	4.0	EA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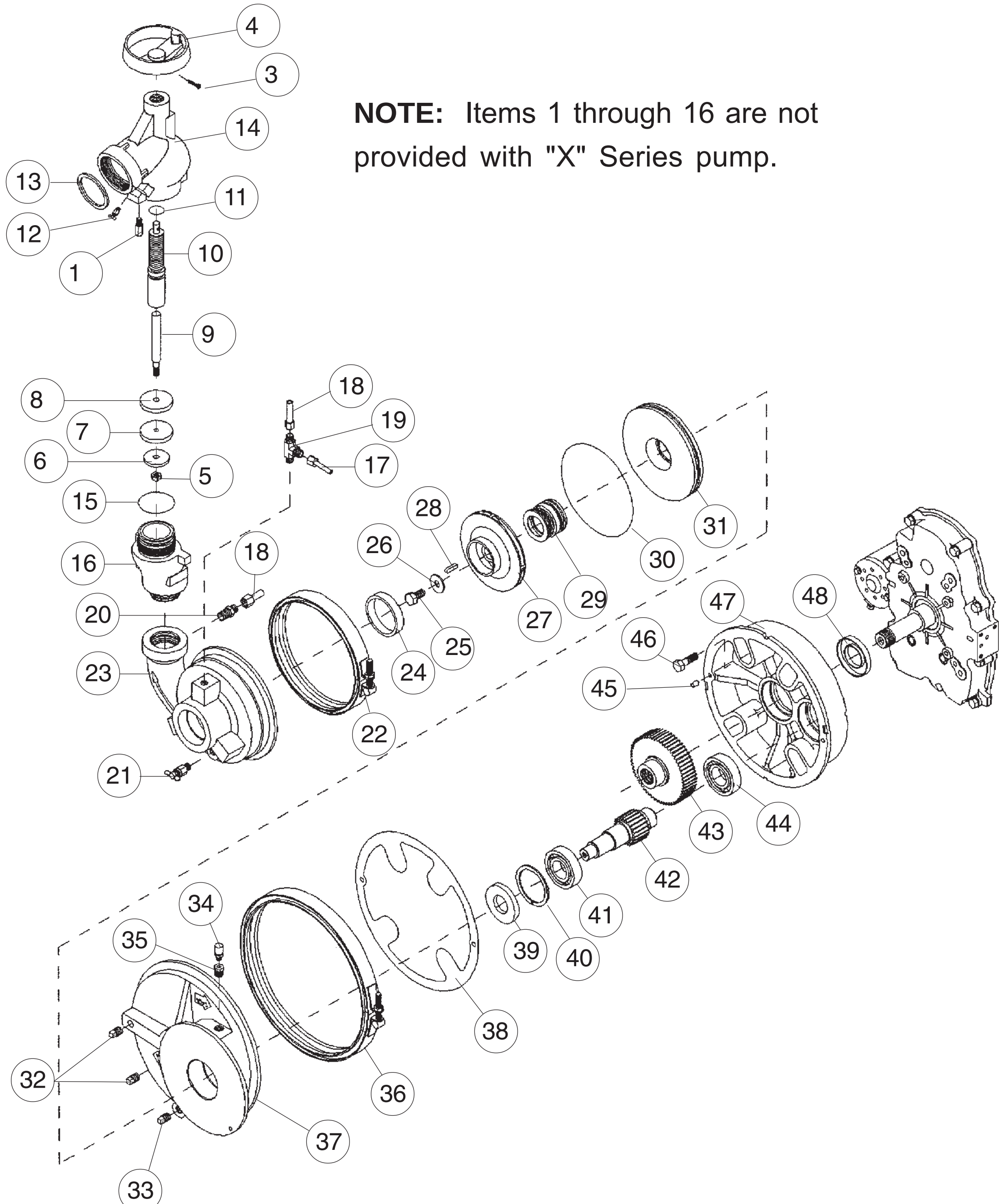
HP200, HP300 AND HP400 PUMP END

ITEM	PART NUMBER	DESCRIPTION	QTY	UNIT
1	604-0079-00-0	1/4 ODX.040 THERMOPLASTIC TUBING	2.9	FT
2	082-0262-11-0	CONNECTOR-1/4 NPT X 1/4 TUBE PLTD	1.0	EA
3	082-0261-11-0	ELBOW 1/4 MNPT X 1/4 TUBE, PUSH	1.0	EA
4	210-1000-02-0	5504-1000 NUT M-10 X 1.5	4.0	EA
5	097-1070-00-0	WASHER 7/16 ZINC PL STL FLAT	8.0	EA
6	218-1015-02-0	SCREW M10-1.5 X 30 H.H.ZINC PL	4.0	EA
7	007-2080-01-0	HP300 DISCH. VALVE ADAPTER		
		(HP200 AND HP300 PORTABLE PUMPS)	1.0	EA
	178-0370-00-0	HP400 DISCHARGE MANIFOLD		
		(HP400 PORTABLE PUMP)	1.0	EA
	115-0070-00-0	115-2 1/2 FLANGE (HP200 "X" SERIES)	1.0	EA
	115-0080-00-0	115-3 FLANGE		
		(HP300 AND HP400 "X" SERIES)	1.0	EA
8	046-0050-00-0	46DW GASKET	1.0	EA
9	038-1270-01-0	1/4 DRAIN VALVE-PLTD BRASS	1.0	EA
10	242-0880-00-0	V-BAND CLAMP (10.125 IN. DIAMETER)	1.0	EA
11	001-0780-00-0	HP300/400 PUMP VOLUTE	1.0	EA
	001-0810-00-0	HP200 PUMP VOLUTE	1.0	EA
12	321-0070-00-0	FZ-321 CLEARANCE RING	2.0	EA
13	016-0960-01-0	HP200 IMPELLER	1.0	EA
	016-0960-00-0	HP300 IMPELLER	1.0	EA
	016-0970-00-0	HP400 IMPELLER	1.0	EA
14	296-5250-00-0	MECH.SEAL 1-3/8" SHAFT TYPE 21	1.0	EA
15	040-2680-00-0	-268 NITRILE SEAL RING	1.0	EA
16	018-1632-17-0	SCREW 3/8-16 X 3-1/4 H.H. SST LOCK	4.0	EA
17	097-0200-06-0	SEALING WASHER-3/8" SST	4.0	EA
18	002-0630-00-0	PUMP HEAD	1.0	EA
HP "I" COMPONENTS				
19	217-0201-00-0	1/4 INCH NPT PIPE PLUG		
		(2 REQUIRED FOR IX PUMPS)	1.0	EA
20	168-0040-13-0	PRESSURE GUAGE	1.0	EA
21	082-0211-00-0	ELBOW, 1/4 INCH NPT SERVICE	1.0	EA
	546-1740-00-0	LEVEL 1 SPARE PARTS KIT (GASKETS & SEALS)		



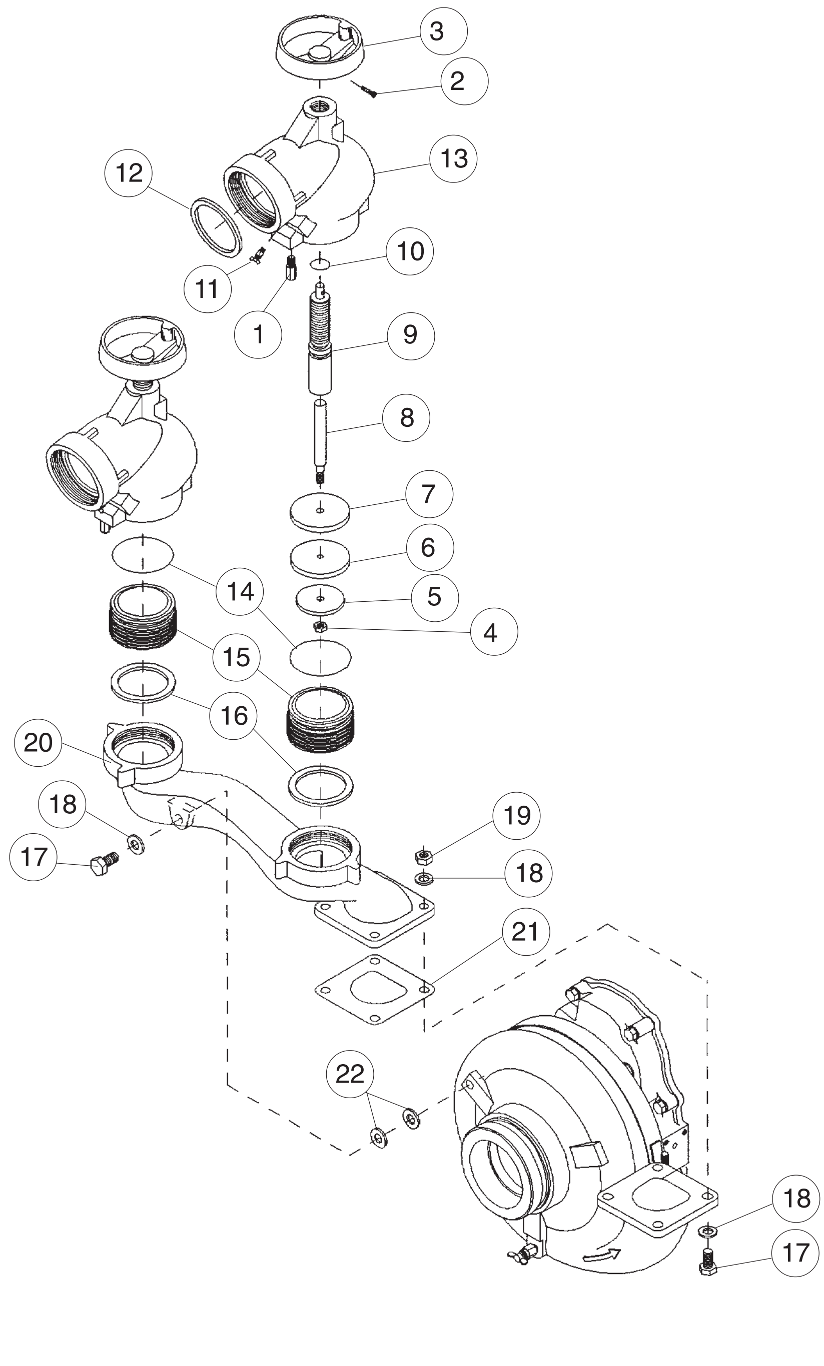
NOTE: Items 1 through 16 are not provided with "X" Series pump.

PL-4: HP100 PUMP END AND GEARBOX

ITEM	PART NUMBER	DESCRIPTION	QTY	UNIT
1	018-8250-00-0	STUD-HP SERIES VALVE STOP M8	1.0	EA
2	538-1450-01-0	HP100 DISCHARGE VALVE ASSEMBLY	1.0	EA
3	218-0408-19-0	SCREW M4-.7X16 SOC.HD. LOCK	1.0	EA
4	012-0170-02-0	HANDWHEEL-HP SERIES DISCHARGE	1.0	EA
5	210-0805-11-0	NUT M8-1.25 STNLS STL LOCKING	9.0	EA
6	097-1750-03-0	HP100 VALVE WASHER	1.0	EA
7	097-1760-01-0	HP100 VALVE SEAL WASHER	1.0	EA
8	097-1750-02-0	HP100 VALVE BACKUP WASHER	1.0	EA

HP100 PUMP END AND GEARBOX

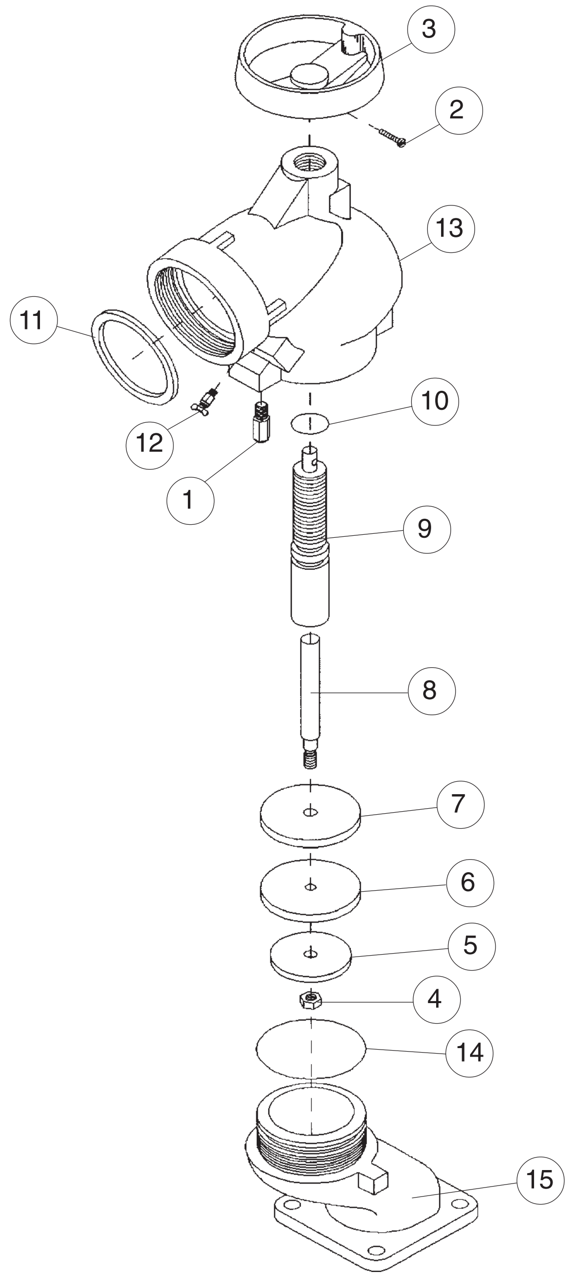
ITEM	PART NUMBER	DESCRIPTION	QTY	UNIT
9	041-0480-00-0	HP SERIES VALVE STEM	1.0	EA
10	041-0470-00-0	HP SERIES VALVE SHAFT	1.0	EA
11	040-2100-00-0	2308-210 O-RING	1.0	EA
12	038-1220-01-0	1/8 DRAIN VALVE-PLTD BRASS	1.0	EA
13	097-1840-00-0	2 INCH ISO(BSP) SEAL WASHER	1.0	EA
14	038-1600-00-0	HP100 DISCHARGE VALVE BODY	1.0	EA
15	040-2250-00-0	40-4N187 (3P-400) SEAL RING	1.0	EA
16	007-2080-00-0	HP100 DISCH. VALVE ADAPTER	1.0	EA
17	604-0079-00-0	1/4 ODX.040 THERMOPLASTIC TUBING	2.9	FT
18	604-0033-00-0	3/8 OD X.032 WALL COPPER TUBE	1.0	FT
19	082-0209-02-0	TEE- 1/4 FNPT BRASS	1.0	EA
20	082-0206-02-0	CONNECTOR-1/4NPT TO 3/8 TUBING	1.0	EA
21	038-1270-01-0	1/4 DRAIN VALVE-PLTD BRASS	1.0	EA
22	242-0880-01-0	V-BAND CLAMP (7.125 DIA.)	1.0	EA
23	001-0790-00-0	HP100 PUMP VOLUTE	1.0	EA
24	321-0430-00-0	HP100 CLEARANCE RING	1.0	EA
25	218-1012-17-0	SCREW M10 X 25 HH SST NY-LOCK	1.0	EA
26	097-0380-01-0	HP100 IMPELLER WASHER	1.0	EA.
27	016-0980-00-0	HP100 IMPELLER	1.0	EA
28	017-0260-01-0	HP100 IMPELLER KEY	1.0	EA
29	296-5050-06-0	HP100 MECHANICAL SEAL	1.0	EA
30	040-2540-00-0	-254 NITRILE SEAL RING	1.0	EA
31	002-0640-00-0	HP100 PUMP HEAD	1.0	EA
32	217-0201-00-0	1/4 NPT SQUARE HEAD STEEL PLUG	2.0	EA
33	217-0201-08-0	1/4 NPT MAGNETIC PLUG	1.0	EA
34	044-0260-02-0	1/8 AIR VENT-NO CHECK	1.0	EA
35	082-0214-00-0	BUSHING 1/4 X 1/8 NPT STEEL	1.0	EA
36	242-0880-00-0	V-BAND CLAMP (10.125 DIA.)	1.0	EA
37	004-0490-01-0	HP100 GEARBOX (PUMP SIDE)	1.0	EA
38	046-1570-00-0	HP100 GEARBOX GASKET	1.0	EA
39	296-2720-00-0	METRIC OIL SEAL(30MM X 62 X 7)	1.0	EA
40	077-2440-00-0	79S244 (12M-79) RETAINING RING	1.0	EA.
41	250-0206-20-0	206W BEARING	1.0	EA
42	037-1840-00-0	HP100 PUMP SHAFT	1.0	EA
43	031-1180-00-0	HP100 DRIVE GEAR	1.0	EA
44	250-0206-20-0	206W BEARING	1.0	EA
45	064-6020-01-0	0.25DIA X .375 LG DOWEL PIN	2.0	EA
46	018-1612-07-0	SCR-3/8-16X1 1/4LG.HEX.LOCKING	4.0	EA
47	004-0490-00-0	HP100 GEARBOX (INPUT SIDE)	1.0	EA
48	296-2720-01-0	METRIC OIL SEAL(35MM X 62 X 7)	1.0	EA
	538-1450-51-0	HP100 DISCHARGE VALVE ASSEMBLY	1.0	EA
	546-1740-01-0	LEVEL 1 SPARE PARTS KIT (GASKETS & SEALS)		



PL-5: HP400 DISCHARGE MANIFOLD

HP400 DISCHARGE MANIFOLD

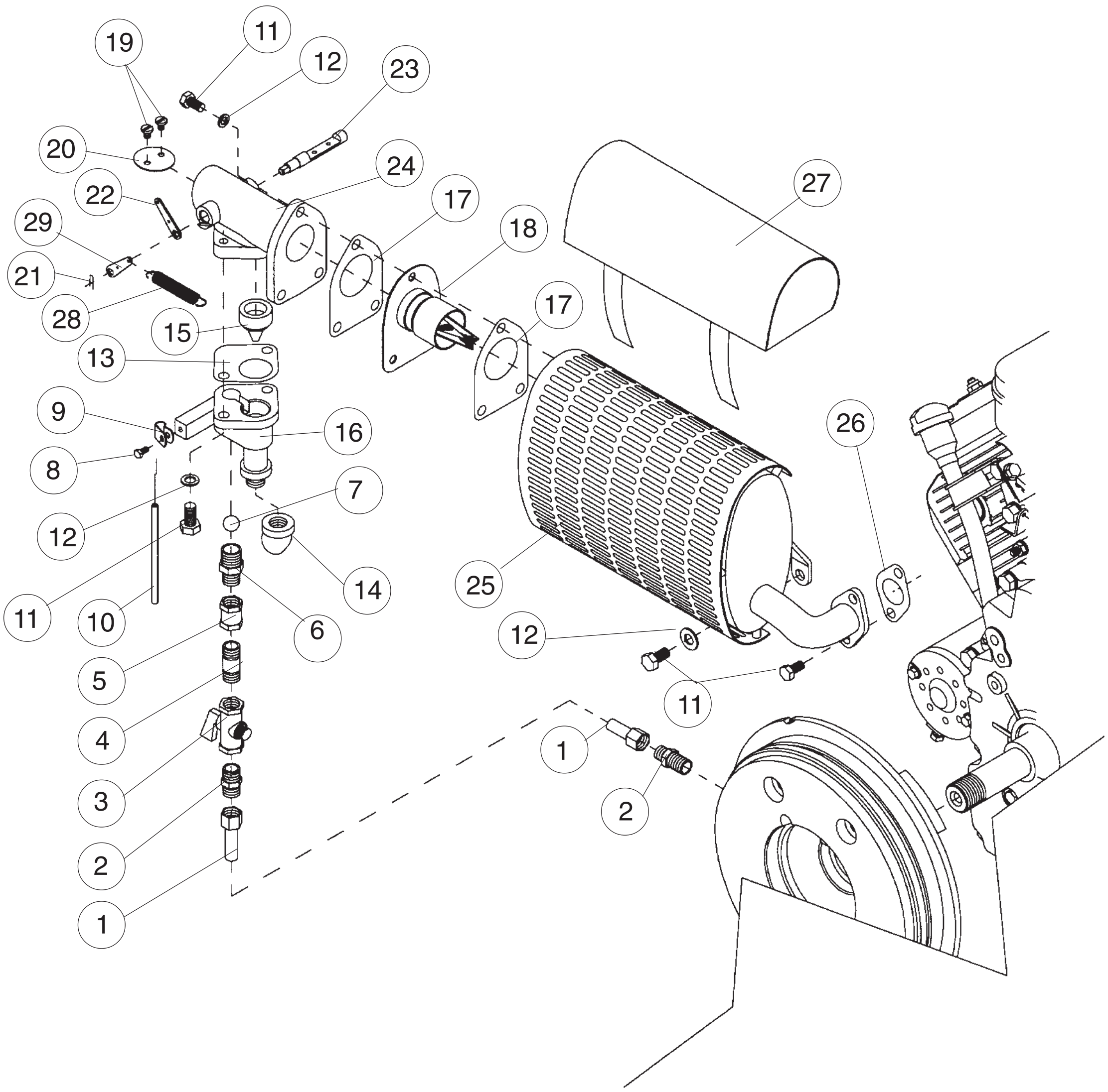
ITEM	PART NUMBER	DESCRIPTION	QTY	UNIT
1	018-8250-00-0	STUD-HP SERIES VALVE STOP M8	2.0	EA
2	218-0408-19-0	SCREW M4-.7X16 SOC.HD. LOCK	2.0	EA
3	012-0170-02-0	HANDWHEEL-HP SERIES DISCHARGE	2.0	EA
4	210-0805-11-0	NUT M8-1.25 STNLS STL LOCKING	8.0	EA
5	097-1750-01-0	HP300 VALVE WASHER	2.0	EA
6	097-1760-00-0	HP300 VALVE SEAL WASHER	2.0	EA
7	097-1750-00-0	HP300 VALVE BACKUP WASHER	2.0	EA
8	041-0480-00-0	VALVE STEM	2.0	EA
9	041-0470-00-0	VALVE SHAFT	2.0	EA
10	040-2100-00-0	2308-210 O-RING	1.0	EA
11	038-1220-01-0	1/8 DRAIN VALVE-PLTD BRASS	2.0	EA
12	097-1840-01-0	2.5 INCH ISO (BSP) SEAL WASHER	4.0	EA
13	038-1510-00-0	HP300 DISCHARGE VALVE BODY	2.0	EA
14	040-2310-00-0	-231 NITRILE SEAL RING	2.0	EA
15	007-2080-02-0	HP400 DISCHARGE VALVE ADAPTER	2.0	EA
16	097-1840-01-0	2.5 INCH ISO (BSP) SEAL WASHER	4.0	EA
17	218-1015-02-0	SCREW M10-1.5 X 30 H.H.ZINC PL	5.0	EA
18	097-1070-00-0	WASHER 7/16 ZINC PL STL FLAT	9.0	EA
19	210-1000-02-0	NUT M-10 x 1.5 ZINC PL STL	4.0	EA
20	178-0370-00-0	HP400 DISCHARGE MANIFOLD	1.0	EA
21	046-0050-00-0	46DW GASKET	1.0	EA
22	097-1830-00-0	SPHERICAL WASHER SET	1.0	EA



PL-6: HP300 DISCHARGE VALVE ASSEMBLY

HP300 DISCHARGE VALVE ASSEMBLY

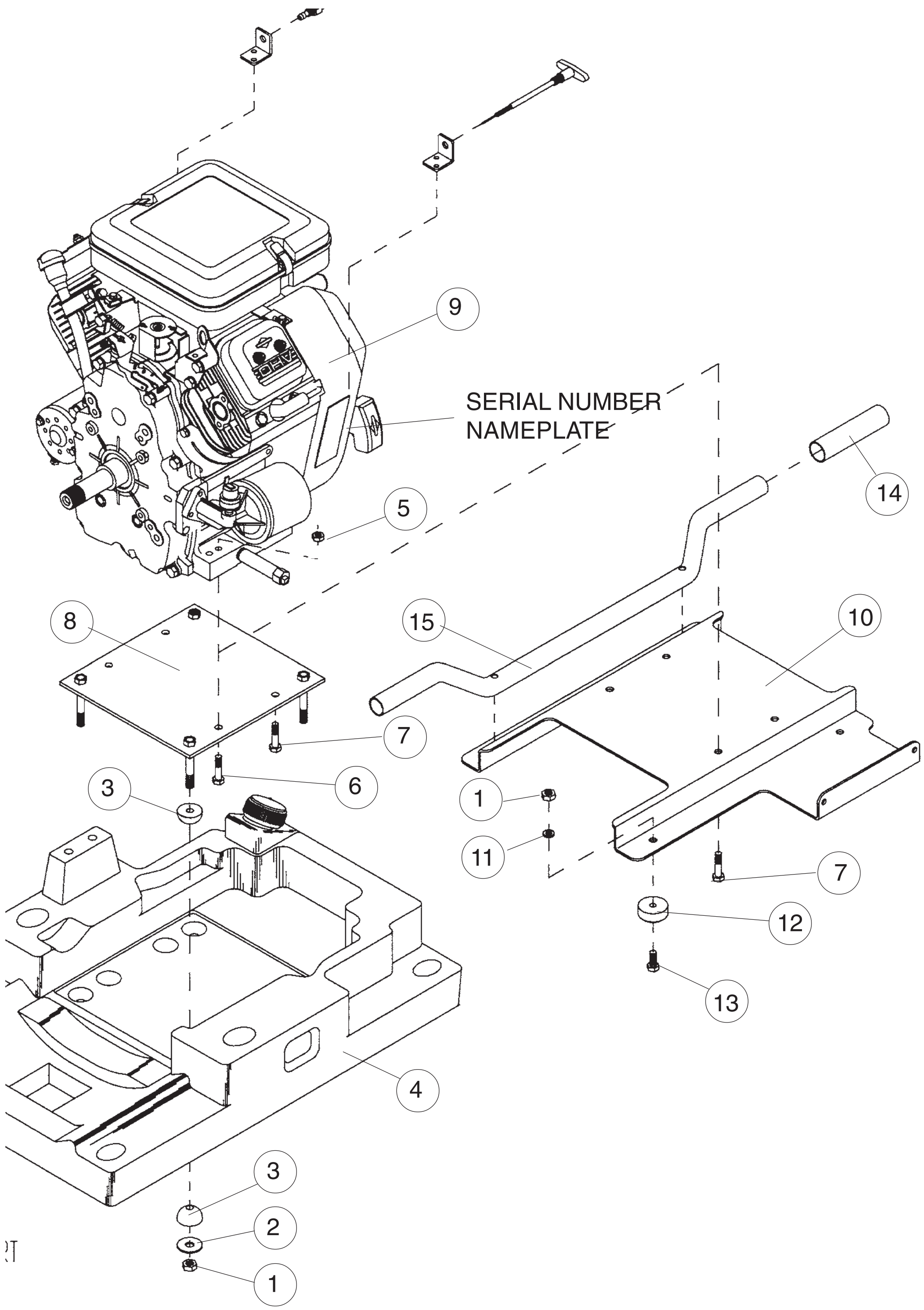
ITEM	PART NUMBER	DESCRIPTION	QTY	UNIT
1	018-8250-00-0	STUD-HP SERIES VALVE STOP M8	1.0	EA
2	218-0408-19-0	SCREW M4-.7X16 SOC.HD. LOCK	1.0	EA
3	012-0170-02-0	HANDWHEEL-HP SERIES DISCHARGE	1.0	EA
4	210-0805-11-0	NUT M8-1.25 STNLS STL LOCKING	8.0	EA
5	097-1750-01-0	HP300 VALVE WASHER	1.0	EA
6	097-1760-00-0	HP300 VALVE SEAL WASHER	1.0	EA
7	097-1750-00-0	HP300 VALVE BACKUP WASHER	1.0	EA
8	041-0480-00-0	VALVE STEM	1.0	EA
9	041-0470-00-0	VALVE SHAFT	1.0	EA
10	040-2100-00-0	2308-210 O-RING	1.0	EA
11	097-1840-01-0	2.5 INCH ISO(BSP) SEAL WASHER	1.0	EA
12	038-1220-01-0	1/8 DRAIN VALVE-PLTD BRASS	1.0	EA
13	038-1510-00-0	HP300 DISCHARGE VALVE BODY	1.0	EA
14	040-2310-00-0	-231 NITRILE SEAL RING	1.0	EA
15	007-2080-01-0	HP300 DISCH. VALVE ADAPTER	1.0	EA
16	568-1450-50-0	REPLACEMENT DISCHARGE VALVE ASSEMBLY (NOT SHOWN)		



PL-7: HP SERIES PUMP EXHAUST PRIMER ASSEMBLY

HP SERIES PUMP EXHAUST PRIMER ASSEMBLY

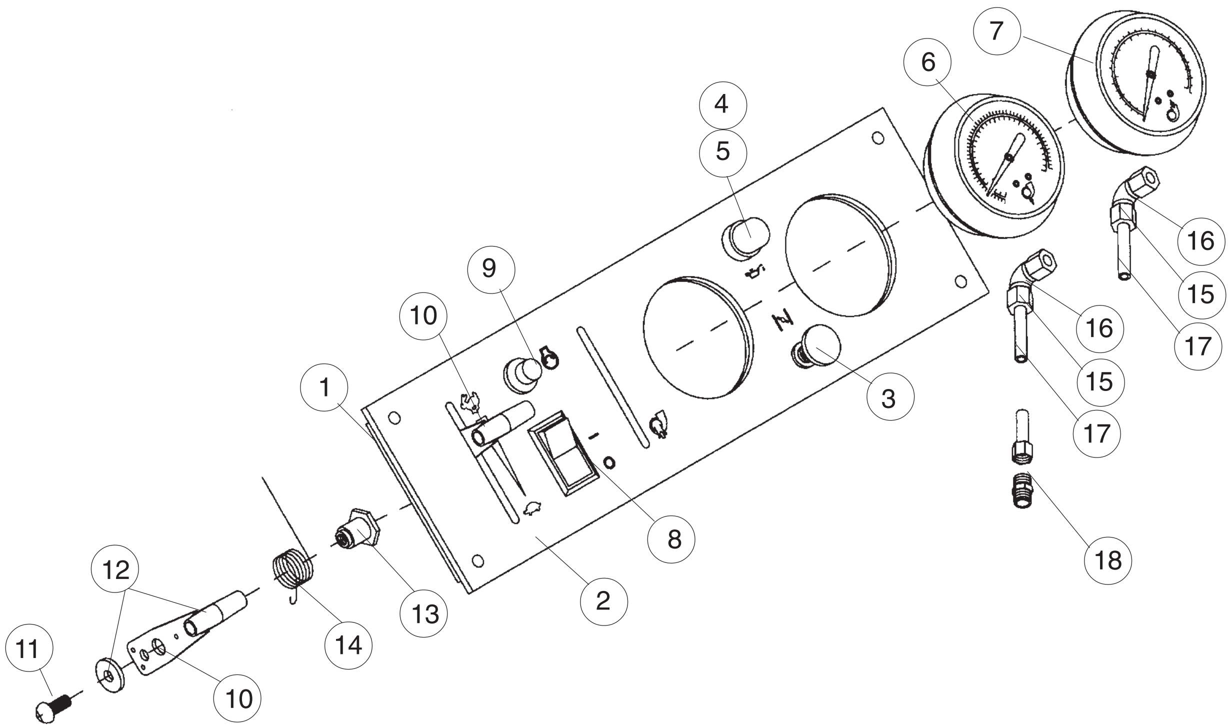
ITEM	PART NUMBER	DESCRIPTION	QTY	UNIT
1	604-0033-00-0	3/8 OD X.032 WALL COPPER TUBE	1.0	FT
2	082-0206-02-0	CONNECTOR-1/4NPT TO 3/8 TUBING	1.0	EA
3	038-1130-00-0	1/4 NPT FEMALE BALL VALVE	1.0	EA
4	082-0212-02-0	NIPPLE-1/4 NPT PLTD BRS 38 MM (1.5 IN.) LG	3.0	EA
5	082-0215-02-0	COUPLING 1/4 NPT BRASS	1.0	EA
6	276-0230-00-0	CHECK VALVE SEAT	1.0	EA.
7	039-0200-03-0	CHECK BALL-3/8 DIA VITON	1.0	EA
8	218-0404-48-0	SCREW M4-.7 X 8 PHILLIP HD SST	2.0	EA
9	242-0360-01-0	CABLE CLIP	1.0	EA
10	013-0340-10-0	PRIMER CABLE ASSEMBLY (44 IN. LG.) FOR PORTABLE PUMP	1.0	EA
	013-0340-11-0	PRIMER CABLE ASSEMBLY (74-1/4 IN. LG.) FOR “X” SERIES PUMP	1.0	EA
	513-0230-XX-0	PRIMER CABLE ASSEMBLY (XX IN. LG.) FOR “I” SERIES PUMP	1.0	EA
11	218-0812-02-0	SCREW M8-1.25 X 25 H.H. SST	7.0	EA
12	097-0560-02-0	WASHER-5/16 300 SER SST LOCK	6.0	EA
13	046-0850-01-0	EJECTOR GASKET	1.0	EA.
14	082-0348-02-0	ELBOW-3/8 NPT X 1/2 SOLDER	1.0	EA
15	007-0900-01-0	NOZZLE-EJECTOR	1.0	EA
16	038-0500-01-0	BODY-EJECTOR	1.0	EA
17	046-6240-01-0	EXHAUST PRIMER GASKET	2.0	EA
18	010-0300-01-0	SPARK ARRESTOR SCREEN (INCLUDED WITH MUFFLER, ITEM 25)	1.0	EA
19	218-0404-48-0	SCREW M4-.7 X 8 PHILLIP HD SST	1.0	EA
20	038-0550-01-0	EXHAUST VALVE BUTTERFLY	1.0	EA
21	064-6290-01-0	HAIRPIN COTTER PIN-HP EXHAUST	1.0	EA
22	012-0830-01-0	EXHAUST VALVE LEVER (PORTABLE & "X" SERIES)	1.0	EA
	012-0830-01-0	EXHAUST VALVE LEVER ("I" SERIES)	2.0	EA
23	037-0820-01-0	EXHAUST VALVE SHAFT	1.0	EA
24	038-0510-01-0	EXHAUST VALVE BODY	1.0	EA
25	524-0240-00-0	MUFFLER- B&S VANGUARD V-TWIN	1.0	EA
26	B&S-805024	MUFFLER GASKET (INCLUDED WITH ENGINE)	2.0	EA
27	142-1090-00-0	MUFFLER BLANKET	1.0	EA
28	042-0650-01-0	EXHAUST VALVE SPRING ("I" SERIES)	1.0	EA



PL-8: HP SERIES PUMP ENGINE MOUNTING

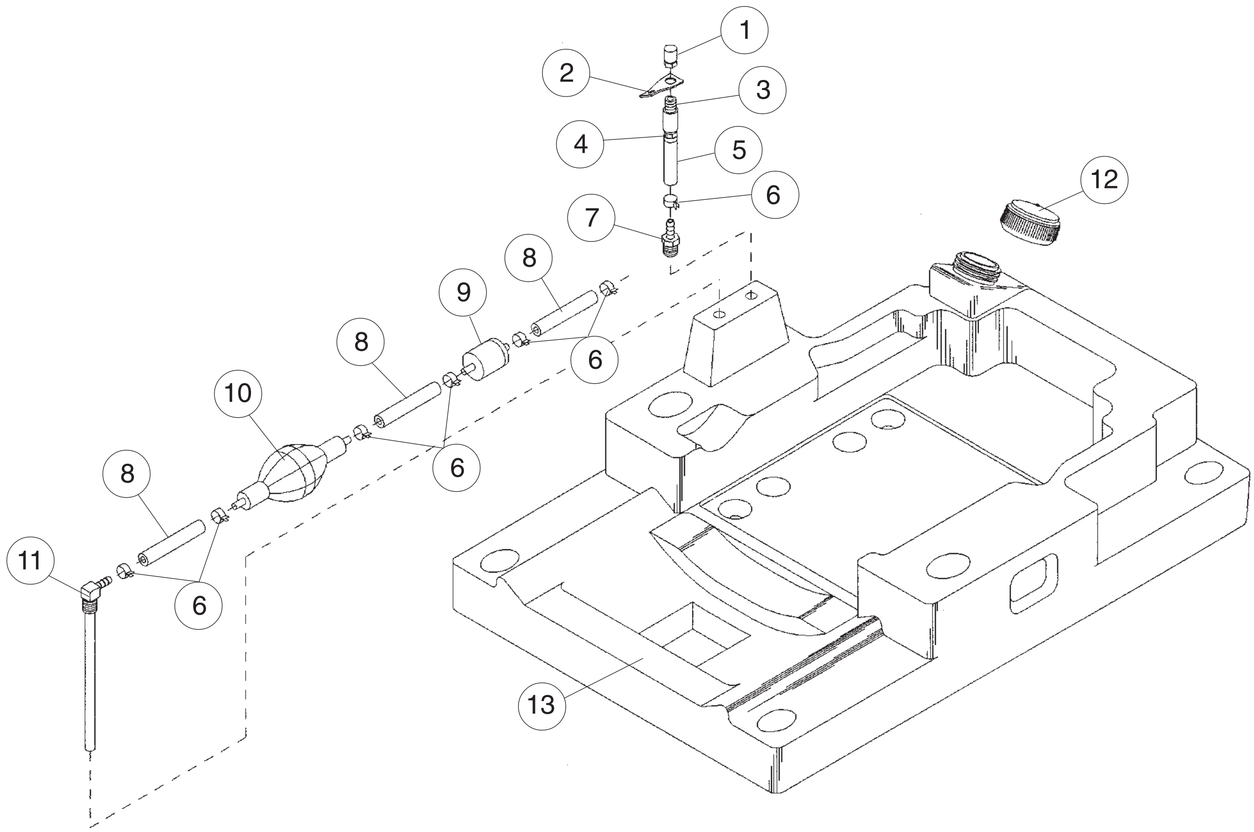
HP SERIES PUMP ENGINE MOUNTING

ITEM	PART NUMBER	DESCRIPTION	QTY	UNIT
1	210-0805-11-0	NUT M8-1.25 SST LOCK	4.0	EA
2	097-1850-00-0	WASHER-.34ID X 1.13OD X .091	12.0	EA
3	048-0800-01-0	VIBRATION MOUNT BUSHING	8.0	EA
4	108-0560-00-0	FUEL TANK PORTABLE PUMP	1.0	EA
5	210-0805-11-0	NUT M8-1.25 SST	4.0	EA
6	218-0822-02-0	SCREW M8-1.25 X 45 HH ZINC PLTD STL	2.0	EA
7	218-0817-12-0	SCREW M8-1.25 X 35 HH SST	2.0	EA
8	047-0200-01-0	ENGINE MOUNTING BASE	1.0	EA
9	045-0680-00-0	B&S MODEL 350447-0080 ENG(B35)	1.0	EA
		<u>HP "I" SERIES MOUNTING</u>		
10	547-0190-03-0	BASE - HP "I" SERIES	1.0	EA
11	097-0560-02-0	WASHER, LOCK SST	4.0	EA
12	097-0520-00-0	RUBBER PAD	4.0	EA
13	218-0180-12-0	SCREW M8-1.25 X 20 SST, LOCK	4.0	EA
	218-0822-02-0	SCREW M8-1.25 X 45 HH ZINC PLTD STL (USED WITH HANDLE KIT)	4.0	EA
14	012-0220-00-0	HAND GRIP	4.0	EA
15	512-0080-04-0	OPTIONAL HP "I" SERIES HANDLE	2.0	EA
	512-0080-03-0	OPTIONAL HP "I" SERIES HANDLE KIT	1.0	EA
16	019-0560-02-0	BRACKET	2.0	EA
17	513-0230-02-0	PRIMER CONTROL	1.0	EA
18	088-0250-00-0	FUEL COUPLING	1.0	EA
19	200-0690-03-0	OPTIONAL HP "I" BATTERY KIT WITH MOUNTING	2.0	EA



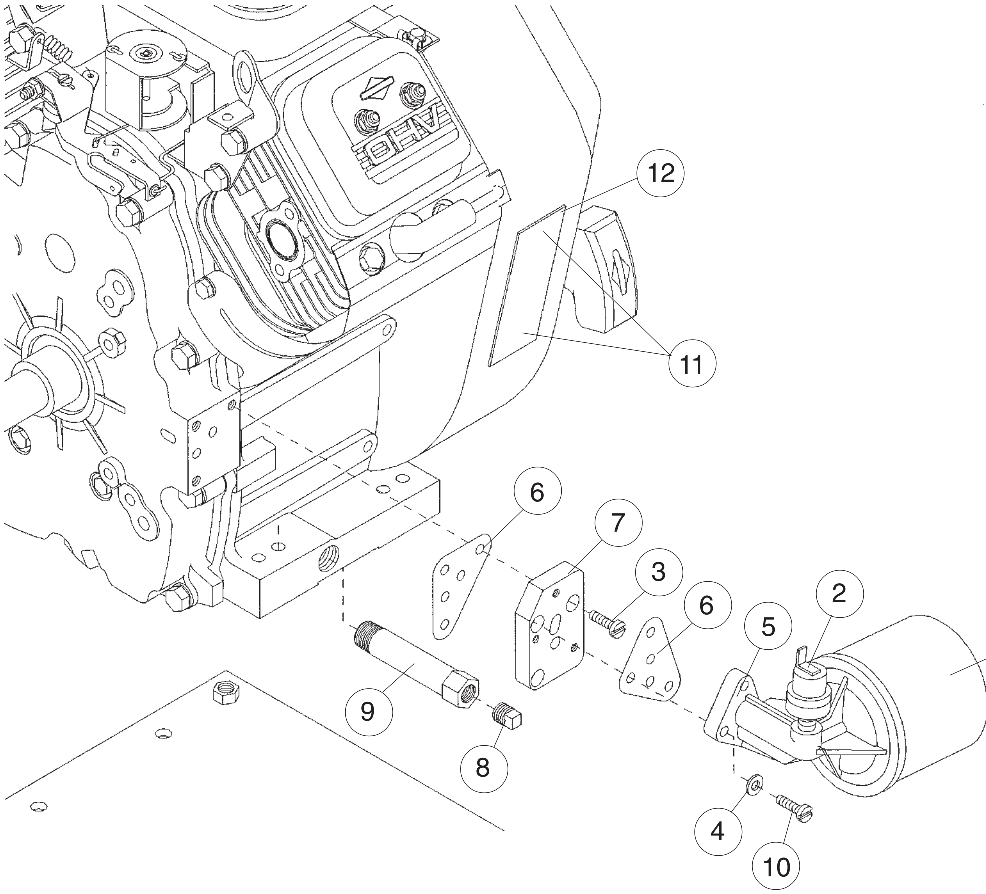
PL-9: INSTRUMENT PANEL ASSEMBLY

ITEM	PART NUMBER	DESCRIPTION	QTY	UNIT
1	019-0320-64-0	INSTRUMENT PANEL SUPPORT PLATE	1.0	EA
2	019-0320-63-0	INSTRUMENT PANEL PLATE	1.0	EA
3	513-0230-00-0	CHOKE CONTROL-18.25" LONG		
		(HP PORTABLE SERIES)	1.0	EA
	513-0230-01-0	CHOKE CONTROL-77.5" LONG (HP X-SERIES)	1.0	EA
4	200-0540-11-0	RED LIGHT ASSY	1.0	EA
5	200-0540-02-0	BULB-14 VOLT 0.24 AMP 3.4 WATT	1.0	EA
6	168-0050-20-0	30-0-150 COMPOUND GAGE,LIQ.FIL A	1.0	EA
7	168-0040-25-0	0-400 DISCH.PRESS.GAGE,LIQ.FIL A	1.0	EA
8	200-0170-01-0	SWITCH-ON/OFF HP SERIES	1.0	EA
9	200-0120-03-0	STARTER SWITCH	1.0	EA
10	013-0340-04-0	THROTTLE/EXHAUST VALVE CONTROL LEVER	2.0	EA
11	018-1205-44-0	SCREW-1/4-20 X5/8	2.0	EA
12	012-0770-00-0	"T" HANDLE, WASHER	2.0	EA
13	110-7530-00-0	NUT-1/4-20 SHOULDER	1.0	EA
14	042-0650-00-0	HP SERIES EXHAUST VALVE SPRING	1.0	EA
15	142-0410-00-0	TUBING INSERT EYLET	2.0	EA
16	604-0079-00-0	1/4 IN OD X 0.040 WALL THERMO TUBING		
		HP PORTABLE COMPOUND GAGE	17.0	IN
		HP PORTABLE DISCHARGE GAGE	19.0	IN
		HP "X" SERIES COMPOUND GAGE	23.0	IN
		HP "X" SERIES DISCHARGE GAGE	29.0	IN
17	042-0650-00-0	ELBOW	2.0	EA
18	092-0262-11-0	CONNECTOR 1/4 IN NPT X 1/4 TUBE PUSH	1.0	EA
19	168-0070-15-0	OPTIONAL HP "I" SERIES PANEL ASSEMBLY	2.0	EA



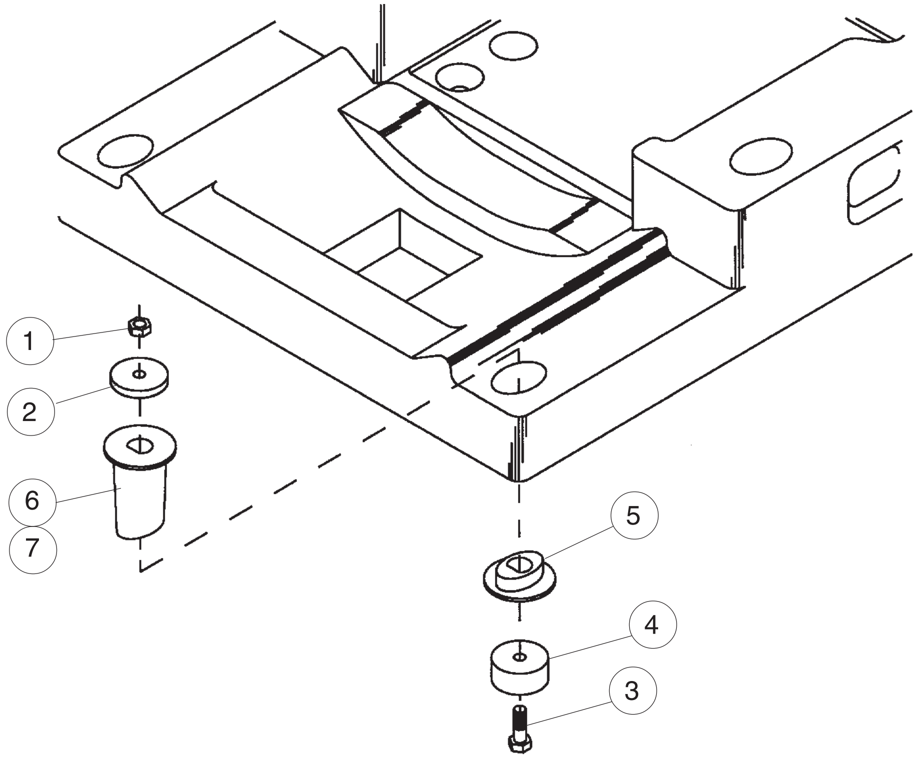
PL-10: FUEL VENT AND PICK-UP ASSEMBLY

ITEM	PART NUMBER	DESCRIPTION	QTY	UNIT
1	044-0260-02-0	1/8 AIR VENT-NO CHECK	1.0	EA
2	019-0560-06-0	FUEL VENT COUPLING BRACKET	1.0	EA
3	082-0110-00-0	COUPLING 1/8 NPT STEEL	1.0	EA
4	082-0118-02-0	ELBOW-1/8 NPT TO 1/4 ID HOSE	1.0	EA
5	340-0060-02-0	1/4 ID FUEL HOSE	1.9	FT
6	242-0620-01-0	HOSE/TUBING CLAMP	6.0	EA
7	082-0240-02-0	CONNECTOR-1/4MNPT X 1/4ID HOSE	1.0	EA
8	340-0060-02-0	1/4 ID FUEL HOSE	1.9	FT
9	BAS-493629	FUEL FILTER ASSEMBLY	1.0	EA
10	003-0080-00-0	PRIMING BULB WITH CLAMPS	1.0	EA
11	582-0220-05-0	FITTING-FUEL LINE PICK-UP	1.0	EA
12	008-0300-02-0	FUEL TANK CAP-2"	1.0	EA
13	108-0560-00-0	FUEL TANK PORTABLE PUMP	1.0	EA
14	108-0260-00-0	HP "I" SERIES FUEL TANK ASSEMBLY (NOT SHOWN)	1.0	EA



PL-11: OIL FILTER AND DRAIN ASSEMBLY

ITEM	PART NUMBER	DESCRIPTION	QTY	UNIT
1	BAS-491056	OIL FILTER	1.0	EA
2	BAS-491657	OIL PRESSURE SWITCH	1.0	EA
3	218-0608-19-0	SCREW M6-1 X 16 SOC. HD. SST LOCK	3.0	EA
4	BAS-805449	WASHER	3.0	EA
5	BAS-805292	OIL FILTER HOLDER	1.0	EA
6	046-6600-00-0	GASKET-HP SERIES OIL FILTER	2.0	EA
7	005-1150-00-0	OIL FILTER ADAPTER-HP SERIES	1.0	EA
8	217-0201-04-0	PLUG-1/4 NPT HEX SOCKET HD BRS	1.0	EA
9	082-0302-90-0	OIL DRAIN BUSHING	1.0	EA
10	BAS-805030	SCREW	3.0	EA
11	018-5002-00-0	DRIVE SCREW OR RIVET	2.0	EA
12	101-0500-00-0	SERIAL NUMBER PLATE	1.0	EA



PL-12: HP "X" SERIES MOUNTING HARDWARE

ITEM	PART NUMBER	DESCRIPTION	QTY	UNIT
1	210-0805-11-0	NUT M8-1.25 STNLS STL LOCKING	12.0	EA
2	097-1850-00-0	WASHER 1.13 OD X 0.34 ID X 0.091 IN. THK ZINC PLTD STL	4.0	EA
3	218-0850-12-0	SCREW M8-1.25 X 100 H.H.ZINC PL	4.0	EA
4	097-0520-00-0	1-FZZ-264A RUBBER PAD #1019-2W	4.0	EA
5	048-1180-03-0	HANDLE SLEEVE BASE	4.0	EA
6	048-1180-01-0	HANDLE SLEEVE	4.0	EA
7	159-1350-00-0	SPACER	4.0	EA

HALE

6/15/98

HP550 (Minuteman)
HP550X (Volunteer)
PORTABLE PUMPS

DESCRIPTION, OPERATION AND MAINTENANCE MANUAL

PumpSerial Number: ______________________________

All Hale products are quality components: ruggedly designed, accurately machined, precision inspected, carefully assembled and thoroughly tested. In order to maintain the high quality of your unit, 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 unit. ALWAYS INCLUDE THE UNIT SERIAL NUMBER IN CORRESPONDENCE.

HALE PRODUCTS, INC. • A Unit of IDEX Corporation • 700 Spring Mill Avenue • Conshohocken, PA 19428 • TEL: 610-825-6300 • FAX: 610-825-6440

Hale Products cannot assume responsibility for product failure resulting from improper maintenance or operation. Hale Products is responsible only to the limits stated in the product warranty. Product specifications contained in this material are subject to change without notice.

IDEX CORPORATION

PORTABLE PUMPS
SAFETY-RELEVANT DATA

Thank you for purchasing a HALE Pump.

HALE Portable Pumps are designed to give safe and reliable service - however, BEFORE operation it is essential that the Operating Instructions are carefully read and understood.

A risk-assessment of the pump has been conducted with the following results:

TRAINING
It is ESSENTIAL that HALE pumps are operated ONLY by TRAINED PERSONNEL.

ENGINE
When using HALE pumps driven by a gasoline-powered engine, the following safety points MUST be observed:

- DO NOT OPERATE the unit close to flammable materials or structures.
- Keep ALL UNTRAINED people AWAY from the unit during operation.
- GASOLINE is extremely flammable and MUST be HANDLED WITH CARE.
- DO NOT refuel while smoking or allow sparks or flames into the refueling area.
- DO NOT OVERFILL the fuel tank. After refueling ENSURE that the fuel cap is refitted.
- Be careful NOT TO SPILL fuel; if any fuel is spilled, ensure that the area is dry BEFORE starting the engine. HALE recommends refueling when the engine is COLD.
- DO NOT run the engine in an enclosed area as poisonous gases are given off which can cause injury.
- The exhaust system becomes VERY HOT during operation and REMAINS HOT for a time AFTER the engine has been stopped. DO NOT TOUCH the exhaust while the engine is HOT.
- The starting system is driven by battery. ALWAYS connect the battery positive (+) cable BEFORE the negative (-) and disconnect the negative BEFORE the positive.
- Batteries produce EXPLOSIVE GASES so keep sparks, flames and cigarettes away.

NOISE
When running, the engine-driven portable pump is noisy so EAR PROTECTION IS NECESSARY.

MANUAL HANDLING
The HALE Portable Pump design incorporates suitable lifting handles or points. A manual-handling sheet is provided with each model. The secondary starting method (hand-start) provided MUST BE USED WITH CARE, following the Operating Instructions.

NOTES

The FULL Pump Serial Number must be quoted on ALL communications.

1) COOLING: IT IS VERY IMPORTANT THAT A MINIMUM DIFFERENTIAL PRESSURE OF 43.5 PSI IS MAINTAINED IN THE PUMP UNIT TO ENSURE THAT SUFFICIENT PUMPED WATER IS BEING CIRCULATED THROUGH THE HEAT EXCHANGER TO PREVENT OVERHEATING OF THE ENGINE UNIT.
2) DRY RUNNING - This pump may only be run in a dry condition during the priming procedure, i.e. typically 30 seconds at approximately 5,200 r.p.m.

Warning: Care should be taken if exceeding these figures as terminal damage may occur to the gland-seal components if water is not present in the pump casing to both cool and lubricate these components.
3) ACCIDENTAL STARTING - PREVENTION
a) While work is being carried out on the engine, pump or electrical systems, disconnect the battery cables - See b) below, and the spark-plug leads.
b) When working on the HONDA engine, make sure that BOTH the BATTERY and PULSER ROTOR connections are disconnected. Battery disconnection alone DOES NOT ensure the prevention of accidental engine starting as movement of the rotor will trigger the ignition.
The pulser-rotor connections are located under the Capacitor Discharge Ignition (CDI) cover on the R.H. side of the engine.

GENERAL

The terms "L.H." (Left-hand) and "R.H." (Right-hand) used in this book apply when the pump unit is viewed from the suction tube-end.

ACKNOWLEDGMENT

We acknowledge with thanks the permission given by the HONDA MOTOR CO. LTD., to reproduce material from that company's engine publications as necessary.

DISCHARGE VALVES

By turning the hand wheel counter-clockwise, the valve can be opened for the discharge of water. When the valve is open and no water Is being discharged, the valve seal is held against the volute discharge port by a spring in the valve body.

When the pump is priming, the live seal acts as a non-return valve so that the prime is not lost. The release knob allows the valve seal to be lifted higher than normal by turning the hand wheel with the release knob pulled out. This operation is only carried out after the pump has been stopped and allows the valve seal to be raised above the volute discharge port enabling water to drain past the valves from hoses or risers.

CONTENTS

PART B - ENGINE

PART C - PARTS LIST

GENERAL DATA

ENGINE DATA

Engine	Honda BF45A (Modified)
Configuration	3-cylinder 4-stroke, OHC vertical crankshaft
Bore and Stroke	2.75" x 2.75"
Capacity	49.4 cu. in.
Rated Power	6600 r.p.m. max.*
Idle Speed	950±50 r.p.m.
Valve Clearance -Inlet (COLD)	.005" - .007"
Exhaust (COLD)	.008" - .010"
Battery (Low-Maintenance)	12 Volt 18 Amp Hr, Neg. Ground
Ignition Timing Range	5° - 32° BTDC
Spark Plug -Type	N.G.K. D7EA or equivalent
- Gap	.0236"-.0276"
Fuel Tank Capacity	3.7 gallons
Fuel Pump	Diaphragm-type driven from camshaft
Carburetors (Three)	Constant-vacuum type
Lubrication System	Pressure-feed and splash
Oil Sump Capacity (With Filter)	2.75 quarts
(Without Filter)	2 quarts
Oil Pressure (Engine at 176° F)	28 PSI at 950±50 r.p.m.
Oil Filter	Honda screw-on disposable cartridge
Cooling System	Water circulation by engine pump with thermostat, heat exchanger, oil cooler and header tank.
Cooling Water Capacity	1.3 gallons
Operating Temperature	187° F
Anti-Freeze	Ethylene Glycol-base
Starter - Electric	Electric starter 1.2 HP (Inertia-type)
- Manual	Rope-wrap on flywheel

*Full throttle r.p.m.

PUMP DATA

Pump - Model	HP550/HP550X
- Type	Single-stage, centrifugal.
Rated Output	250 gallons per minute (GPM) at 145 PSI and 10 feet above sea level.
Pump Shaft Seal	Spring-loaded, self-adjusting, carbon-faced gland with silicon-carbide counterface.
Discharge Valves	Screw-down DIN-type (2-OFF).
Priming	Exhaust-gas ejector and automatic priming valve.
Thermal Relief Valve (Optional) Operating Temperature	133° F.
Length (Cradle Handles Closed)	26.75"
Width	19.5"
Height (Complete Unit)	23.75"
Weight (With Battery, Oil, Coolant and Fuel)	247 lbs.

ENVIRONMENTAL PROTECTION

It is ILLEGAL to pour engine oil and other contaminants on to the ground, down sewers and drains or into water courses.

Disposal of these MUST be made through AUTHORIZED waste-disposal contractors to licensed waste disposal sites.

IF IN DOUBT contact the Local Authority for advice on disposal facilities.

HEALTH AND SAFETY

To avoid injury, HALE recommends that operators should take ALL necessary precautions to safeguard themselves and others and to follow the operating procedures laid down in this book.

When handling gasoline, batteries or hot machinery:-

a) DO NOT SMOKE.

b) DO NOT EXPOSE volatile fluids or battery gases to an open flame.

c) DO NOT TOUCH hot parts of machinery.

d) AVOID PROLONGED SKIN CONTACT with fluids, especially if they are known to be, or are suspected of being, either corrosive or carcinogenic.

e) PROTECT THE EYES as necessary.

f) DISCONNECT THE BATTERY when working on the electrical system to avoid short-circuits.

g) DO NOT LIFT heavy weights without suitable assistance.

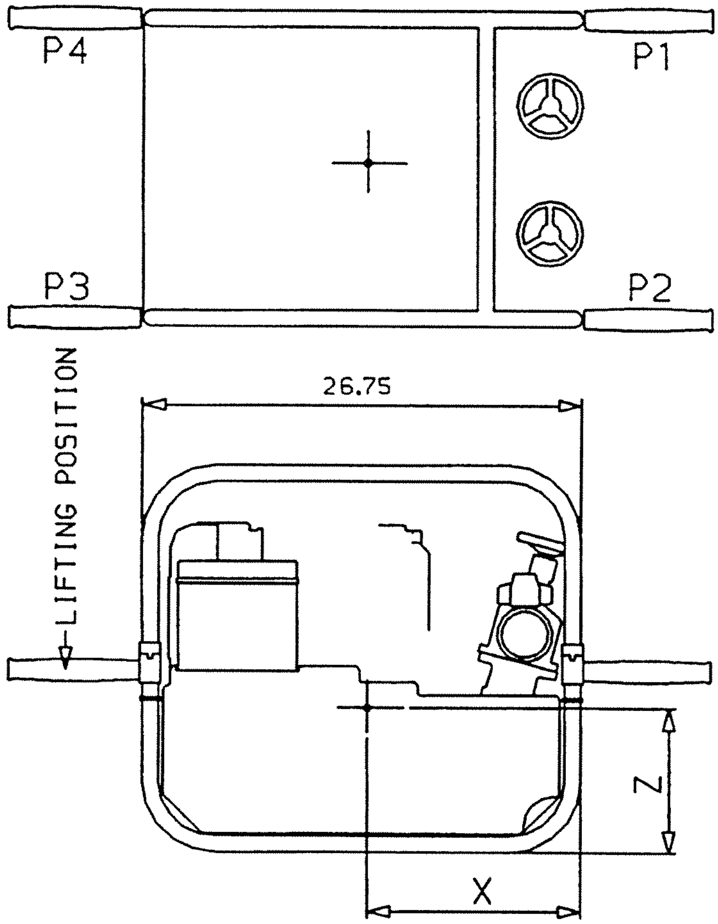
h) DO NOT INHALE fumes or gases.

i) DO NOT REMOVE protective guards or shields.

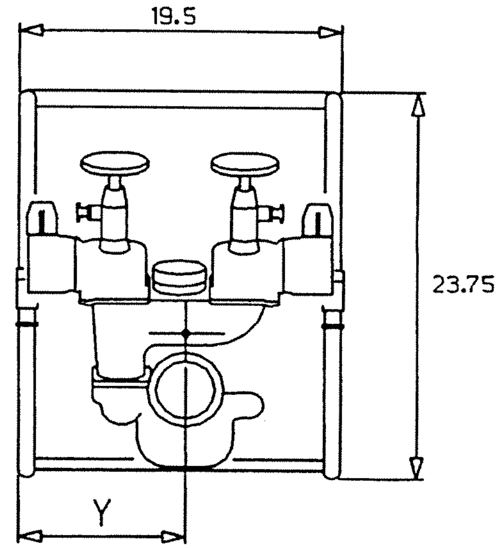
j) DO NOT SPILL fuel when refueling - fuel vapor or spilled fuel can easily be ignited.

k) CLEAN UP IMMEDIATELY any spilled fuel, oil or anti-freeze.

l) WASH YOUR HANDS IMMEDIATELY after handling fuel, oil or anti-freeze.



HALE RECOMMENDS TEAM LIFTING TO BE ADOPTED IF NO OTHER FORM OF LIFTING IS AVAILABLE. USE OF THE LIFTING FACILITIES THAT ARE PROVIDED ON THE UNIT IS STRONGLY ADVISED.



		DRY	WET
WEIGHT (LBS)		207	247
CENTER OF GRAVITY (INCHES)	**X**	13.9	14.5
	Y	9.3	8.9
	Z	12.5	12.4
LIFTING FORCES (LBS)	**P1**	47.4	58.4
	P2	54.0	62.8
	P3	56.2	65.0
	P4	49.6	60.6

CONSTRUCTION	
PUMP CASING	ALUM
IMPELLER	ALUM
PUMP SHAFT	ST. STL
WEARING RINGS	FIBER
MANIFOLD	ALUM
CRADLE	ST. STL
ENGINE HEAD	ALUM
ENGINE BLOCK	ALUM

NOTE: THE WET WEIGHT IS INCLUSIVE OF THE FULL CAPACITY OF ENGINE OIL, COOLING WATER AND FUEL.

RECOMMENDED
LUBRICANTS, FUEL AND ANTI-FREEZE

ENGINE LUBRICANTS

STANDARD	AMBIENT TEMPERATURE	LUBRICANT VISCOSITY
AP1,SG	14°F (-10°C) and above	20W/40, 20W/50
SF/CC,CD	-5°F (-20°C) and above	10W/40
	-5°F to +86°F (-20°C to + 32°C)	10W/30
	-13°F (-25°C) and above	15W/40,15W/50

GASOLINE FUEL

Premium Grade Gasoline
with Minimum Research Octane Number of 86 (Unleaded *).

*NOTE: The pump can be run on 4-star fuel but not for sustained periods as damage to exhaust valves and seats can result. HALE therefore cannot accept responsibility for any claims resulting from sustained use of leaded fuel in this pump.

ANTI-FREEZE

Ethylene-Glycol base type

DESCRIPTION

PUMP

The HALE HP550 Model is a single-stage, centrifugal pump powered by a Honda engine.

The pump suction tube, volute, discharge valves, manifold and impeller are all manufactured from corrosion-resisting aluminum alloy, while the pump shaft is of stainless steel.

The impeller is hydraulically-balanced to reduce end-thrust and pump shaft-sealing is accomplished by a spring-loaded, self-adjusting, carbon-faced gland running against a silicon-carbon counter face.

Optional extras for the HP550 Pump are as follows:

1) TRV42 Thermal Relief Valve.

2) Floodlight assembly.

3) Remote Fuel Tank and Hose Assembly - 6.25 gallon capacity.

4) Wheelbarrow Assembly

5) Axle & 2 Wheel Assembly

ENGINE

The modified Honda engine is an in-line, vertical crankshaft, 3-cylinder, 4-stroke unit with a belt-driven overhead camshaft and triple constant-vacuum carburetors.

Engine capacity is 808cc with 2.75" bore and stroke.

The aluminum cylinder block, incorporating the crankcase, is installed with cast-iron cylinder liners and a robust crankshaft is supported on four main bearings.

Aluminum pistons are used and the cylinder head is of heat-treated aluminum.

The electronic ignition system provides excellent starting characteristics and eliminates the need for any maintenance.

An electronic overspeed-and-engine protection system is also fitted. This actuates in the event of high coolant temperature or low oil pressure by progressively reducing the engine speed to 2,800 r.p.m. until the problem is solved, then returning gradually to the set speed.

INSTRUMENTS AND CONTROLS

Switches, gauges and controls installed (See Fig. A):

Compound Gauge (1)	Indicates vacuum in pump suction tube during priming.		
Pressure Gauge (2)	Indicates pump unit water pressure.		
Throttle Control (3)	Controls engine speed.		
START Button (4)	Press - until engine starts.		
Ignition Switch (5)	Toggle to LEFT for ignition ON.		
	Toggle to RIGHT to switch OFF and to STOP the engine		
Choke Control (6)	Operation:	FULLY OUT	- Cold Engine Start
		MIDWAY	- Warm-up
		FULLY IN	- Choke Disengaged
Hours Meter (7)	Indicates TOTAL hours engine running time.		
Coolant Temperature Lamp (8)	Indicates high engine coolant temperature.		
Oil Pressure Lamp (9)	Indicates low engine oil pressure.		
Panel Lamps (10)	Provides instrument panel and gauges illumination when ignition switch is in 'ON' position.		
Primer Rod Control (11)	Pulling the control rod activates the pump priming system.		
Lighting Socket (12)	Provides a power source for the optional flood light or for battery charging.		

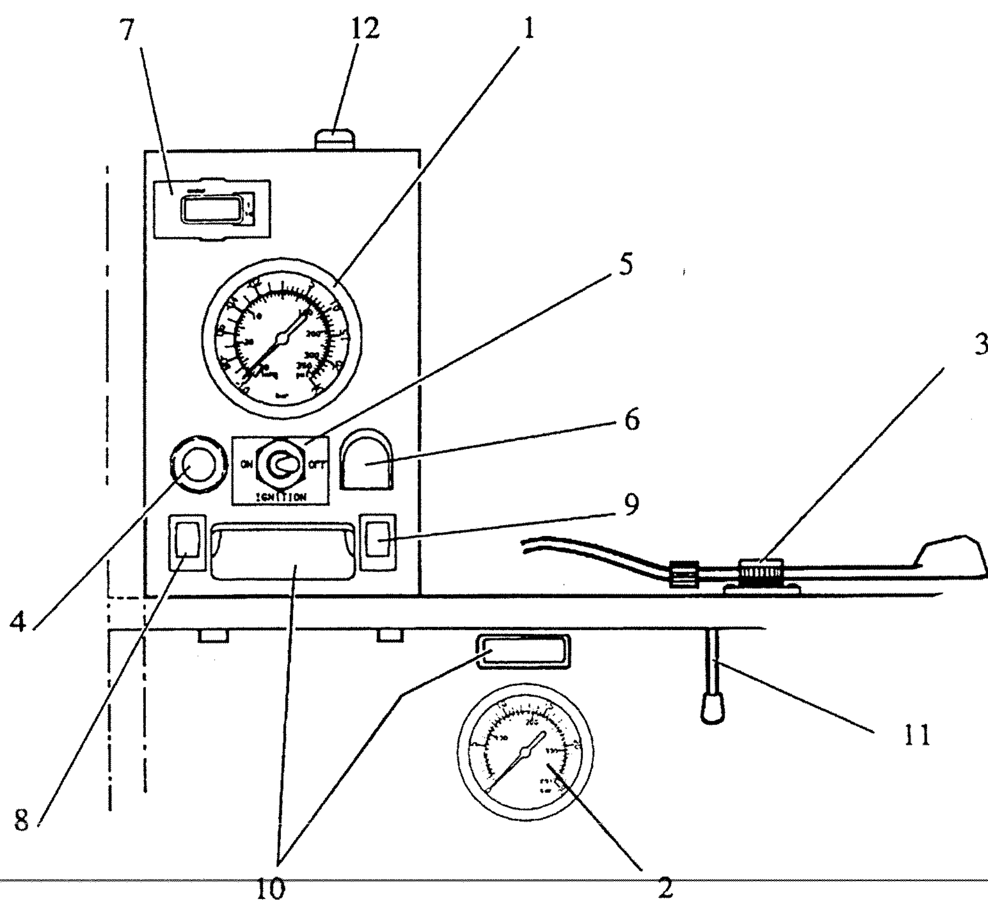


Fig. A. Instruments, Gauges and Controls

. COOLING SYSTEM

To enable normal operating temperatures to be maintained over extended running periods, a closed-circuit engine-cooling system is used.

The system incorporates a heat exchanger, oil-cooler and header tank.

Raw water is piped down from the volute through a strainer to the engine oil cooler, then on through the heat-exchanger tubes and returned to the suction tube.

The closed-circuit engine-cooling system takes coolant from the engine which is then passed through the heat exchanger where it comes into contact with the internal tubes containing the pumped raw water.

Note: The raw water and engine coolant do not come into direct contact but the heat transfer takes place through the walls of the internal tubes.

The coolant then passes through the coolant header tank and is returned to the engine water pump.

IMPORTANT NOTE:
It is VERY IMPORTANT that a DIFFERENTIAL PRESSURE OF 43.5 PSI is maintained in the pump unit to ensure that the pumped water is being circulated through the heat exchanger to prevent overheating of the engine unit.

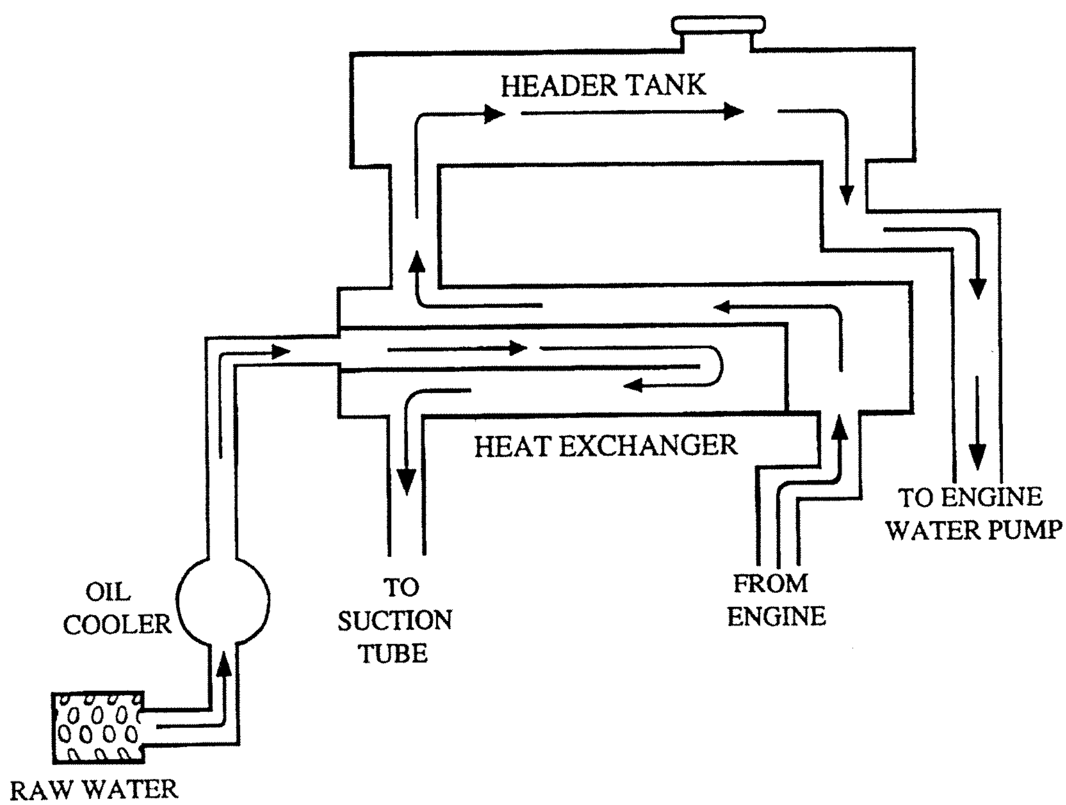


Fig. B. Water and Coolant Circuit

DISCHARGE VALVES

Screw-Down DIN-Type

By turning the handwheel counter-clockwise, the valve can be opened for the discharge of water.

When the valve is open and no water is being discharged, the valve seal is held against the volute discharge port by a spring in the valve body.

When the pump is priming, the valve seal acts as a non-return valve so that the prime is not lost.

The release knob allows the valve seal to be lifted higher than normal through the action of the handwheel being turned with the release knob pulled out. Note: This operation is only carried out after the pump has been STOPPED.

This operation will allow the valve seal to be raised above the discharge port and enable water to drain past the valve from hoses and dry-risers.

PRIMING

An exhaust gas ejector-type priming system is installed incorporating an automatic priming valve.

The priming system is activated by pulling the primer control rod to the limit of its travel with the engine throttle approximately 3/4 open.

When priming is complete, the control rod is released and returns to its normal position under the influence of a return spring.

Discharge of water is then controlled by the position of the engine throttle control and discharge-valve opening.

FLOODLIGHT UNIT (Optional)

The floodlight is located adjacent to the engine valve cover.

It may be raised to a height of 48" measured from floor level, rotated through 360° and the actual lamp unit tilted through 90°.

The power-supply cable for the lamp plugs into a socket on the instrument panel.

The socket may also be used for battery-charging purposes.

PREPARING THE PUMP UNIT FOR RUNNING

Check the following points BEFORE starting the engine:

COOLING SYSTEM

The heat exchanger and header tank are mounted at the R.H. side of the engine.

Unscrew the filler cap of the header tank and, if necessary, add CLEAN water until the level is approximately 1/2" below the bottom of the filler neck.

Use soft rainwater - if available - NEVER use dirty or contaminated water.

Use only anti-freeze suitable for aluminum engines and mix with water in the correct ratio* for the prevailing or expected minimum temperature. (See - PROTECTION AGAINST FROST).

A compartment is incorporated in the header tank for the storage of the rope which can be used for manual back-up starting. (See STARTING THE ENGINE - Manual Back-Up Starting).

* Anti-freeze MUST be mixed in the proportions stated for the particular brand recommended.

ENGINE LUBRICATING OIL

The lubrication oil filler is positioned at the top of the engine valve cover.

Check the oil level every 5-HOURS RUNNING TIME or EVERY TIME that the unit is used. The oil dipstick is positioned on top of the engine oil sump at the L.H. side of the engine.

To check the oil level proceed as follows:

> **IMPORTANT**: BEFORE checking the oil level with the dipstick - ENSURE that the engine is SWITCHED OFF and that the unit is LEVEL

Note: THE OIL LEVEL CANNOT BE CHECKED WHILE THE ENGINE IS RUNNING.

Always allow the engine to stand for a few minutes after switching off so that the oil remaining around the engine may return to the sump.

Withdraw the dipstick, wipe clean, re-insert it and then withdraw it again to check the oil-level reading.

If the oil level is NOT up to the TOP mark of the dipstick, add fresh oil to the correct level.
(See list of RECOMMENDED LUBRICANTS).

IMPORTANT: NEVER ALLOW THE LEVEL TO FALL BELOW THE BOTTOM MARK ON THE DIPSTICK

Note: Do not over-fill when topping-up. Engine-sump capacity is 2.75 quarts (Inc. filter).

FUEL TANK

~~The fuel tank is mounted at the L.H. side of the unit with a capacity of 3.7 gallons.~~

Check that a sufficient quantity of fuel is present for the anticipated requirements.

No fuel tap is installed due to the position of the fuel tank. Fuel is drawn from the tank by the engine fuel pump when the engine is running.

The fuel-level gauge is incorporated in the screw-on filler cap.

IMPORTANT: DO NOT USE LEADED FUEL - The ignition timing is set for the use of UNLEADED GASOLINE.

Note: The fuel tank is connected to the engine via a quick-release connector which can be unfastened to allow an external tank to be connected.

THERMAL RELIEF VALVE (Optional)

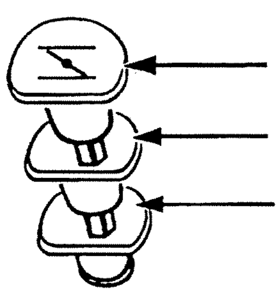
The raw-water pump system can incorporate a TRV42 Thermal Relief Valve.

Should the pump-water temperature exceed 133°F, the valve releases water via a transfer pipe into the silencer. The resultant excess vapor (steam) produced provides a visual indication of excess pump-water temperature. Alternatively the pipework may be modified to discharge the water to the ground.

Note: This situation can occur if the pump is left running for excessive periods of time with the hose-nozzle controls or the discharge valves in the closed position.

STARTING THE ENGINE

First, check the fuel, oil and water levels (See under PREPARING THE PUMP UNIT FOR RUNNING). Then pull the choke control FULLY OUT (Cold-Starting Position) - See Fig. C.



	POSITION		*STATUS*
-	FULLY OUT	-	**COLD START**
-	MIDWAY	-	**WARMING UP**
-	IN	-	**NORMAL RUNNING**

Fig. C. Choke-control Positions

Open the throttle slightly.

Switch on the ignition by pushing the ignition-switch toggle to the LEFT.

To start the engine press the starter button on the control panel and release it as soon as the engine starts. The oil pressure light should extinguish immediately - if it does not: stop the engine and investigate the reason.

Note: When restarting a HOT engine, DO NOT USE the choke control - to do so may prevent the engine from starting.

IMPORTANT: DO NOT allow the pump to run in a DRY condition, except during the normal priming procedure.

Manual Back-up Starting

A compartment, integral with the coolant tank, is provided for the storage of the starter rope for emergency starting.

Release the flexible tab handle securing the flywheel cover and open the cover to reveal the flywheel.

Unscrew the RED cap and withdraw the rope from the storage compartment. Ensure that the ignition switch is in the OFF position to prevent accidental starting.

Insert the knot of the rope into one of the cutaways in the periphery of the flywheel and wrap the remainder of the rope counter-clockwise around the flywheel in the groove provided.

Switch ON the ignition and open the throttle slightly.

Give the rope a sharp, but continuous pull to start the engine.

Return the cover to its closed position and secure it with the flexible tab handle.

WARNING: TAKE EXTREME CARE TO KEEP CLEAR OF THE ROTATING MACHINERY WHEN THE ENGINE STARTS.

Always replace the rope in the compartment provided and then reinstall the cap.

RUNNING THE ENGINE

If the engine is started with the intention of running it only for a short period, it is important that it reaches its normal operating temperature before being switched off.

This is to allow the corrosive condensate, generated during normal running of the engine and evaporating as the engine warms up, to be expelled from the system. These corrosive deposits if left in the system will cause deterioration of engine parts.

IMPORTANT: DO NOT allow the pump to be run DRY during the above procedure.

PRIMING THE PUMP FROM OPEN WATER

Set the pump approximately level - if necessary, use packing under the frame.

Remove the suction cap, connect the suction hose and close the discharge valves.

Ensure that the suction connection is tight and that the end of the suction hose, with strainer attached, is submerged to a sufficient depth below the level of the water supply.

If the suction hose-end is too near to the surface of the water supply, a vortex may form. Conversely, if the end of the suction tube is on the bottom (or even too near the bottom) then sand or gravel for example, may be drawn into the pump. In this situation, a basket filter should also be used.

We recommend that the use of those pumping positions resulting in any part of the suction hose being higher than the pump-suction connection are avoided - to prevent air pockets in the suction hose.

Priming

Pump priming is accomplished using the following method:

1) Start the engine and open the throttle approximately 3/4 of its travel.

2) Pull the primer operating rod out to its limit - there is no need to use excessive force.

3) Move the throttle-setting to give maximum smooth running and watch the gauges.

4) At the first positive 'flick' of the pressure gauge, release the primer rod.

5) Partially-open a discharge valve to release trapped air and ease back the throttle.

6) Fully-open the discharge valve(s) by turning the handwheel(s) counter-clockwise.

The pump will now be discharging water. Pressure should be regulated by opening and closing the discharge nozzles and throttle as required.

Note: When pumping, GRADUALLY make adjustments to the engine speed - NEVER suddenly jerk the throttle either open or closed.

HYDRANT PUMPING

Remove the suction cap.

Connect the pump with a hydrant-to-suction adapter.

Fully-open the discharge valves.

Start the engine and set the throttle control so that the engine is idling.

Turn on the hydrant.

Open the throttle only so far as is necessary to maintain the desired working pressure.

Note: The compound gauge needle MUST NOT be allowed to drop below zero, otherwise a vacuum will be created on the suction side of the pump causing damage to the main water supply or the collapse of the supply hose.

PROTECTION AGAINST FROST

As a precautionary measure when frost is first anticipated, drain the pump-volute casing by tipping the whole unit towards the suction-end, or remove the drain plug situated at the base of the volute casing. Then open the drain valve located on the volute.

Use an anti-freeze solution in the engine coolant system in the correct proportions stated for the particular brand recommended.

As the engine is constructed of aluminum alloy, it is essential that the anti-freeze solution is of the type suitable for use with this material.

If no anti-freeze is available, it will be necessary to drain the engine.

Always drain the cooling system while the engine is WARM.

IMPORTANT: NEVER attempt to run the engine without water.

Note: After draining, attach a **'WATER DRAINED'** notice to warn others that the system must be refilled before restarting the engine.

MAINTENANCE

IMMEDIATELY AFTER USE

When the pump has been used to pump sea-water, contaminated or very dirty fresh water, flush it through thoroughly using FRESH, CLEAN water.

EVERY 5 HOURS RUNNING TIME (OR WEEKLY)

Oil Check

Check the engine oil level. To do this, carry out the following procedure:

1) Stop the engine and withdraw the dipstick, wipe it, re-insert it and again withdraw it.

2) Check if the oil is below the bottom mark on the dipstick. If necessary, add fresh oil to the correct level - See list of RECOMMENDED LUBRICANTS.

IMPORTANT: THE OIL LEVEL CANNOT BE CHECKED WHILE THE ENGINE IS RUNNING.

3) It is advisable to let the engine stand for a few minutes to allow oil circulating in the engine to drain back into the sump before checking on the dipstick to obtain a true reading. **Note**: Ensure pump is on a LEVEL SURFACE before checking oil level.

Coolant Check

WARNING: NEVER remove the filler/pressure cap while the cooling system is HOT or with the engine RUNNING. Allow the pressure to reduce before unscrewing the cap and protect yourself against coolant or vapor.

Check the coolant level. To do this, carry out the following procedure:

1) Remove the filler cap from the header tank and, if necessary, add coolant to bring the level to approximately 3/4" below the bottom of the filler neck.

2) Replace filler cap.

Note: ALWAYS top-up the solution of water and anti-freeze so as NOT to dilute the coolant ALREADY IN the system. NEVER add dirty or contaminated water.

Fuel Check

Check the level in the fuel tank by checking the fuel gauge on the tank filler cap.

IMPORTANT: DO NOT SMOKE OR USE A OPEN FLAME WHEN WORKING WITH GASOLINE.

EVERY 50 HOURS RUNNING TIME OR EVERY 6 MONTHS -Whichever occurs first.

Drain the engine oil - this should be carried out while the engine is WARM:

1) Remove the drain plug (located on the side of the sump) and drain out the old oil.

2) Reinstall the sump plug securely and then refill the sump with fresh oil - See list of RECOMMENDED LUBRICANTS.

3) Refill until the oil level is at the correct-reading mark on the dipstick. This will take approximately 2 quarts, excluding the filter.

4)Replace the screw-on filter cartridge (oil capacity 0.75 quarts).

5) Clean the spark plugs and, if necessary, adjust the gaps - the correct gap setting is 0.023" to 0.027". **Note**: Adjust the gap by bending the overhead electrode - NEVER the center electrode.

6) Clean the spark-plug seating surfaces in the cylinder head, taking care that foreign matter does not enter the engine cylinder bores.

GENERAL CHECKS

1) Tightness of ALL pipe connections.

2 Electrolyte level in the battery - top-up if necessary.

WARNING: DO NOT SMOKE OR ALLOW AN OPEN FLAME NEAR THE BATTERY WHEN EITHER CHECKING OR CHARGING IT - EXPLOSIVE GASES CAN BE RELEASED.

3) Check the inlet and exhaust-valve clearances with the engine COLD and adjust as necessary.

DESCRIPTION

The HALE HP550 Fire Pump is a compact, portable, self-contained unit.

It is designed to provide a reliable, continuous performance of 250 GPM at 150 PSI from a 10 ft draft. When connected to a tank, the HP550 can provide over 500 GPM at 90 PSI.

The pump shaft is mounted vertically and the impeller operates in a horizontal plane.

Discharge

The volute and discharge manifold are manufactured from aluminum and two DIN-style discharge valves are provided; the discharge valves may be reoriented rearwards if required.

Priming

An exhaust gas ejector-type priming unit is installed and the system incorporates an automatic priming valve.

Fuel

The fuel tank has a capacity of 3.7 gallons and the filler cap has a built-in fuel gauge. A quick-release fuel connector allows an optional 6.25 gallon remote fuel tank to be connected if required.

Starting

A flywheel-mounted 10 amp alternator charging an 18 amp/hr battery (which is mounted on top of the fuel tank) and a 0.9kw inertia-engaging type starter motor are provided.

Back-up starting using a rope-wrap on the flywheel may be used, if necessary, after raising the hinged flywheel cover.

Engine Protection

The entire is provided with an electronic over-speed and engine protection system initiated by a high coolant temperature or low oil pressure, (See PART B - ENGINE).

Instrumentation

The instrumentation comprises: compound gauge, pressure gauge, high coolant temperature and low oil pressure warning lamps, choke and throttle controls, starter button and hours counters.

Illumination

Illumination for the instruments along with a socket for both the battery-charging and the optional floodlight is provided.

Cooling

The cooling system incorporates header tank and shell-and-tube type heat exchanger. The coolant capacity of 5.25 quarts is circulated by the engine water pump and a filler/ pressure-release cap is installed to the header tank. An engine oil cooler is also incorporated in the system.

Tools

Suction-tube wrench mountings are provided to mount two wrenches (optional) longitudinally along the cradle frame base.

MAINTENANCE
PUMP
SECTION 1

VOLUTE AND WEAR RING

To Remove

Drain all fluids.

Disconnect and remove the battery.

Remove the fuel tank (See SECTION 14).

Remove the discharge manifold and discharge valves (See SECTION 9).

Unscrew the union nuts and disconnect the priming pipe.

Remove priming valve. (See SECTION 6).

Unscrew the union nut and detach the compound gauge flexible pipe at the volute-end.

Turn the complete pump unit on its end - obtain assistance to perform this task.

Note: The Pump Suction eye should now be uppermost with the engine cylinder head-cover at the lowest point.

Remove the screws and detach the skid-plate.

Unscrew and remove the nuts, washers and bolts from the pump mountings and remove pump mountings.

Remove the five M10 nuts, one M10 socket-head screw and washers securing the pump volute.

Carefully allow the engine and pump unit to move away from the frame with the engine mountings acting as pivots.

Maneuver the volute from its location over the impeller and withdraw it from the cradle frame.

Maintenance

The bottom wear ring is installed to the volute and retained by two M6 screws and washers.

The front wear ring should be checked for both wear and damage by measuring the inner diameter (A) at several places (Fig. 1-1).

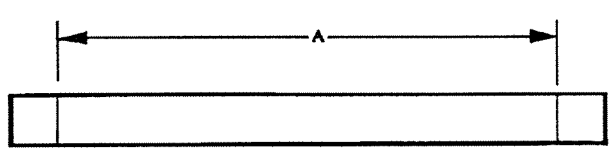


Fig. 1-1. Measuring the Wear Ring

If the measurement obtained at any point is more than 4-5/32" or if any serious physical damage is apparent, a new wear ring MUST be fitted.

To Reinstall

Reinstallation is a reversal of the removal instructions.
Note: Ensure that ALL parts are thoroughly cleaned BEFORE reinstallation and ALWAYS install a NEW 'O' ring.

IMPELLER

To Remove

Remove the volute (See SECTION 1).

Prevent the pump shaft from rotating and, using an accurately-fitting wrench, unscrew the Ml6 self-locking nut from the pump shaft.

Recover the washer from the shaft and withdraw the impeller - taking care not to lose the key.

Recover the silicon-carbide seal and associated rubber seating from the rear face of the impeller If necessary.

Maintenance

Measure the impeller front boss (A) and rear boss (B) in several places.

If the FRONT boss measurement is LESS THAN or the REAR boss measurement is MORE THAN, the figures quoted below, install a new impeller.

HP 550 Model	**Impeller Boss Diameter**
Front Boss (A)	4.086" Min. O/D.
Rear Boss (B)	4.206" Max. I/D.

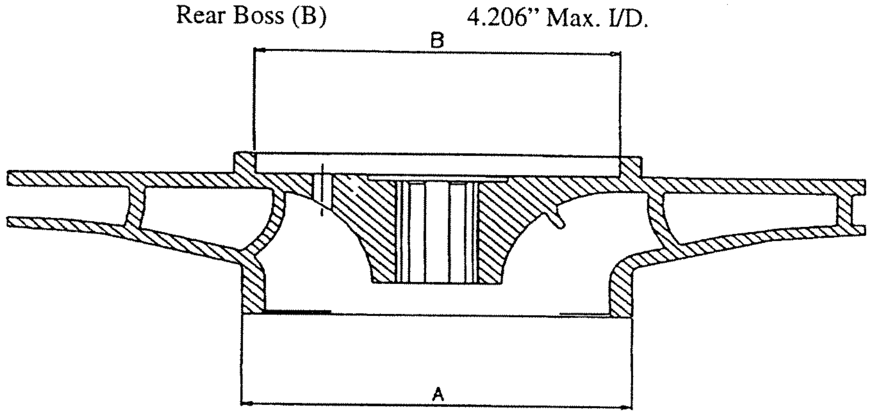


Fig. 2-1. Measuring Impeller Boss Diameters

Inspect the impeller for damage due to foreign matter, contaminated water or cavitation.

Check for objects trapped between the vanes and, if found, remove by pushing the object from the periphery towards the center of the impeller.

Check the impeller and pump-shaft key ways for any wear which could have resulted from a loose impeller nut. Ensure that the key is not damaged.

Note: If wear or damage is found, the appropriate components must he replaceed.

IMPORTANT: Thoroughly clean ALL components BEFORE reassembly taking care not to mark the pump shaft.

To Reinstall

~~Reinstallation is a reversal of the removal instructions.~~

Ensure that the washer is reinstalled to the pump shaft and that the nut is fully tightened.

IMPORTANT: Do not forget to reinstall the silicon-carbide seal into its rubber seating - located in the rear face of the impeller (See SECTION 3).

SECTION 3

CARBON SEAL, SEAL HOUSING AND UPPER WEAR RING

To Remove

Remove the Volute and wear ring (See SECTION 1) and remove the impeller (See SECTION 2). Withdraw the 'O' ring and retaining washer from the pump shaft.

Unscrew the four M6 screws and remove the upper- wear ring. If the wear ring is a tight install in the housing DO NOT lever on the outside of the ring, place two of the screws removed in the two M6 tapped holes and 'jack' the wear ring out evenly.

Remove the two M6 screws - these do not have the large washer under the head - from the carbon seal-and-carrier assembly.

Use two of the long M6 screws previously removed from the wear ring and screw them into the two vacant holes in the carbon seal-and-carrier assembly. Once the screws contract the bosses, continue to turn each screw by an equal amount, to 'jack' the assembly from its location.

It is not necessary to remove the two remaining screws and washers from the carbon seal-and-carrier assembly. If for any reason it is considered necessary to part the assembly, note that the carbon-seal carrier is under spring tension and MUST BE RESTRAINED WHEN REMOVING THE SCREWS.

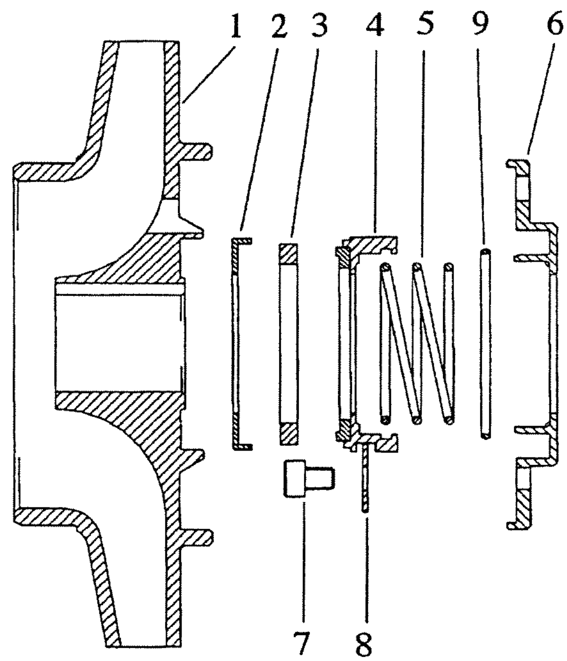
Remove the water flinger from its groove in the pump shaft.

If the mating silicon-carbide seal at the rear of the impeller requires replaceing; pry it from the seating in the impeller. The seating should also be removed, since it should be replaceed at the same time as the seal.

Maintenance

Install (a) a new 'O' ring to the internal groove of the seal housing, (b) the external U ring on the boss and (c) the large 'O' ring, around its periphery.

Install a new oil seal to the seal housing with the lip facing towards the finned-area of the housing.



1. Impeller
2. Rubber cup
3. Carbon seal
4. Holder and carbon insert
5. Spring
6. Carbon seal housing
7. Cap head screw
8. Retainer
9. 'O' ring

Fig. 3-1. Carbon Seal Assembly

If there is excessive leakage past the carbon seal, examine all component parts for wear, damage or deterioration - Fig.3-1 refers.

First, inspect the silicon-carbide seal (3) and the carbon insert (4) for scoring, cracks or chipping of the working faces.

IF ANY ONE of these problems is evident, the series MUST BE REPLACED AS A PAIR.

Note: The silicon-carbide seal fits into a rubber seating in the rear face of the impeller.

It is unlikely that the spring (5) will require replacement.

The upper wear ring should be checked for wear and damage by measuring the outer diameter (A) at several places (Fig. 3-2).

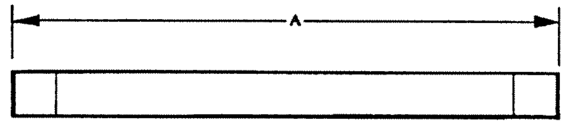


Fig. 3-2 Measuring the upper wear ring

If the measurement obtained at any point is less than 4.144" or physical damage is apparent, a new wear ring MUST be fitted.

To Reinstall

Reinstallation is a reversal of the removal instructions. DO NOT OMIT the water flange from shaft. The finned-area of the seal-housing faces nearest to the engine with the cutaway adjacent to the oil-sump pipe. Apply Loctite 574 sealant to the faces of the four tapped bosses on the carbon-seal housing BEFORE refitting the carbon seal assembly.

Note: DO NOT APPLY THE LOCTITE TO THE SCREW THREADS.

IMPORTANT NOTES

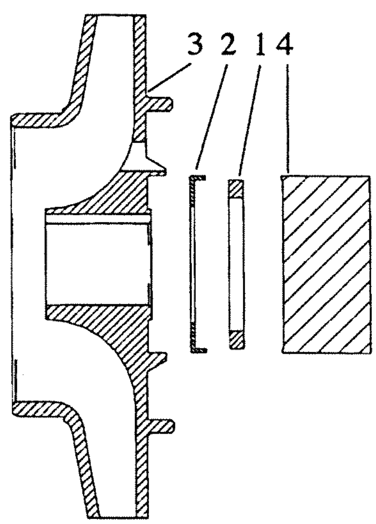
1. Remember to install the 'O' ring and washer to the pump shaft BEFORE installing the impeller.

2. The silicon-carbide seal and rubber seating assembly must be FULLY and SQUARELY SEATED in the rear face of the impeller, by using the following assembly procedure (Refer to Fig. 3-3). Incorrect assembly will result in the seal not performing correctly and premature failure.

i) Using soap solution as a lubricant, install the silicon-carbide seal (1) into rubber seating (2).

ii) Apply more soap solution to the seating periphery and use Special Tool No. 56571(4) with its lip located over the seal, to press assembly SQUARELY into the impeller (3) rear face.

iii) Ensure that the assembly is FULLY-SEATED in the impeller.



1. Carbon seal
2. Rubber cup
3. Impeller
4. Special Tool

Fig. 3-3. Fitting the seal-and-seating

SECTION 4

PUMP SHAFT AND ADAPTER HOUSING

To Remove

Remove the volute and wear ring (See SECTION 1) and remove the impeller (See SECTION 2).

Remove the carbon seal, the seal housing and wear ring (See SECTION 3).

Drain the engine oil.

Remove the six M6 socket-head screws - three from above and three from below and detach the engine oil sump.

Remove the nine socket-head screws securing the adapter housing to the engine crankcase.

Recover the eight sealing washers - the screw entering the engine oil sump does not require one.

Take care not to damage the oil pick-up pipe and strainer. If detaching it, always use a new 'O' ring when refitting.

It is recommended that the drive flange is only removed if damaged, or to permit work to be conducted on the engine. If it is necessary to remove it, proceed as follows: Unscrew and remove the six M8 socket-head screws securing the pump shaft to the pump shaft drive flange.

Remove the pump shaft and store safely to avoid damage.

The staking of the crankshaft nut which secures the pump shaft adapter MUST he released BEFORE attempting to unscrew the nut - FAILURE TO DO THIS MAY RESULT IN DAMAGE TO THE CRANKSHAFT THREADS.

Prevent the crankshaft from turning and unscrew the crankshaft nut. Remove the washer and withdraw the pump shaft adapter from the crankshaft (using Special Tool 56566).

Maintenance

Inspect the pump shaft for physical damage and undue wear as follows:

a) The thread of the impeller nut should not be damaged - indicating that it has been loose.

b) The keyway should not be misshapen due to the key moving as a result of a loose impeller nut.

c) The shaft must not be damaged due to impact or abrasion.

d) The drive flange screw threads must be sound and the splines undamaged.

Note: ALL components must be perfectly CLEAN before they are refitted.

Reinstall

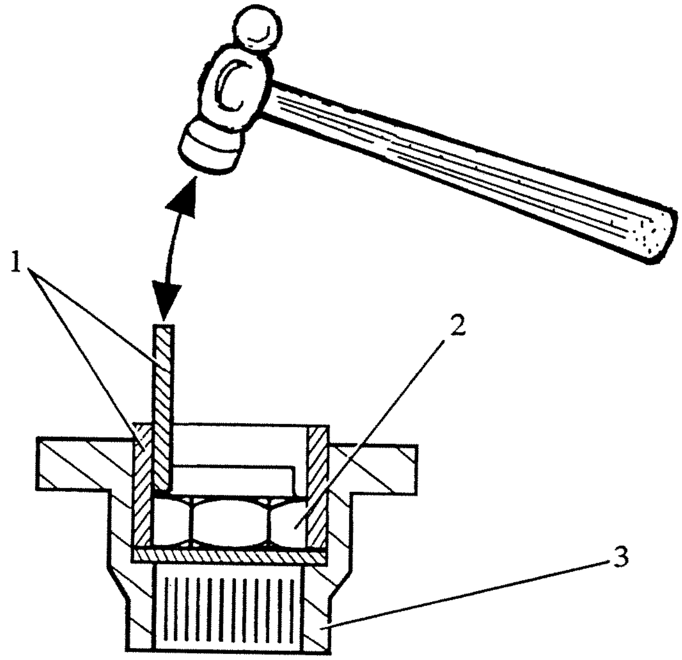
Check that no foreign matter is present on the crankshaft and the drive flange.

~~Slide the drive flange onto the crankshaft splines - followed by the washer and ensure that it is fully seated.~~

Then screw-on a NEW M22 crankshaft nut and tighten to a torque of 67.85 ft/lbs.

Check the run-out (concentricity) of the pump shaft adapter - MUST NOT EXCEED 0.394" total indicator reading.

Using Special Tools, Number 53563 carefully stake the nut in the groove in the threaded-portion of the crankshaft (Fig. 4-1).



1. Tool 53563
2. M22 Nut
3. Pumpshaft adaptor

Fig. 4-1. Staking the Crankshaft Nut

Install the pump shaft and apply Loctite Retainer 638 to the threads of the six M8 socket-head screws. Tighten the screws progressively to a torque of 31 ft/lbs.

Check the run-out of the pump shaft if the adapter has been disturbed; run-out (concentricity) MUST NOT EXCEED 0.394" total indicator reading.

Reinstallation is a reversal of the removal instructions.

Use new 'O' rings and joints to prevent oil and water leaks.

Reinstall a new oil-seal housing complete with new oil seal, with the open side of the seal facing towards the engine. Pack the seal with Molyslip MPG grease to assist initial lubrication.

EXHAUST GAS EJECTOR

Operation

Priming is by means of an exhaust gas ejector. With the engine running and the pump primed, the engine exhaust gases pass from the exhaust manifold, through the ejector housing and into the silencer in the normal way (Fig. 5-1)

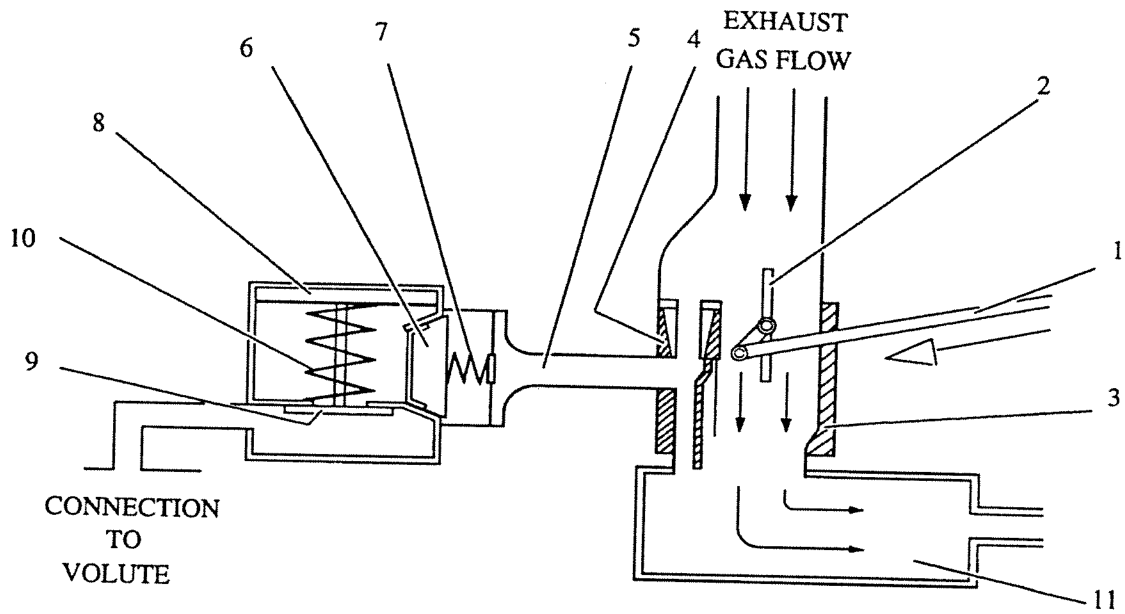


Fig. 5-1. Exhaust Gas and Water Flow - Ejector Not Working

The ejector becomes operational when the primer operating rod (1) is pulled to the limit of its travel (Fig. 5-2).

The action of pulling the rod closes a butterfly valve (2) in the ejector housing (3) which then causes the exhaust to be deflected throughout the ejector nozzle (4) thereby creating a depression (vacuum) in the priming pipe (5) and, on the outlet side of the non-return valve (6). This causes the non-return valve to lift off its seating against the pressure of its Spring (7). It also draws the diaphragm (8) down, which moves the seating washer (9) against the pressure of the spring (10) into the open position. The depression then allows water to flow into the volute under atmospheric pressure.

As the pump is primed, evacuated air and then water pass through the system and into the silencer (11).

When pump priming is complete (indicated by the first positive needle-movement of the pressure gauge) the primer operating rod (1) is released and returns to its static position under the influence of a return spring causing the butterfly valve (2) to open. The exhaust gases then resume their normal path (Fig. 5-1) the depression in the priming pipe (5) and the outlet housing side of the non-return (6) is then destroyed and the valve closes under the influence of its spring (7).

The diaphragm (8) returns to its static position under the influence of the spring (10) and the sealing washer (9) contacts its seating.

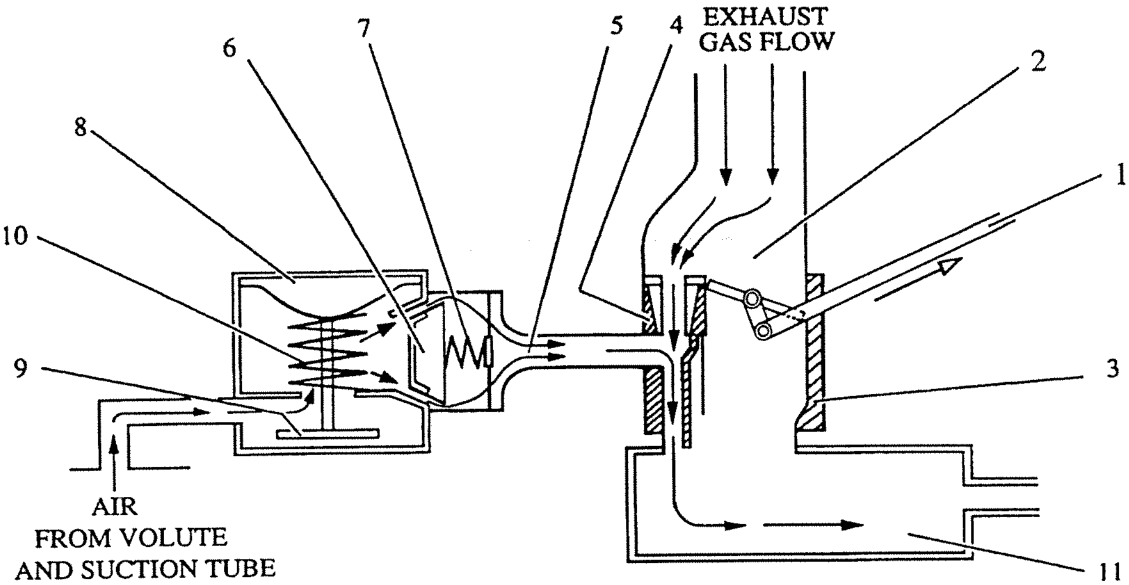


Fig. 5-1. Exhaust Gas and Water Flow - Ejector Not Working

To Remove

Disconnect the battery and remove the five bolts and washers securing the outer heat shield to the silencer and detach the shield.

Unscrew the four nuts and washers at the silencer-mounting flange, detach the silencer and recover the casket. This will also release the rear section at the silencer heat shield.

Release the primer-operating rod from the priming lever by removing the split pin and washer from the end of the rod.

Unscrew the union nut at each end of the priming pipe and remove the pipe.

Remove the screws securing the pump mounting legs to the cradle and raise the engine just enough to disengage the mountings. The exhaust ejector housing may then be withdrawn from its lower mounting studs. Recover the gasket.

Maintenance

Remove the nut and bolt from the priming lever and pull the lever from the butterfly valve operating shaft.

Should it be necessary to remove the butterfly valve: Remove the two screws securing it to the operating shaft.

The operating shaft may then be withdrawn from the housing. If the shaft- or housing-bearing areas are excessively worn, replace the parts. **Note:** They do not need to be a close tolerance fit.

SECTION 6

PRIMING VALVE

The priming valve is automatic in action and is mounted on the suction tube. There are two modes of operation: 1) Lift Priming and 2) Relay Pumping (See Fig. 6-1)

1) If Priming
When the exhaust primer unit is operated (See SECTION 5) a depression is created on the outlet housing side of the non-return valve (22) which causes it to lift off its seating. The main chamber of the body (9) then depressurizes causing the diaphragm (4) to operate against the pressure of the spring (7) thereby opening the sealing washer assembly (11), (12) and (13). The depression then causes the air to be evacuated from the volute and water to he drawn into the volute and priming system.

When the exhaust primer operating rod is released, the depression is removed from the priming valve (22) which then closes under the influence of the spring (21) and seals against its seating. The depression is removed from the chamber of the body (9) and the spring (7) returns the sealing washer-assembly against its seating in the body.

2) Relay Pumping
When relaying from a hydrant or another pump the volute is, naturally already primed. The priming system is therefore not required in its normal operating mode. The priming valve is arranged so that with water pressure present below the scaling-washer assembly, the sealing washer (12) seals firmly against its seating in the body (9).

To Remove

Disconnect the battery.

Unscrew the two union nuts at each end of priming pipe, detach the priming pipe and then remove the two M6 screws and washers securing the priming valve to the volute. Take care not to lose the 'O' ring seal.

1. Bolt, hex. head
2. Washer
3. Cover
4. Diaphragm
5. Screw M6, socket-head
6. Thrust pad
7. Spring
8. Spacer
9. Body
10. Gasket
11. Seal retaining washer
12. Sealing washer
13. Seal-support washer
14. Washer M6
15. Nut M6, self-locking
16. Inlet cover
17 Straight Coupler
18. Screw M5, socket head
19. Washer
20. Gasket
21. Spring
22. Valve
23. Seal
24. Spring Locator
25. Outlet housing
26. Sealing Washer
27. 'O' ring

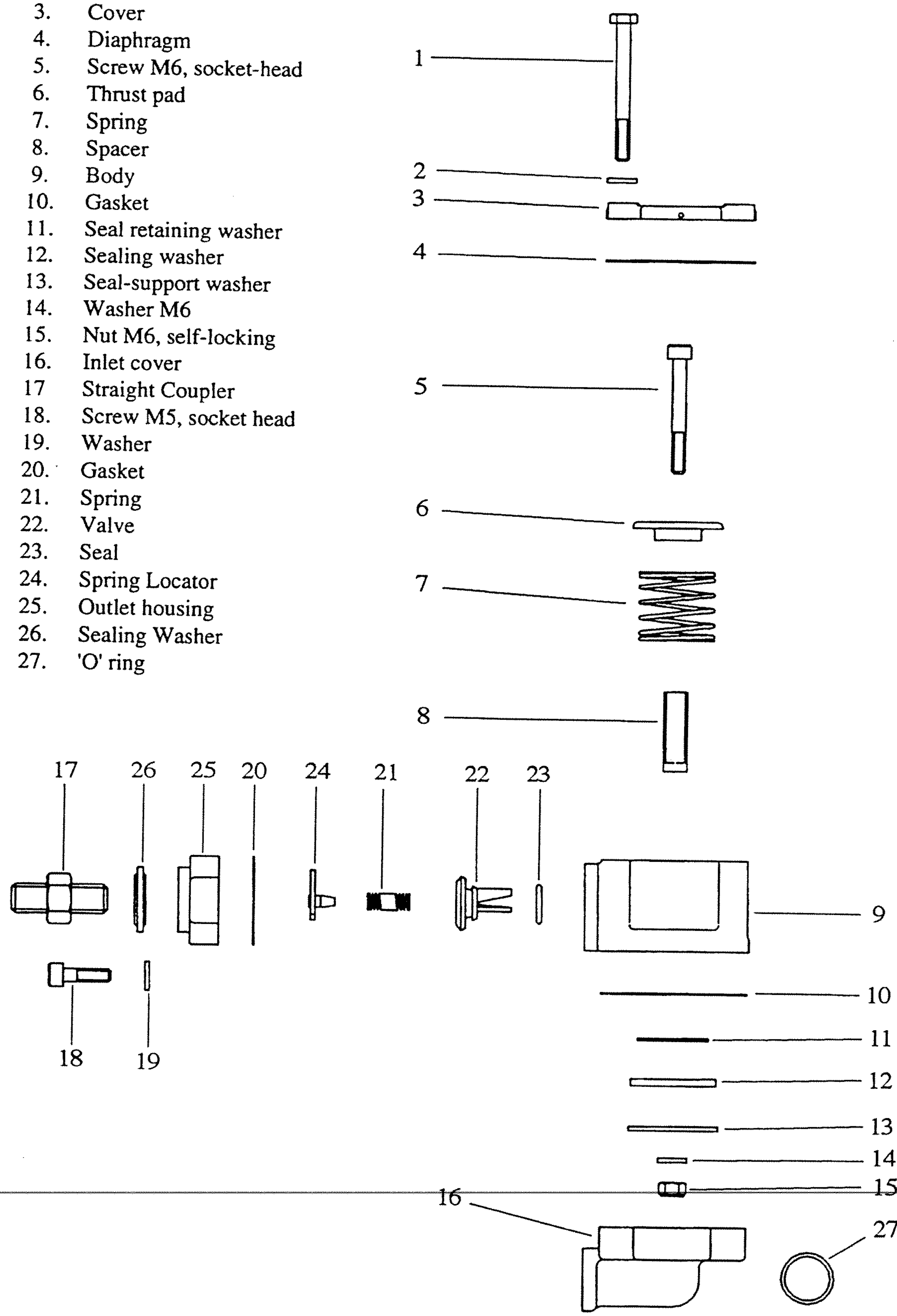


Fig. 6-1. Priming Valve Components

Maintenance (Fig. 6-1)

Unscrew and remove the four M6 bolts (1) and washers (2) from the diaphragm cover (3). The cover (3) diaphragm (4) priming valve body (9) and inlet cover (10) can then he separated.

Remove the outer housing (25) from the body (9) by unscrewing the four M5 socket-head screws (18). Recover the washers (19) and separate the housing from the body taking care not to lose the spring locator (24) spring (21) and the valve (22).

Use a socket key in the socket-head screw (5) and a wrench to unscrew the M6 self-locking nut (15). Remove the washer (14).

The seal-support washer (13), sealing washer (12) and seal retaining washer (11) may then be withdrawn from the inlet cover-end of the body (9).

From the diaphragm-end of the body, remove the socket-head screw (5), thrust pad (6), spring (7) and spacer (8).

Remove the 'O' ring (27) from the mounting-flange face of the inlet cover (16) and thoroughly clean the cover and install a new 'O' ring. If the adapter is damaged, install a new one. ALWAYS use a new sealing washer.

Thoroughly clean the priming valve body (9) ensuring that all traces of the old gaskets are removed.

Check the condition of the spring locator (24), spring (21) and valve (22). If damaged or worn, replace them.

The seal (23) installed to the valve (22) should be discarded and a new one fitted.

A new sealing washer (12) should be installed between the seal-support washer (13) and the seal retaining washer (11).

Check the condition of the spring (7) and if damaged install a new one.

Discard the old diaphragm (4) and use a new one.

Reassemble in the reverse order to dismantling using new gaskets (10) and (20).

To Reinstall

Reinstallation is a reversal of the removal instructions using a NEW 'O' ring at the priming valve-to-suction tube mounting face.

SECTION 7

INSTRUMENT PANEL

To Remove

Disconnect the battery.

Remove instrument panel cover.

Unscrew the union nut of the flexible pipe from the compound gauge.

Disconnect the multi-pin wiring plug and the two Lucar connections from the pressure-gauge lamp adjacent to the starter motor.

Release the choke-control rod by disengaging it from the choke control.

Remove the three screws securing the panel to the cradle and lift the panel-and-instruments assembly from the cradle.

To Reinstall

Reinstallation is a reversal of the removal instructions.

Ensure that the plug and wiring are correctly connected and that the internal sealing rings are in place and undamaged.

Reconnect the battery.

SECTION 8

DISCHARGE VALVES AND COUPLINGS

Operation

To CLOSE the valve (non-operational position) turn the hand wheel clockwise until resistance is felt. The valve plate is then firmly in contact with the seating and water cannot flow in either direction (Fig. 8-1).

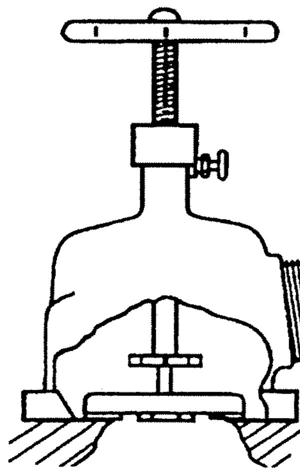


Fig. 8-1. Valve Closed - No Water Discharge

To OPEN the valve (operational position) turn the hand wheel counter-clockwise until it stops. The valve plate is then only held onto its seating by the spring installed in the center of the valve spindle. With the pump operational, water pressure lifts the valve plate off its seating against the spring pressure. Water will then be discharged (Fig. 8-2).

If operations temporarily cease, water flow stops and the valve plate returns to its seating under the influence of the spring. This maintains a head of water on the discharge side of the valve and therefore prevents the prime being "lost".

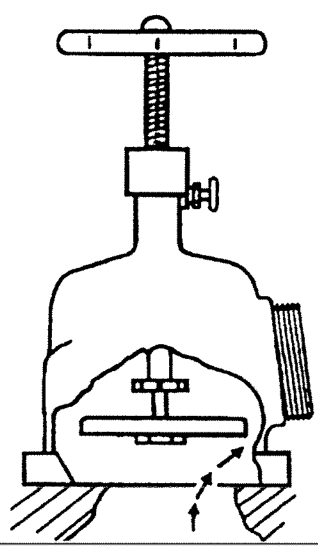


Fig. 8-2. Valve Open - Water Discharging

To DRAIN hoses or high-risers (operations terminated). Pull out the release knob and turn the hand wheel counterclockwise until it stops. The valve plate is then raised clear of the seating and is not under any spring pressure.

This then allows water to drain back from the discharge side of the valve, through the pump volute and out of the suction tube.

Note: This operation must only be performed with the pump stopped.

Ensure that the valves are CLOSED upon completion of this operation.

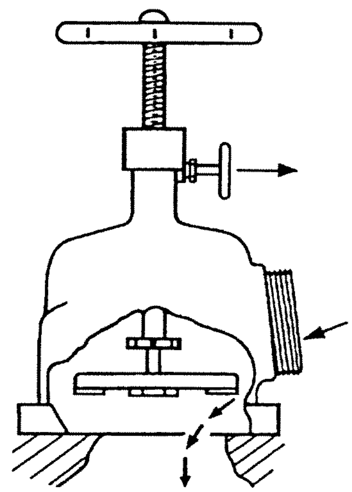


Fig. 8-3. Valve Open - Water Draining

To Remove

Unscrew and remove the four M10 nuts and washers screwing each valve to the discharge ring fold. Remove the valve and recover the 'O' ring, from the valve-mounting flange.

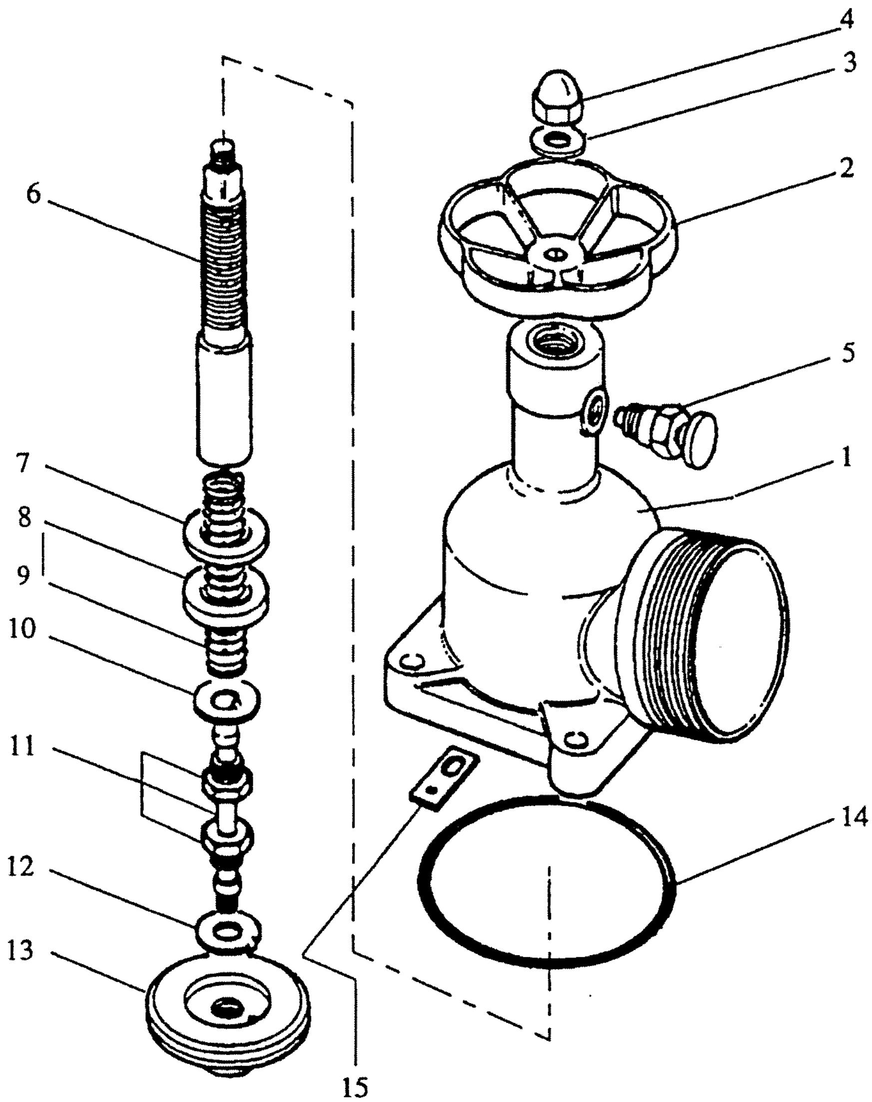
Maintenance (Fig. 8-4)

Remove the valve-spindle release knob (5). Temporarily reinstall the hand wheel (2) or use an open-ended wrench to turn the valve spindle (6) clockwise as far as it will go. Continue unscrewing the spindle (6)counter-clockwise (viewed from the bottom) until it is released from the body (1)

Release the locking plate (12) and hold the plate (13) while unscrewing the lower nut of the stem assembly (11). Then release the locking plate (10) at the other end of the assembly (11) and unscrew the nut.

Note: There is a spring (9) in the spindle, therefore some spring tension will be present when the nut is unscrewed from the internal thread of the spindle (6).

If it is necessary to install a new spindle seal (indicated by water leaking from the thread portion of the spindle below the handwheel) carefully drift the seal (8) and the support ring (7) from the body (1).



1. Valve Body
2. Handwheel
3. Washer
4. Domed Nut
5. Spindle Release Knob
6. Spindle
7. Support Ring
8. Seal
9. Spring
10. Locking plate
11. Stem assembly
12. Locking plate
13. Plate
14. 'O' ring
15. Anchor (for chain)

Fig. 8-4. Discharge Valve Components

Reassembly is a reversal of the dismantling instructions.

Ensure that the spindle-seal support ring (7) is reinstalled and that the seal (8) is pressed into position with its lip towards the base of the valve body (1).

Do not forget to correctly locate the 'tag' of each locking plate before bending the edge off the plate to lock the nut.

Apply a little molybdenised listate grease to the thread of the spindle.

To Reinstall

Reinstallation is a reversal of the removal instructions. Install a new 'O' ring.

Instantaneous Coupling

To Remove

If it is necessary to remove the connector body, unscrew it in a counterclockwise direction. Recover the shims.

Examine the release bolt (6) for excessive wear. If worn on the vertical face (the one nearest the valve) it must be replaceed. To remove it, proceed as follows:

Unscrew the release closure disc (1) from the release cap (3) in a counter-clockwise direction.

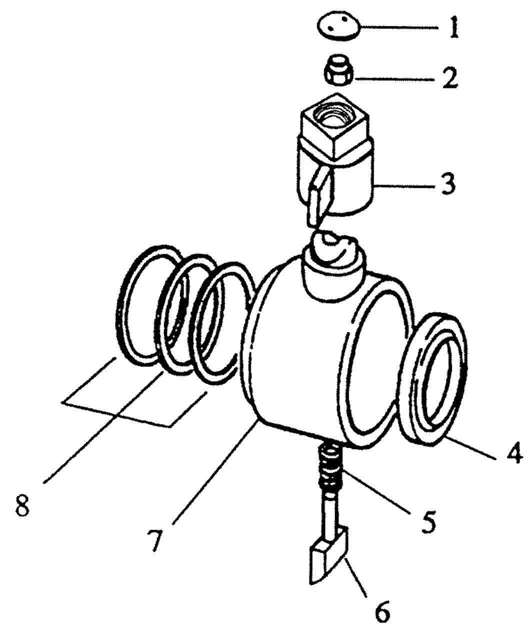
Unscrew the self-locking nut (2). This will allow the release bolt (6) and spring (5) to be with-drawn from inside the connector body (7).

Check the condition of the spring (5). It should have good tension, be unworn and clean. If the tension is weak or it is damaged or badly corroded, install a new spring.

Check the contour of the cam for wear in the release cap (3) and on the connector itself. Replace worn components.

If, after installing a new release bolt (6) in the connector body (7), there is still excessive movement, replace the connector.

Examine the connector seal (4) for wear or damage and replace if necessary.



1. Closure Disc
2. Self-locking Nut
3. Release Cap
4. Seal
5. Spring
6. Release Bolt
7. Body
8. Shims

Fig. 8-5. Instantaneous Coupling

Reassembly is a reversal of the dismantling instructions noting the following:

Ensure that the vertical face of the release bolt (6) is nearest the valve body and always install a new self-locking nut.

Tighten the new self-locking nut (2) until the leading edge of the curved face of the release bolt (6) is level with the edge of the bolt hole in the connector body (7). This setting will also ensure that the tension of the spring (5) is correct. Do not forget to reinstall and tighten the closure disc (1).

Apply Molybdenum Disulfide grease (Lithium Grease) to the spring (5) and release bolt (6).

To Reinstall

Reinstallation is a reversal of the dismantling instructions but be sure to select suitable shims (8) in order that the cap (3) is in the vertical plane when the coupling is fully-tightened. The shims are available in thickness of 0.0295", 0.0394", 0.0591".

SECTION 9

DISCHARGE MANIFOLD

To Remove

Remove the discharge valves (See SECTION 8).

Unscrew the union nuts of the flexible pipe supplying water to the engine oil cooler and remove the pipe.

Remove the screw securing the priming-operating rod to the manifold and lower both the bracket and the operating rod.

Unscrew the four socket screws securing the discharge manifold to the volute, noting that one screw retains the chain anchor for the suction blank cap chain. The manifold may then be removed from the volute and the 'O' ring recovered.

If the pump pressure gauge needs to be removed, carefully unscrew it counter-clockwise from the manifold.

To Reinstall

Reinstallation is a reversal of the removal instructions.

Install a NEW 'O' ring to the manifold joint if necessary.

SECTION 10

COOLING SYSTEM

Operation

To enable normal operating temperatures to be maintained over extended running periods, a closed-circuit engine-cooling system is used. This system incorporates a heat exchanger and heater tank.

Raw water is piped from the volute via a strainer to the engine oil cooler, then through the heat exchanger tubes and returned to the suction tube.

The closed-circuit engine-cooling system takes coolant from the engine and passes it through the heat exchanger where it comes into contact with the internal tubes containing the raw water. The raw water and engine coolant do not come into direct contact but the heat transfer takes place through the walls of the internal tubes.

The coolant then passes through the coolant header tank and is returned to the engine water pump. The total coolant capacity is 1.3 gallons.

Note: Always use the correct ratio of water and anti-freeze in the engine cooling system. Periodic removal and cleaning of the strainer is essential to maintain adequate cooling of the engine.

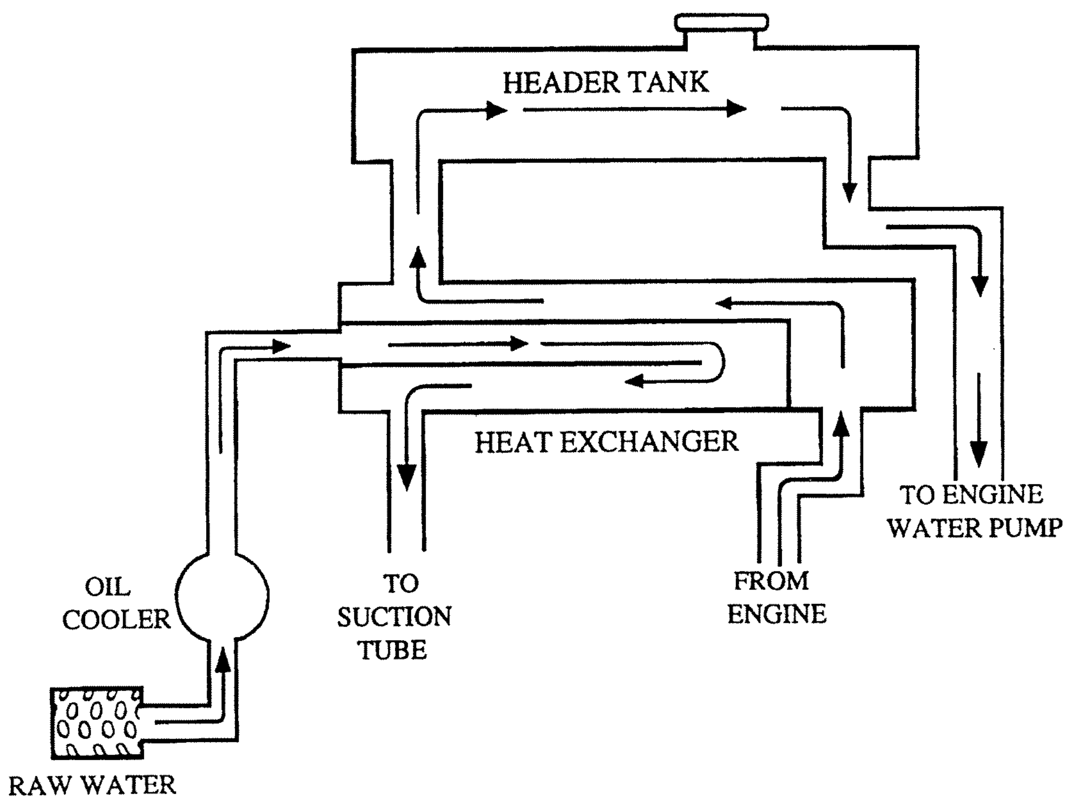


Fig. 10-1. Raw Water and Engine Coolant Circuits

SECTION 11

HEAT EXCHANGER

To Remove

Disconnect the battery.

Drain the engine coolant.

Remove the coolant header tank (See SECTION 13).

Unscrew the four screws and washers to release the brackets securing the heat exchanger to the coolant tank.

Carefully separate the heat exchanger from the tank and recover the 'O' ring.

To Reinstall

Reinstallation is a reversal of the removal instructions, but use a NEW 'O' ring at the heat exchanger-to-coolant tank joint.

IMPORTANT: DO NOT FORGET TO REFILL THE ENGINE COOLING SYSTEM WITH THE CORRECT RATIO OF WATER AND ANTI-FREEZE.

SECTION 12

WATER AND OIL PUMP

To Remove

Drain the coolant system completely.

Undo the hose clips and remove the flexible hose from the header tank. Undo the threaded collars on the rigid plastic pipe work assembly at the water pump and adapter housing and then remove the pipe assembly.

Remove the four M6 nuts securing the impeller housing to the seal housing and lift off. Remove the pressed steel impeller cover, slide off the impeller and pry out the woodruff key in the shaft.

Remove the four M6 nuts securing the seal housing/oil pump to the cylinder head, restrain the oil pump body from moving and lift off the seal housing.

If the oil pump is to be removed, with the oil sump left fitting, then the four M6 studs retaining the oil pump will need to be removed. This may be done using a pair of M6 nuts locked together onto the stud. If the oil sump is already removed, then the oil pump will slide easily off the retaining studs.

Undo the three pan head screws and remove the cover plate.

Remove the oil pump rotors, driving pin and thrust washer, and push the drive shaft out through the oil pump body.

To Reinstall

Inspect 'O' rings and replace if damaged. Inspect the oil pump shaft for signs of wear at tang and where the lip seat, run on the shaft, replace if damaged. Scrupulously clean all parts prior to reassembly.

Insert the pump shaft, fill thrust washers and pin, inner and outer rotors, noting that the punch mark in the outer rotor faces towards the water pump.

Place 'O' ring in the oil pump body, copiously smear oil rotor with clean oil and replace cover plate then retain with three pan head screws. Ensure that the pump shaft will rotate freely by hand.

Reinstall formed 'O' ring in base of the oil pump and reinstall the oil pump assembly onto the cylinder head ensuring that the oil pump shaft engages with the slot in the camshaft.

Replace the seals in the seal housing ensuring that the small seal is installed open side to the water pump and the two larger seals are installed open side to the oil pump. Pack the seals with Molyslip MPG grease or equivalent.

Reinstall the 'O' ring to the seal housing and install the seal housing to the end of the oil pump and secure with the four M6 nuts and washers.

Install the gasket and steel cover to the seal housing, with the gasket between the cover and housing.
Install the woodruff key to the shaft.

Examine the impeller for signs of damage or cracking, replace if necessary. Insert the impeller into the pump liner, ensuring the vanes are correctly aligned when looking into the liner. (See Fig. 12-1).

Install the impeller and liner onto the pump shaft and, if necessary, rotate the liner counter-clockwise to align the raised tang with the slot in the impeller housing.

- Reinstall the impeller housing and 'O' ring and retain with four M6 nuts. Reinstall the rigid plastic and flexible rubber pipes.

Refill with coolant.

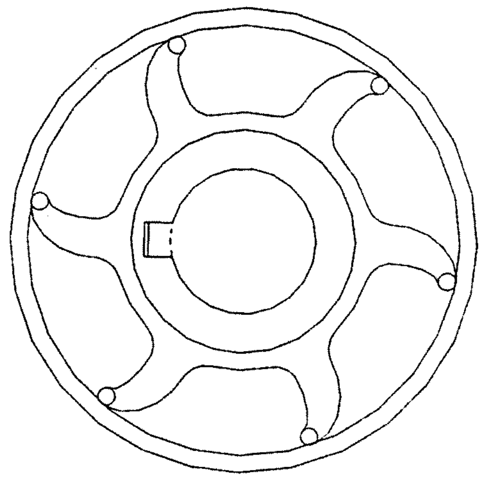


Fig. 12-1. Impeller/Liner Vane Alignment

SECTION 13

COOLANT HEADER TANK

To Remove

Disconnect the battery.

Drain the engine coolant.

Unscrew the two union nuts to the flexible pipes at the heat exchanger.

Slacken the hose clips and detach the large hoses from the coolant header tank and heat exchanger.

Remove the three screws and washers securing the coolant header tank to the cradle and remove the tank-and-heat exchanger as an assembly.

If it is necessary to separate the heat exchanger from the coolant tank see SECTION 11.

To Reinstall

Reinstallation is a reversal of the removal instructions.

IMPORTANT: DO NOT FORGET TO REFILL THE COOLING SYSTEM WITH THE CORRECT RATIO OF WATER AND ANTI-FREEZE.

SECTION 14

FUEL TANK

To Remove

No smoking or open flame.

Disconnect and remove the battery.

Disconnect the dual-line connector (this is also used for connecting the optional 6.3 gallon remote fuel tank).

Remove the connector from the side of the fuel tank by unscrewing the single M6 screw.

Remove the M6 screw securing the fuel line to the intake manifold.

From below the cradle, unscrew and remove the four M6 x 15 socket-head screws and washers to release the fuel tank.

Remove the fuel tank and store SAFELY away from heat and open flames.

Note: KEEP THE FILLER CAP SCREWED ONTO THE TANK - EVEN WHEN EMPTY.

Maintenance

NO MAINTENANCE is necessary, or possible, apart from ensuring that the fuel tank is kept clear of sediment.

Note: All fuel should be properly filtered before use. The fuel tank capacity is 3.7 gallons.

The filler cap incorporates a fuel-level gauge and this may be replaceed as a complete assembly only.

An in-line fuel filter is incorporated in the fuel-supply line. This should be checked periodically for excessive contamination by sediment and water. It is NOT a serviceable item and must be replaceed as a unit.

To Reinstall

Reinstallation is a reversal of the removal instructions.

SECTION 15

MANUAL BACK-UP STARTING

To use the manual starting facility, release the flexible tab securing the hinged-portion of the flywheel cover. Fold the hinged portion back to reveal the engine flywheel.

Unscrew the RED cap and withdraw the starter rope from the storage section which is integral with the coolant tank. DO NOT unscrew the YELLOW coolant filler cap.

Insert the knot of the rope into one of the cutaways in the periphery of the flywheel and wrap the remainder of the rope counterclockwise around the flywheel in the groove provided.

Switch ON the ignition slightly open the throttle and give the rope a sharp, but continuous pull to start the engine.

WARNING: BE EXTREMELY CAREFUL TO KEEP CLEAR OF ROTATING MACHINERY.

When the engine has been started, immediately hinge the cover back to its normal position with the flexible tab.

Replace the starter rope in the storage facility and reinstall the RED cap.

SECTION 16

PUMP REMOVAL

NOTE: The pump is not removed from the engine as a complete unit, but is dismantled as necessary to facilitate maintenance and/or repairs..

To dismantle the pump refer to the following sections:

SECTION 1	VOLUTE AND WEAR RING
SECTION 2	IMPELLER
SECTION 3	CARBON SEAL, SEAL HOUSING AND WEAR RING
SECTION 4	PUMP SHAFT AND ADAPTER HOUSING
SECTION 8	DISCHARGE VALVES
SECTION 9	DISCHARGE MANIFOLD

SECTION 17

MONTHLY PUMP TEST

VACUUM TEST

Install the suction-tube cap in position and close the discharge valves.

Start the engine and open the throttle.

Pull the primer operating rod to activate the priming system.

When the vacuum reading of 10.1 - 11.6 PSI is shown on the compound gauge, stop the engine.

The vacuum reading should NOT FALL more than 0.5 PSI in one minute for a pump in excellent condition.

PRESSURE TEST

The purpose of this test is to trace a vacuum leak.

Connect the pump to a water supply which is capable of exerting a pressure of 50-100 PSI. This can be done by installing an adapter in the pump-casing drain hole and then connecting this to a hose or by using a hydrant-to-suction tube adapter.

If pressurizing through the drain hole, it will he necessary to install the suction-tube blank cap.

With the discharge valve partially-open to allow air to escape, turn on the water supply.

When the pump casing is full of water, close the discharge valve and build up the pressure to 50-100 PSI.

If there are leaks, their locations will be shown by water seepage at those points.

Note: FAULT TRACING

Although it is outside the scope of this manual to give full instructions on the rectification of faults on the engine and pump unit, the following Fault Tracing chart is presented in order that the user can ascertain the probable cause of any fault which may occur.

SECTION 18

PUMP FAULT-TRACING

POSSIBLE FAULT	REMEDY
HIGH VACUUM GAUGE READING RELATIVE TO SUCTION LIFT	
1. Suction strainer choked.	Remove and clean
FAILURE TO LIFT OR HOLD WATER	
1. Suction-hose joints leaking.	Check and tighten.
2. Suction strainer not completely immersed.	Check and submerge.
3. Defective exhaust primer.	Check and rectify.
4. Leaking priming valve.	Check and rectify
5. Discharge valve leaking.	Check and rectify.
BROKEN JETS WITH 'AIR CRACKLE'	
1. Suction strainer not completely immersed or too near to the surface of the water supply.	Check and submerge.
2. Slight leaks on the suction side of the pump.	Check joints and tighten nuts.

If the remedies shown do not clear the fault, then proceed with the MONTHLY PUMP TEST as previously described in SECTION 17.

PART B
ENGINE

SECTION 19

DESCRIPTION

The HONDA BF45A engine is a three-cylinder, single overhead-cam shaft, water-cooled unit mounted with the camshaft in the vertical plane. The camshaft is driven by a composite rubber-toothed drive belt provided with an automatic-tensioning system.

The inlet and exhaust valves are mounted on two separate shafts. A single spring is used for each valve and all valves are installed with oil seals.

The camshaft pulley incorporates the pulser rotor and the flywheel is mounted outboard of the crankshaft pulley. An exciter coil and two interconnected charging coils are installed under the flywheel.

The crankshaft is mounted in four main bearings and has three connecting-rod (big-end) journals equally disposed at 120°. All main and connecting-rod hearings are of the replaceable-shell type with the main bearings being sandwiched between the crankcase and the cylinder block.

Each piston is installed with two compression rings, one multi-rail oil-control ring and a gudgeon pin retained by circlips.

A trochoid-type oil pump incorporating a pressure-relief valve is installed to the cylinder head and is driven by the camshaft. A disposable cartridge-type oil filter and an oil cooler are also fitted.

An impeller-type water pump circulates the engine coolant and a thermostat, thermo-switch, coolant tank and heat exchanger are incorporated in the system.

The fuel system consists of a crankshaft-actuated mechanical fuel pump, three constant-vacuum carburetors, dashpot check-valve installation and linkages for throttle and choke controls to ensure that all three carburetors operate in unison. An air-intake silencer is also fitted.

A high-output electronic ignition system, operating on the Capacitor Discharge Ignition (C.D.I.) principle, is installed using three separate H.T. coils and circuitry.

An engine-speed limiter, coolant overheat /low-pressure alert system is incorporated for engine protection.

In the event of an engine problem occurring, the system gradually reduces the engine revolutions and, when the problem clears, progressively increases the revolutions. This is a useful feature which prevents a sudden reduction and then resumption of pump output at the hose nozzles.

Starting is accomplished by a 0.9Kw inertia-type starter motor utilizing a remotely-mounted solenoid (magnetic switch). An emergency back-up rope-starting facility using the flywheel may also be used.

TIMING BELT, PULLEYS AND TENSIONER

Description (Fig. 20-1).

The timing-belt driving pulley (1) is keyed (2) to the crankshaft (3) and secured with an M48 locknut (4). A guide-plate (5) for the timing belt (6) is installed at each side of the pulley. The complete assembly is mounted inboard of the flywheel, which must be removed (see SECTION 21) before the timing belt can be replaced.

The timing belt-driven pulley is part of the pulser rotor (7) and is doweled (8) to the camshaft (9) and secured with an M 10 screw (10) and washer (11).

The pulser coil assembly (12) is mounted concentrically with, and inboard of, the pulser rotor (7) and secured with three M6 screws (13).

A belt-tensioner (14) is provided incorporating a tension spring (15) and spring anchor (16). The tensioner is secured by an M10 flange bolt (17) with a cap (18) installed over it.

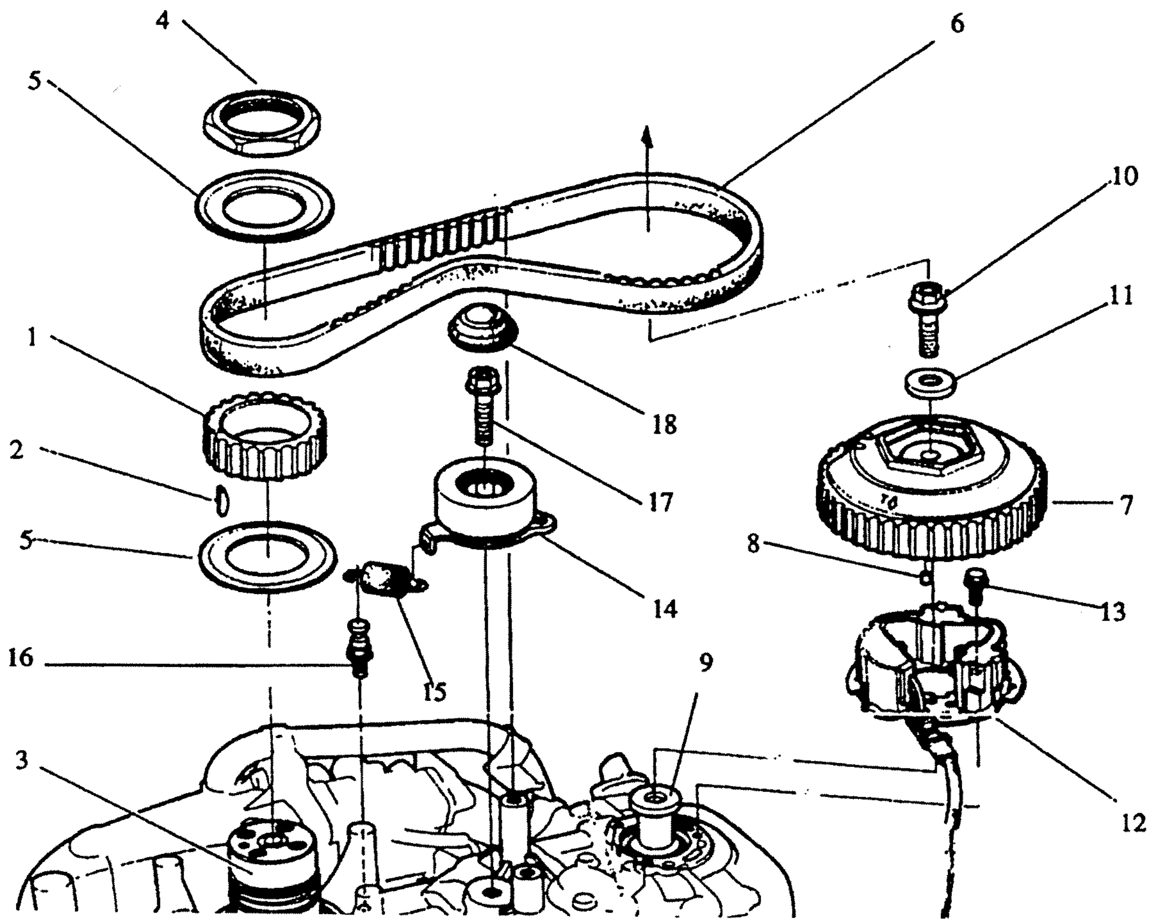


Fig. 20-1. Timing Belt, Pulleys and Tensioner

Inspection

Remove the timing-belt cover and check point 'A' of the timing belt for wear or damage. If wear or damage is evident, install a new timing belt (Fig. 20-2).

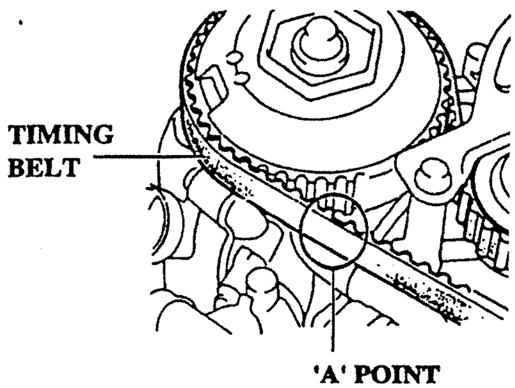


Fig. 20-2. Timing-Belt Inspection

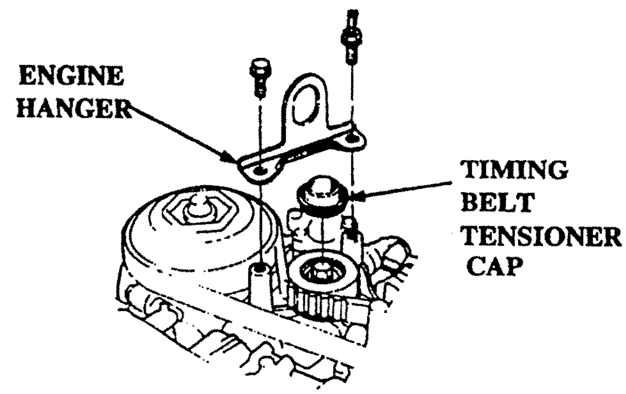


Fig. 20-3. Tensioner Cap and Engine Hanger

Flywheel
(See SECTION 21)
To Remove

Disconnect the battery cables and charging-coil connection and **MOST IMPORTANT** - disconnect the pulser coil connections located under the CDI cover (Fig. 20-1).

Remove the two M8 flange bolts, engine hanger and timing-belt tensioner cap (Fig. 20-3).

Attach the Special Tool 07LPB - ZV30100 to the engine hanger mounting bosses to prevent the flywheel from revolving (Fig. 20-4). Remove the four M10 flange bolts from the flywheel.

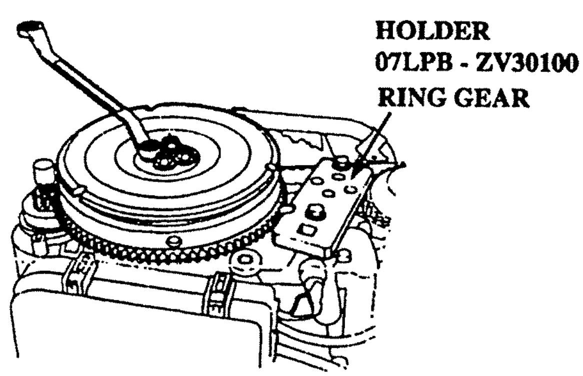


Fig. 20-4. Flywheel Locking Tool

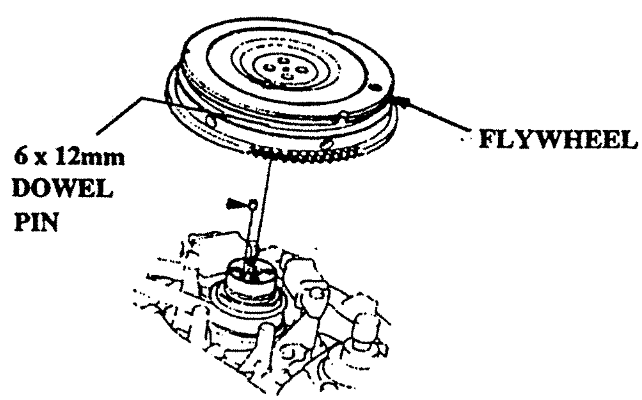


Fig. 20-5. Removing Flywheel and Dowel Pin

Remove the flywheel from the crankshaft. It is located on a dowel installed to the crankshaft.

Release the exciter coil and the two charging coils by unscrewing the two flange bolts securing each coil to its respective mounting pillar (Fig. 20-6).

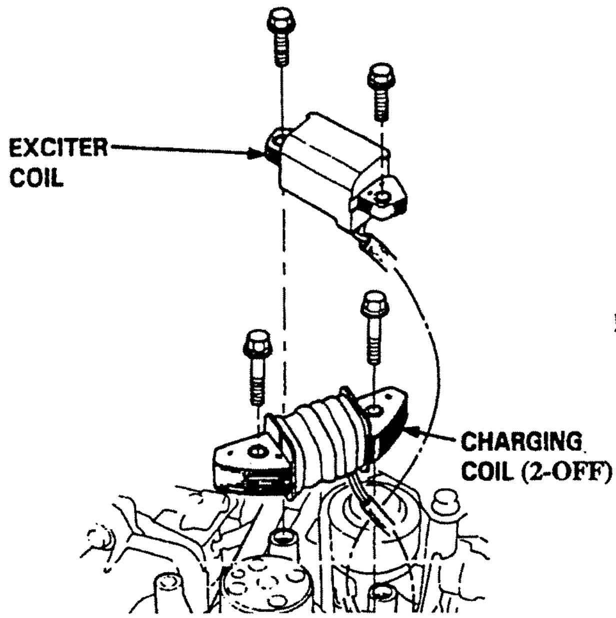


Fig. 20-6. Coil Mounting and Screws

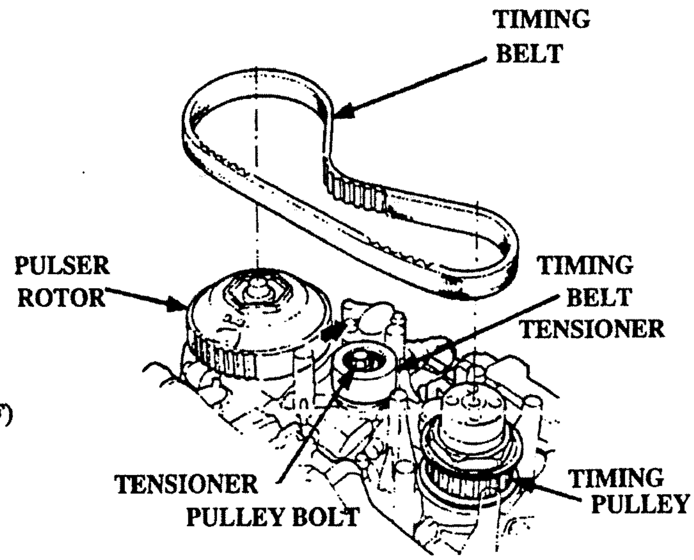


Fig. 20-7. Timing Belt Removal

Loosen the M10 flange bolt which secures the timing-belt tensioner pulley, push the tensioner in the direction of the arrow (Fig. 20-7) and then re-tighten the flange bolt.

Timing Belt

First remove the timing belt from the pulser rotor and then from the timing pulley.

DO NOT USE FORCE to remove the belt; e.g. using a screwdriver or levers and DO NOT TWIST or CONTAMINATE it with oil or grease. Store the belt by hanging it on the wall.

Belt Tensioner

If the timing belt tensioner is to be removed, unscrew the M10 flange bolt, disconnect the tension spring and remove the tensioner pulley assembly (Fig. 20-1). The spring anchor may be unscrewed if required.

Pulser Rotor

To Remove

To remove the pulser rotor, install Special Tool O7LPA-ZV30200 to the rotor to prevent it revolving and remove the M10 screw securing the rotor to the camshaft (Fig. 20-8).

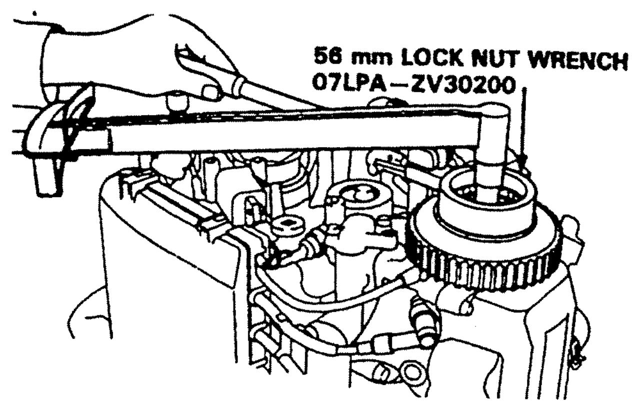


Fig. 20-8. Removing Pulser Rotor

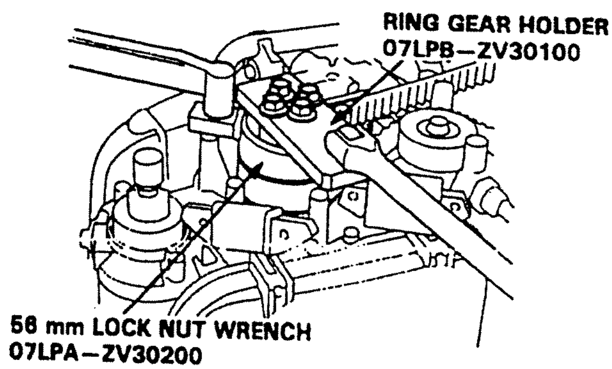


Fig. 20-9. Removing Timing Pulley

Timing Pulley

To Remove

Install Special Tool 07LPA - ZV30200 over the timing pulley M48 locknut and then install Special Tool 07LPB - ZV30100 to the crankshaft using the four M10 flywheel flange bolts (Fig. 20-9). Loosen the locknut and remove the special tools.

Unscrew the locknut from the crankshaft, remove the belt guide, the timing pulley, the woodruff key and the second belt guide (Fig. 20- 1).

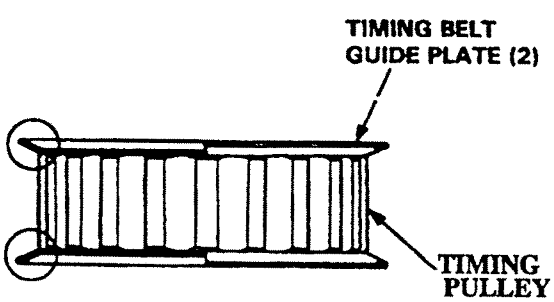


Fig. 20-10. Timing Belt Guides

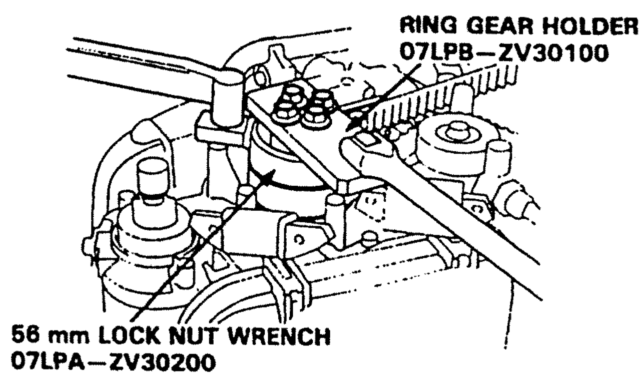


Fig. 20-11. Refitting Timing Pulley

To Reinstall

Install the first belt guide on the crankshaft with the curved surface towards the pulley position (Fig. 20-10). Install the Woodruff key to the crankshaft and reinstall the timing pulley taking care not to misplace the key.

Install the second guide plate (with curved surface TOWARDS the pulley) and screw on the M48 locknut..

Using Special Tools O7LPA – ZV30200 and 07LPB–ZV30100, tighten the locknut to a torque of 95 ft/lbs.

Pulser Rotor

To Reinstall

Install the pulser on the camshaft ensuring that it is property located on the dowel pin. Install the M10 screw and washer and then install Special Tool 07LPA - ZV30200 to hold the pulser rotor.
Tighten the screw to a torque of 42 ft/lbs.

DO NOT TURN THE PULSER ROTOR CLOCKWISE.

Belt Tensioner

To Reinstall

Check that the spring anchor is fitted. Install the tensioner pulley assembly and screw in the M10 flange bolt. Reconnect the torsion spring between the tensioner and the spring anchor. Move the tensioner against the spring tension and temporarily tighten the tensioner pulley bolt (Fig. 20-7).

Timing Belt

To Reinstall

Install the Special Tool 07LPA - ZV30200 to the pulser rotor and turn the rotor counter-clockwise until the – 'T - arrow DOWNWARDS'- mark on the rotor aligns with the 'T - arrow UPWARDS'- mark on the cylinder head (Figs. 20-12 and 20-14).
IMPORTANT: DO NOT TURN THE PULSER ROTOR CLOCKWISE

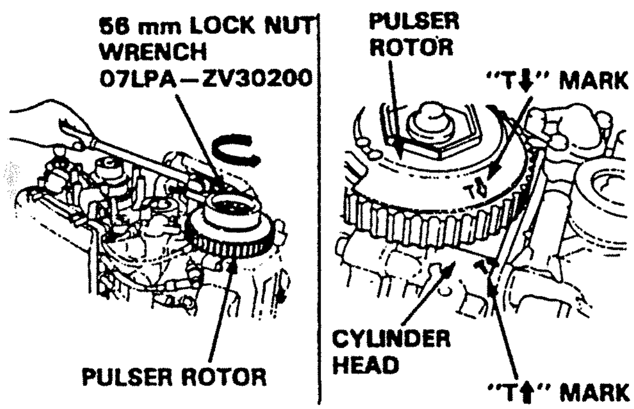


Fig. 20-12. Special Tool and Timing Marks

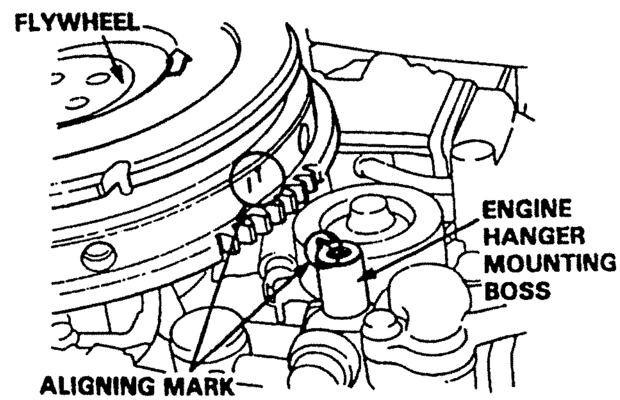


Fig. 20-13. Flywheel Aligning Marks

Temporarily install the flywheel, install the four M10 flange bolts and lightly tighten them. Make sure that the flywheel is correctly located on the dowel pin before tightening the bolts.

Turn the flywheel counter-clockwise to align the 'T mark' on the flywheel with the '1 - mark' located on the engine-hanger mounting boss (Fig. 20-13) and remove the flywheel, taking care not to move the crankshaft.

IMPORTANT: DO NOT TURN THE FLYWHEEL CLOCKWISE

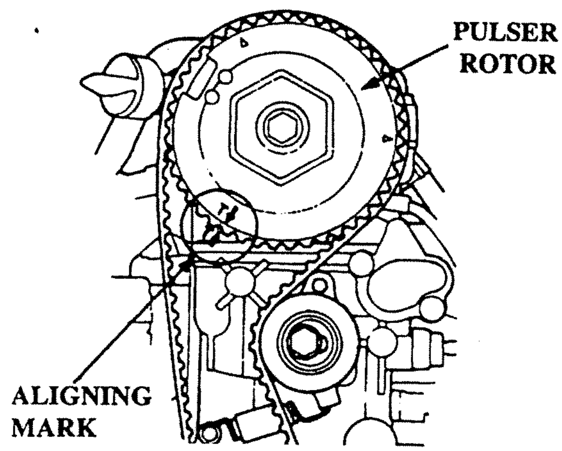


Fig. 20-14. Pulser Rotor Aligning Marks

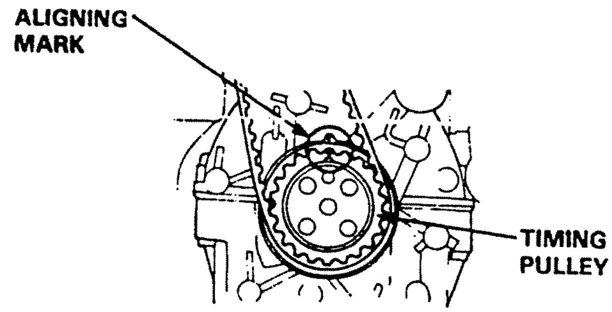


Fig. 20-15. Timing Pulley Aligning Marks

After installing the timing belt, recheck that ALL the timing marks are STILL aligned.

Reinstall the 6 x 10mm dowel pin and flywheel to the end of the crankshaft.

Make sure that the mark on the pulser rotor is aligned with that of the cylinder head and that the mark on the flywheel is aligned with that on the cylinder barrel.

Loosen the M10 tensioner pulley bolt (Fig. 20-16).

The tensioner assembly will then automatically tension the timing bell. DO NOT push the tensioner against the belt by hand.

Remove the flywheel and dowel pin and install Special Tool 07LPB-ZV30100 to the crankshaft and turn the crankshaft two revolutions counterclockwise from the alignment position with the pulser rotor (Fig. 20-17).

IMPORTANT: DO NOT TURN THE FLYWHEEL CLOCKWISE.

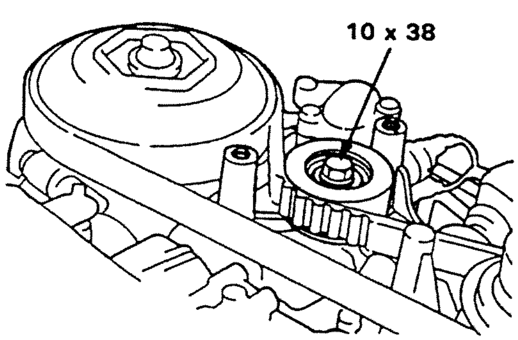


Fig. 20-16. Tensioner Pulley Bolt

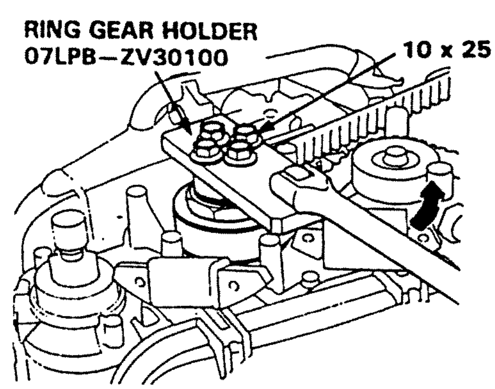


Fig. 20-17. Special Tool Fitted to Crankshaft

- Turn the crankshaft counterclockwise by three teeth of the pulser rotor (Fig. 20-18).

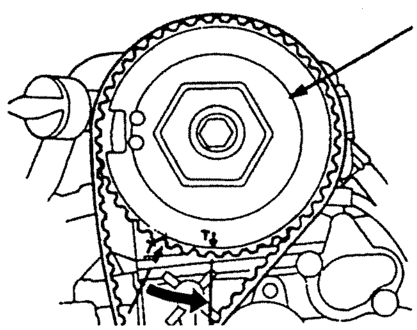


Fig. 20-18. Setting the Pulser Rotor

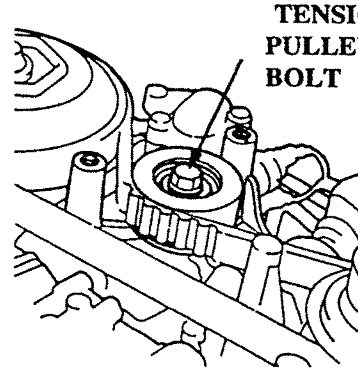


Fig. 20-19. Tensioner Pulley Bolt

The timing belt tensioner is automatically adjusted. DO NOT push the tensioner against the belt by hand.

Tighten the tensioner pulley M10 bolts to a torque of 33 ft/lbs (Fig. 20-19).

Reinstall the exciter coil and charging coils, but DO NOT RECONNECT the wiring to the wiring harness at this stage.

Reinstall the flywheel (see SECTION 21).

Reinstall the timing belt tensioner cap and the engine hanger.

Reinstall the flywheel cover (see SECTION 21).

FLYWHEEL

The flywheel incorporates a starter ring gear and is mounted outboard of the camshaft timing-belt and timing pulley.

To Remove

Disconnect the battery.

Remove the capacitor discharge ignition cover (1) and disconnect the charging-coil wire (2) (Fig. 21-1), and recover the M6 washers (3), rubber grommets (4) and collars (5) (Fig. 21-2).

Unscrew the two M6 screws (1) and two M8 screws securing the flywheel cover (2) - Fig. 21-2, and exciter-coil wire (3) connectors - Fig. 21-1.

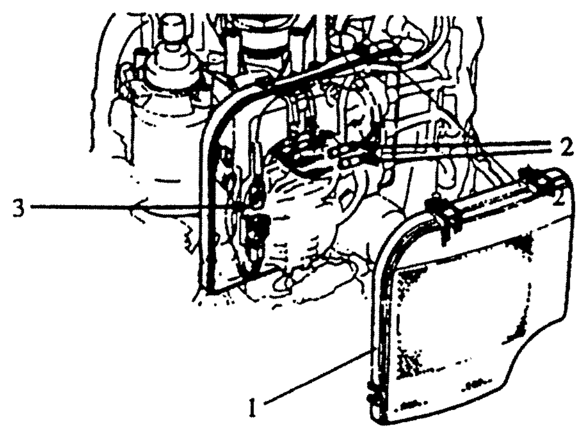


Fig. 21-1. Coil Connections

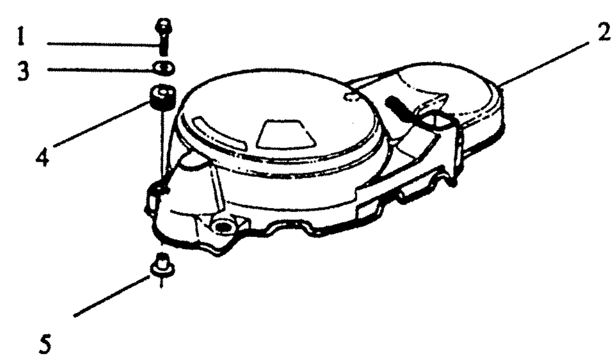


Fig. 21-2. Flywheel Cover

Remove the engine hanger and install Special Tool 07LPB-ZV30100 (Fig. 21-3) to prevent the flywheel from revolving.

Unscrew the four M10 flange bolts and remove the flywheel from the crankshaft.

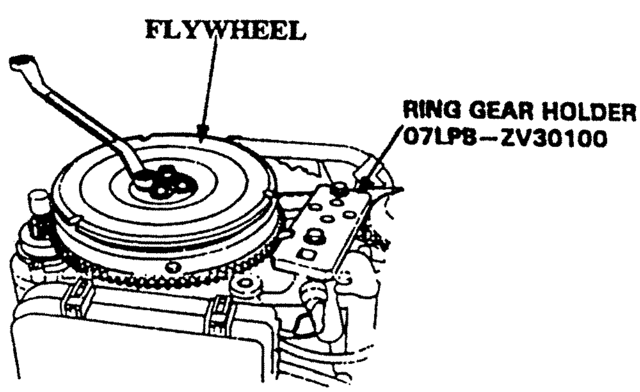


Fig. 21-3. Flywheel Locking Tool

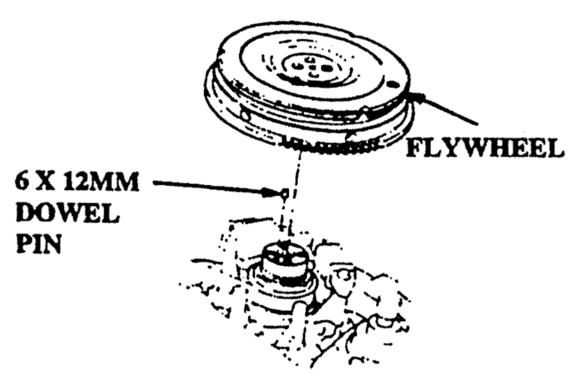


Fig. 21-4. Flywheel and Dowel

DO NOT use a hammer to part it from the crankshaft and AVOID damaging the 6 x 12mm dowel pin in the end of the crankshaft (Fig. 21-4).

To Reinstall

Ensure that the flywheel and crankshaft mounting faces are clean and free of burrs. Check that metallic matter has not been attracted onto the flywheel magnets as this could damage the charging, and exciter coils.

Mount the flywheel ensuring that it is correctly located on the dowel pin.

Oil the four M10 bolts and tighten to a torque of 48 ft/lbs.

Reinstall the flywheel cover.

CHECKING VALVE CLEARANCES

The valve-clearance checking procedure must be performed with the engine COLD.

Remove the flywheel cover (see SECTION 21).

Release the clips securing the breather hoses to the cylinder-head cover and detach the hoses.

Remove the seven M6 flange bolts and CAREFULLY remove the cylinder-head cover.

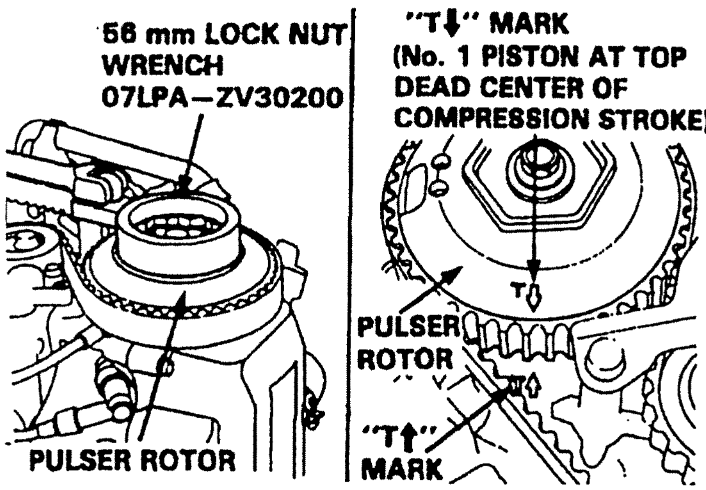


Fig. 22-1. Special Tools and Timing Marks

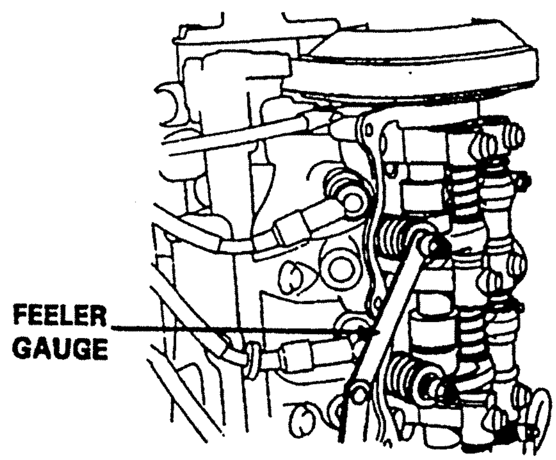


Fig. 22-2. Measuring Valve Clearance

Attach the Special Tool 07LPA-ZV30200 to the pulser rotor as shown, and align the 'T - arrow DOWNWARDS' mark on the pulser rotor with the 'T- arrow UPWARDS' mark on the cylinder head (Fig. 22-1).

Be sure that the 'T - mark' on the flywheel aligns with the '1 - mark' on the engine hanger mounting boss this time (which indicates that the No. I piston is at the top dead center of its compression stroke).

With the No. 1 piston at the top dead center of the compression stroke, measure the intake and exhaust valve clearances (Fig. 22-2).

These should be: Inlet Valve 0.005"-0.007" and Exhaust Valves 0.008"- 0.010".

Loosen the valve-adjusting screw locknut and turn the adjusting screw to obtain the specified intake and exhaust valve clearance.

Hold the adjusting screw and tighten the locknut to a torque of 17 ft/lbs.

Recheck valve clearance after tightening the locknut.

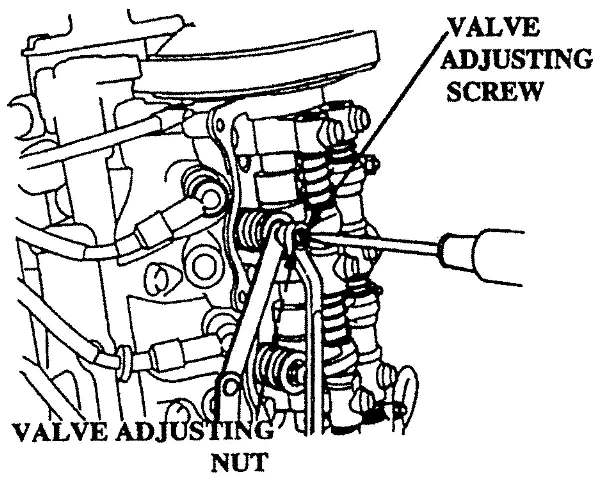


Fig. 22-3. Adjusting Valve Clearance

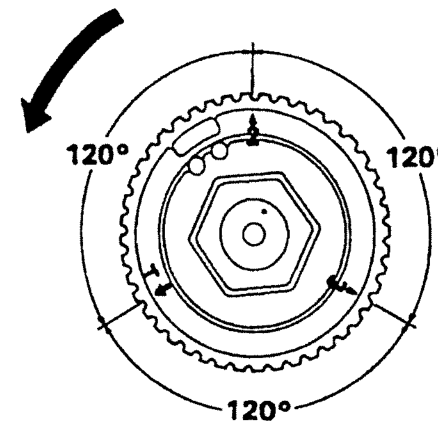


Fig. 22-4. Pulser Rotor Markings

After adjusting the intake and exhaust valve clearances of the No. 1 cylinder, turn the pulser rotor 120° further and align the 2 - TRIANGLE mark with the arrow UPWARDS mark on the cylinder head (which indicates that the No. 2 piston is at top dead center of its compression stroke) then adjust both the intake and exhaust valve clearances (Fig. 22-4).

Finally, turn the pulser rotor 120° further and align the '3 - TRIANGLE' mark with the 'T - arrow UPWARDS' mark on the cylinder head (which indicates that the No. 3 piston is at the top dead center of the compression stroke) then adjust both the intake and exhaust valve clearance (Fig. 22-4).

Thoroughly clean the cylinder head and cover mating surfaces.

Apply 'Three Bond 1201 or 1215' or equivalent to the mating surfaces and install a new gasket.

Reinstall the cylinder head and tighten the seven M6 flange bolts to a torque of 9 ft/lbs.

Reconnect the breather tubes to the head cover.

Reinstall the flywheel cover.

SECTION 23

CYLINDER HEAD

To Remove

Remove the flywheel cover (see SECTION 21).

Remove the pulser and rotor coils (see SECTION 20). Then slacken the clips and detach the breather hoses from the cylinder-head cover.

Remove the air filter (see SECTION 13) and also remove the carburetors (see SECTION 14).

Remove the head cover by unscrewing the seven M6 flange bolts.
Note: If checking the camshaft axial clearances (end float) this should be done BEFORE removing the cylinder head (Fig. 23-17).

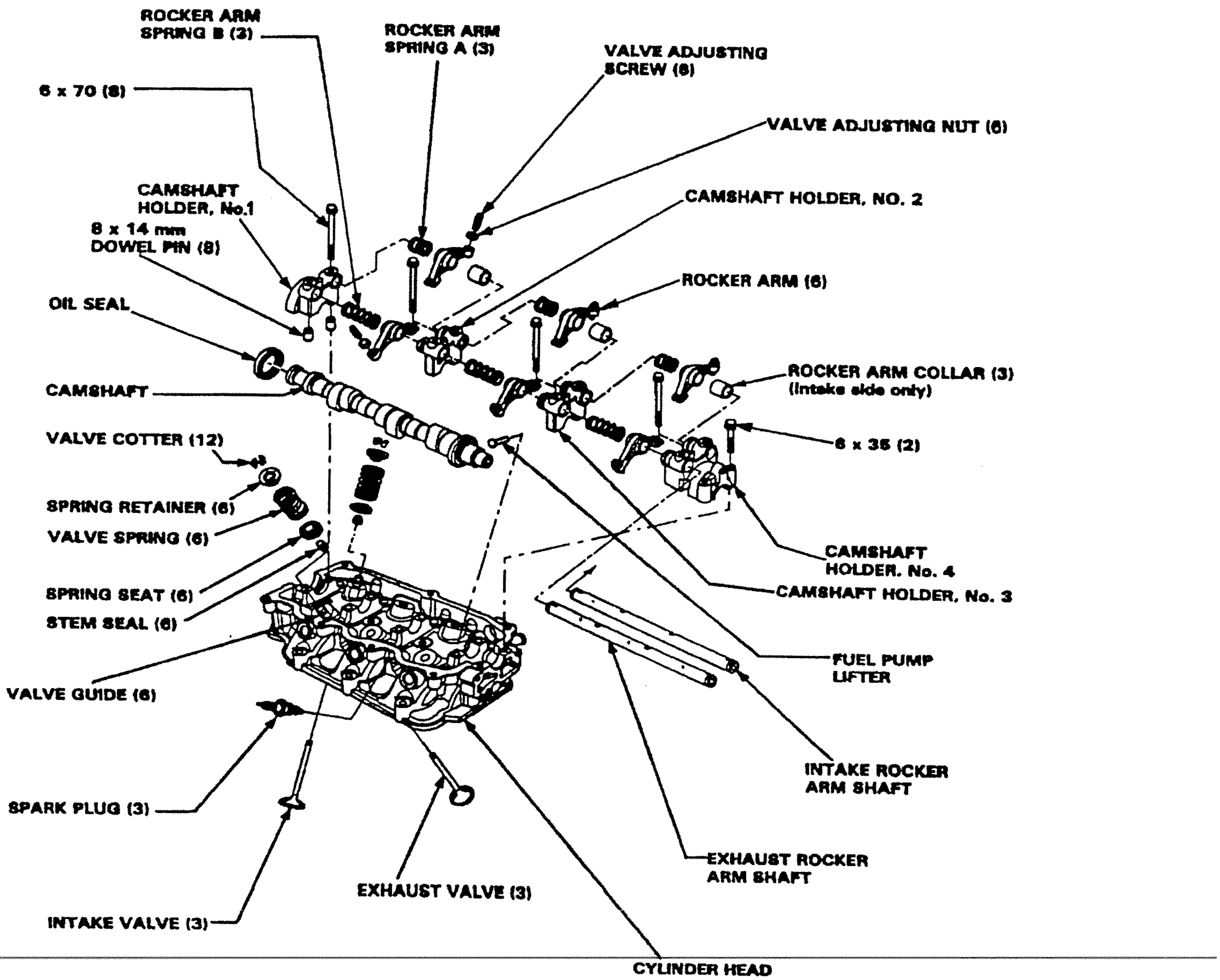


Fig. 23-1. Cylinder Head and Valve Gear

• Progressively loosen the eight M10 and three M8 cylinder-head bolts securing the cylinder head to the cylinder block. Remove the cylinder-head assembly and recover the gasket, eight dowel pins (if loose) oil-path orifice and the 'O' ring from the face of the cylinder block.

Remove the oil pump (see SECTION 26).
Note: Unscrew the spark plugs to prevent accidental damage occurring to them.

Progressively loosen the eight 6 x 70mm and the two 6 x 35mm flange bolts securing the four camshaft holders to the cylinder head (Fig. 23-2).

Lift the camshaft holders and rocker-arm shafts from the eight dowel pins and carefully remove the camshaft and oil seal. Recover the fuel pump lifter from the cylinder head (Fig. 23-3).

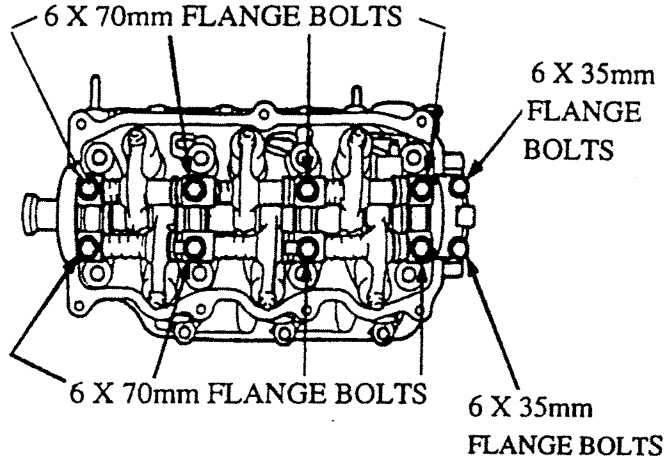


Fig. 23-2. Camshaft Holder Bolts

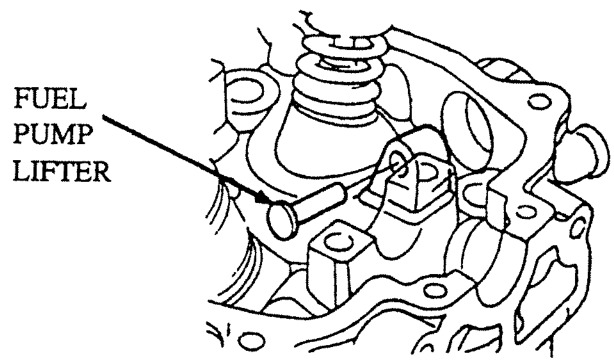


Fig. 23-3. Fuel Pump Lifter

Using valve-spring compressor 07757 - 0010000, remove the spring caps, cotters, springs, spring seats and valve-stem seals. Ensure that the components are kept in sets and marked accordingly to their respective positions in the cylinder head.

Inspection and Maintenance

Valve-Spring Free Length

Measure the free length of the valve spring (Fig. 23-4), - this should he 1.5". The service limit is 1.4" and if shorter than this figure, install a new spring.

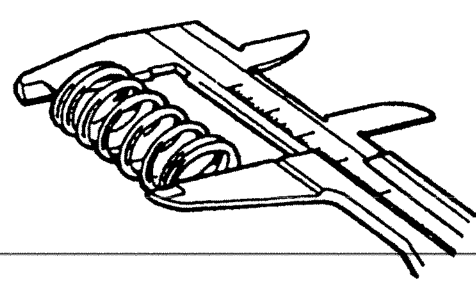


Fig. 23-4. Measuring Valve Spring Length

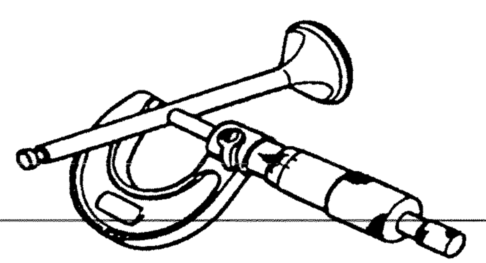


Fig. 23-5. Measuring Valve Stem

Valve Stem Diameter

Inspect each valve stem for abnormal wear or bending. Measure and record each valve-stem diameter (Fig. 23-5).

The standard valve-stem diameter is:

Inlet Valve:	0.2157"-0.2161"	Service limit 0.2146"
Exhaust Valve:	0.2150"-0.2153"	Service limit 0.2134"

If the measurement obtained is LESS THAN the service limit, install a new valve.

Valve Guide Bore Diameter

Ream the valve guides to remove any carbon deposits before measuring the bore diameter.

Measure each valve guide and record the reading obtained (Fig. 23-6).

The standard bore size is:

Inlet and Exhaust Guides: 0.2165"-0.2170" Service limit 0.2177"

If the measurement EXCEEDS the service limit, install a new valve guide.

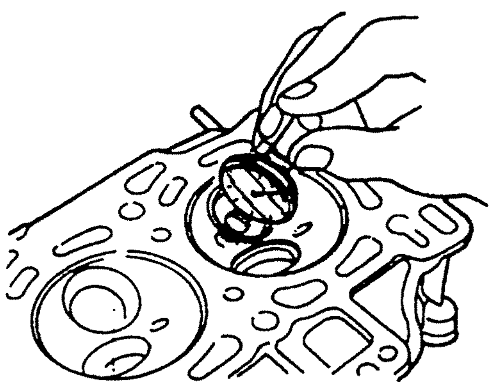


Fig. 23-6. Measuring Valve Guide Bore

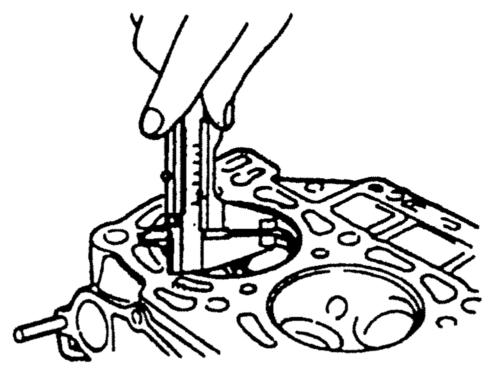


Fig. 23-7. Measuring Valve Seat Width

Valve-Guide-to-Stem Clearance

To obtain the clearance figure, subtract the valve-stem outside diameter from the corresponding valve-guide bore figure.

The standard clearance is:

Inlet:	0.0004"-0.0013"	Service limit 0.0024"
Exhaust:	0.0012"-0.0020"	Service limit 0.0039"

If the valve-guide clearance EXCEEDS the service limit, determine if a new guide of standard dimensions would bring the Clearance within the correct tolerance. If it would, install a new guide and ream to fit.

If the steam-to-guide clearance EXCEEDS the service limit WITH a new guide, install a new valve as well.

Note: Whenever a new valve guide is fitted, the valve seat MUST be reconditioned.

Valve Seat Width

Measure the valve seat width (Fig. 23-7).

The standard width should be:

Inlet and Exhaust Valve Seats: 0.0492"-0.610" Service limit 0.0787"

If the seat width is UNDER the standard limit OR OVER the service limit, recondition the valve seat.

Valve Seat Reconditioning

Thoroughly clean the combustion chambers and valve seats to remove carbon deposits.

Apply a light coat of 'Prussian Blue' or equivalent engineer's marking compound to the valve face. Insert the valve into the guide and, WITHOUT ROTATING, snap it closed several times. The transferred marking compound will show any area which is not concentric with the guide and/or valve.

To recut the valve seat; carefully follow the cutter manufacturer's instructions.

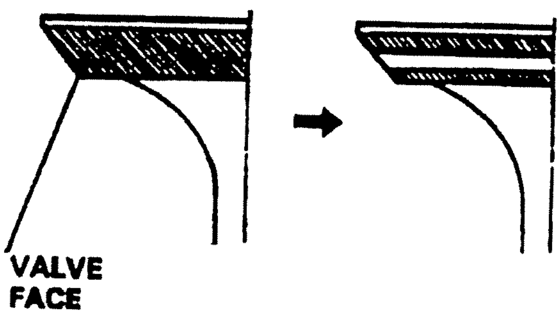


Fig. 23-8. Valve Facing Seating Area

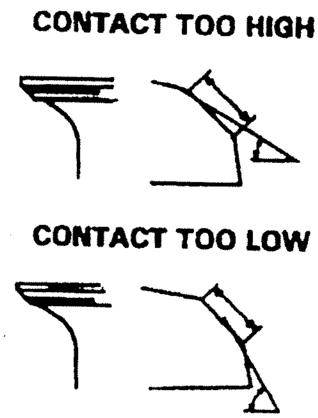


Fig. 23-9. Valve Face Contact Point

Using cutter holder 07781 - 0010101 and a 45° cutter, remove enough seat material to produce a smooth concentric seat.

Turn the Cutter CLOCKWISE ONLY - NEVER counter-clockwise.

Continue turning the cutter as it is lifted from the seat.

Note: Valve head diameter:

Inlet:	Valve Head Diameter 0.945"
Exhaust:	Valve Head Diameter 1.18"

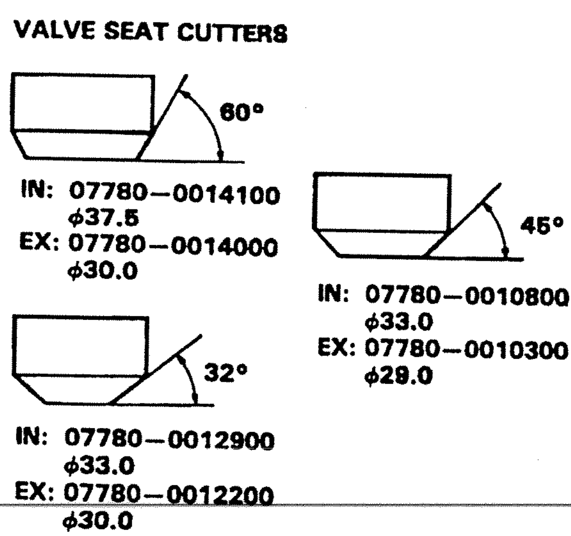


Fig. 23-10. Valve Seat Cutting Angles

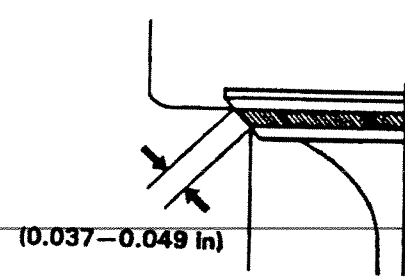


Fig. 23-11. Valve Face Contact Width

Use the 30°-32° and 60° cutters to narrow and adjust valve seat so that it contacts the middle of the valve face (Figs 23-8 and 23-9).

The 30° cutter removes material from the top edge and the 60° cutter removes material from the bottom edge (Fig. 23-1 0).

Ensure that the width of the finished seat is within specification.

Make a light pass with a 45° cutter to remove any possible burrs from the edges of the seat.

After re-surfacing the seat, inspect the valve for even seating. Check the width and concentricity of the seating by applying 'Prussian Blue' or equivalent engineer's compound to the valve face.

Snap the valve closed against the seat several times, taking care not to rotate the valve.

The seating surface is shown by the transferred compound and should have a good contact all the way round.

Lap the valves to their seating using a hand-lapper and lapping compound.

Note: DO NOT use a power drill as this will simply make a series of concentric grooves and will quickly destroy the valve seating and valve.

IMPORTANT: BE SURE TO REMOVE ALL, TRACES OF THE LAPPING COMPOUND FROM THE VALVES AND SEATS. FAILURE TO DO SO WILL RESULT IN SERIOUS ENGINE DAMAGE.

Rocker Arm Shaft

Measure the outside diameter of the rocker arm shaft (Fig. 23-12). The standard size is 0.5502"-0.5509". The service limit 0.5492".
Replace the shaft if its diameter is less than the service limit.

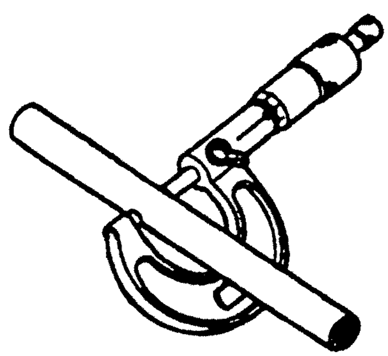


Fig. 23-12. Rocker Shaft Outside Diameter

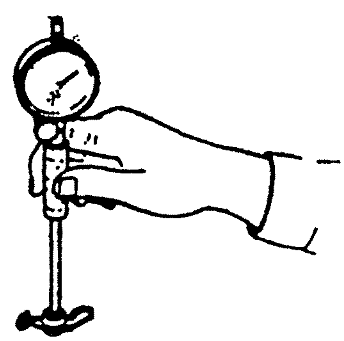


Fig. 23-13. Rocker Arm Bore Diameter

Rocker Arm

Measure the bore of the rocker arm (Fig. 23-13). The standard bore size is 0.5516"-0.5523". The service limit is 0.5531". If the bore is larger than the service limit install a new rocker arm. Check the rocker-arm slipper surface for wear and scratches. Replace if necessary.

Rocker Arm-to Rocker-Arm-Shaft Clearance

The standard rocker-arm-to-rocker-arm clearance is 0.0006"-0.0020". The service limit is 0.0028". If the service limit is exceeded, install a new rocker arm and/or rocker-arm shaft.

Cam Height

Measure the cam height (Fig. 23-14). The standard height is:

Inlet Cam:	1.375"-1.387"	Service limit: 1.366"
Exhaust Cam:	1.377"-1.389"	Service limit: 1.368"

If the cam is less than the service limit, install a new camshaft.

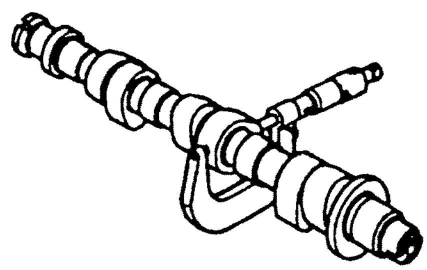


Fig. 23-14. Measuring Cam Height

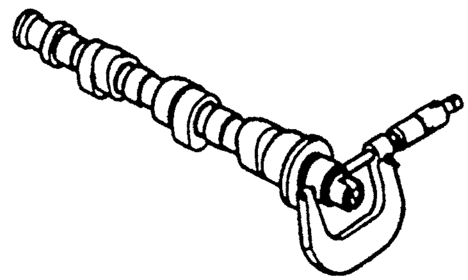


Fig. 23-15. Measuring Camshaft Journal

Camshaft Journal Diameter

Measure the camshaft journal diameter (Fig. 23-15). The standard diameter is 0.9039"-0.9047".

The service limit is 0.9028". If the journal diameter is smaller than the service limit, install a new camshaft.

Camshaft Run-Out

Check the camshaft run-out (Fig. 23-16).

Note that the camshaft run-out is half of the maximum gauge reading already obtained.

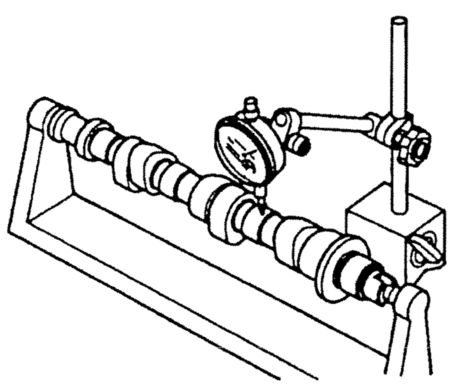


Fig. 23-16. Checking Camshaft Run-Out

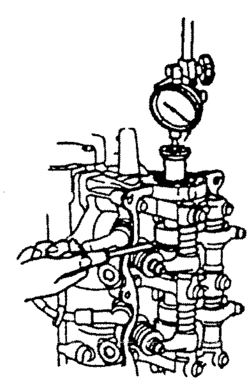


Fig. 23-17. Camshaft Axial Clearance

The standard maximum run-out is 0.0012" and the service limit is 0.0020".

Camshaft Axial Clearance

The camshaft axial clearance (end float) should be checked **BEFORE** removing the cylinder head from the cylinder block (Fig. 23-17).

Loosen the valve-adjusting locknuts and unscrew the adjusting screws before performing the check.

The standard axial clearance is 0.0012"-0.0043". The service limit is 0.0012" and, if exceeded, a new camshaft should he installed and the clearance re-checked. If the service limit is STILL exceeded, a new cylinder head must be fitted.

Camshaft Oil Clearance

Set the Plastigauge axially on each camshaft journal (Fig. 23-18).

Install camshaft holders - Numbers 1, 2, 3, and 4 and the eight 8 x 14mm dowel pins.

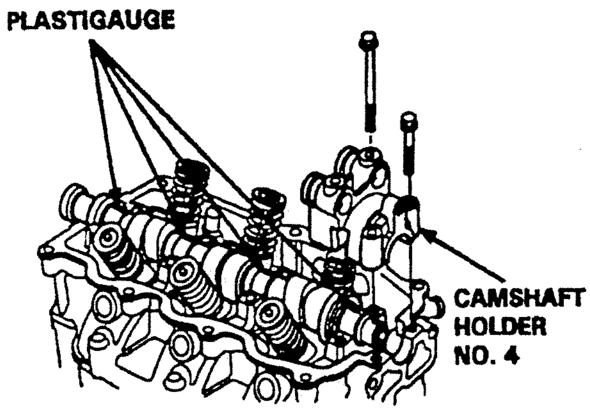


Fig. 23-18. Plastigauge Locations

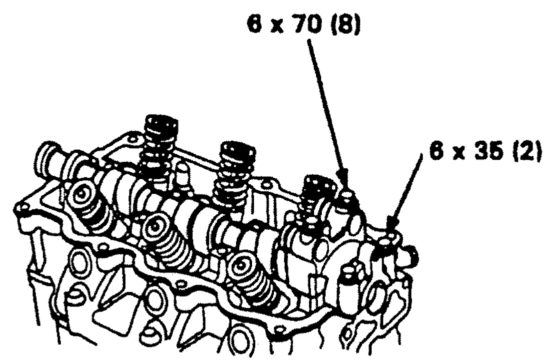


Fig. 23-19. Flange Bolt Location

Tighten the eight 6 x 70mm and two 6 x 35mm flange bolts to the correct torque:
For 6 x 70mm bolts - 10 ft/lbs. and for 6 x 35mm bolts - 9 ft/lbs.

DO NOT rotate the camshaft while tightening the bolts. The inner bolts should be tightened first followed by the outer side to the same torque value (Fig. 23-19).

Remove camshaft holders 1,2,3 and 4 and check the width of each Plastigauge using the scale (Fig. 23-20). Measure the width at its widest point.

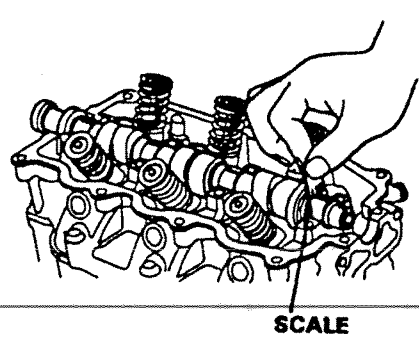


Fig. 23-20. Checking Plastigauge Width

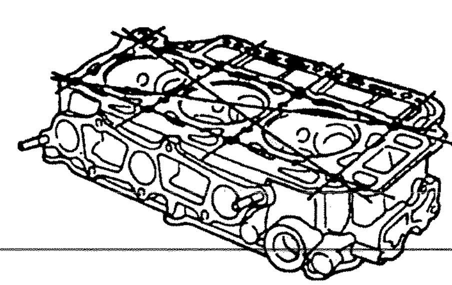


Fig. 23-21. Checking Cylinder Head Warpage

. The standard oil clearance is 0.0008"-0.0026". The service limit is 0.0031". If the oil clearance exceeds the service limit, install a new camshaft and measure the clearance again. If it STILL exceeds the service limit, install a new cylinder head.

Cylinder Head Inspection

Clean any gasket material from the gasket face and any carbon deposits from the combustion chambers. Carefully check the areas around the plug holes and valve seats for cracks. Using a known straight-edge and feeler gauge, check the cylinder head for warpage (Fig. 23-21). The service limit is 0.0039".

Replacing Valves Guides

Chill the new valve guide(s) in the freezer-section of the refrigerator for approximately one hour. Using valve-guide driver Number 07742 – 0010100, drive out the valve guide from inside the combustion chamber (Fig. 23-22). Take care not to damage the cylinder head during valve-guide removal.

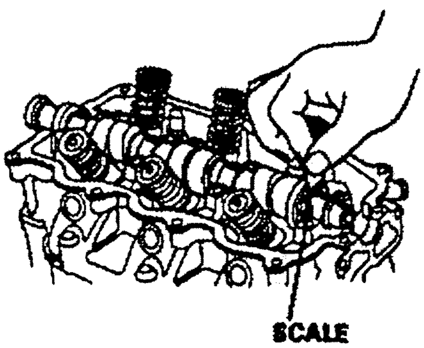


Fig. 23-22. Driving Out Old Valve Guide

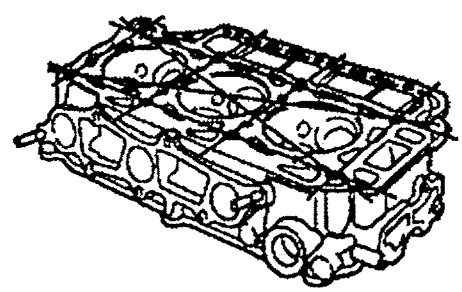


Fig. 23-23. Installing New Valve Guide

Remove the new valve guide(s) one at a time as required for immediate installation. Position the new valve guide at the valve spring side of the cylinder head and drive in towards the combustion chamber (Fig. 23-23).
Following installation, check the guide for damage. If damaged, a new guide must be fitted.

Valve Guide Reaming

For best results ensure cylinder head is at room temperature before reaming the valve guides and coat the valve-guide reamer Number 07984-2000001 and the valve guide with cutting oil.

Turn the reamer clockwise through the valve guide for the full length of the reamer and keep turning the reamer during its withdrawal from the guide (Fig. 23-24).

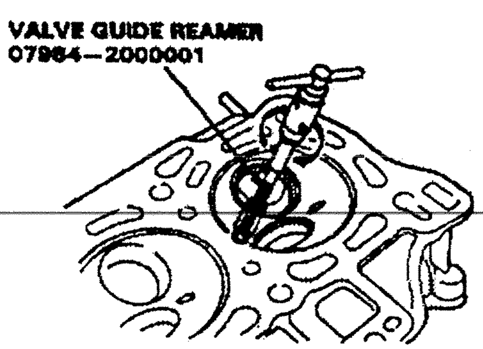


Fig. 23-24. Reaming Valve Guide

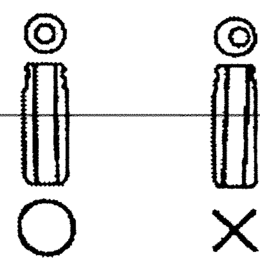


Fig. 23-25. Showing Valve-Guide Bore

Thoroughly clean the cylinder head and valve guide to remove any debris and cutting oil from the reaming operation.

Ensure that the valve-guide bore is straight, circular in section and concentric with the guide body (Fig. 23-25). Insert the valve and check that its operation is smooth over the working area of the valve stem. If it does not operate smoothly, the guide may have been bent during installation. If it has, a new one must be fitted.

Finally, check the valve-guide-to stem clearance.

Cylinder Head Bolts Check

10 x 85mm Bolts

Measure the length of the bolts as shown (Fig. 23-26). The standard length is 3.326"-3.366". The service limit is 3.421" and if not within the service limit, new bolt(s) must be fitted.

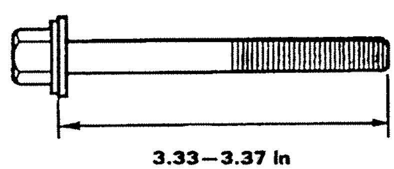


Fig. 23-26. Cylinder Head Bolt Length

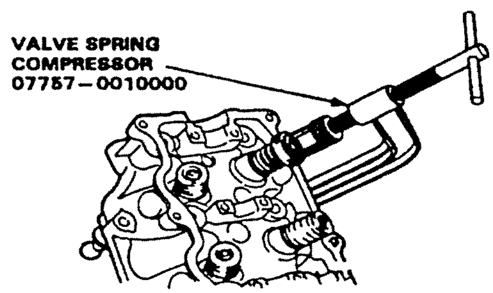


Fig. 23-27. Installing Valve Springs

To Reinstall

Reinstallation is a reversal of the removal instructions, noting the following:
When refitting valves, install a new stem oil seal to each valve and lubricate stem with engine oil. Use the valve-spring compressor Number 07757 - 0010000 to compress the valve springs and install the valve cotters (Fig. 23-27). Ensure that they are correctly seated in the groove of the valve stem.

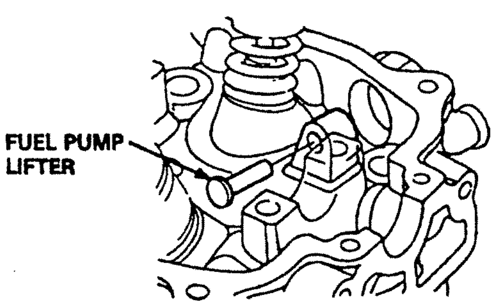


Fig. 23-28. Fuel Pump Lifter Location

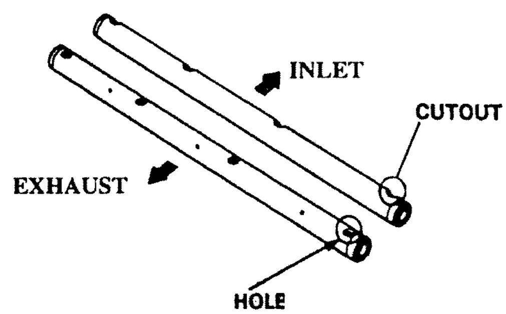


Fig. 23-29. Rocker Arm Shaft Installation

DO NOT FORGET to install the fuel-pump lifter in the cylinder head before installing the camshaft and rocker-arm shafts. Lubricate with engine oil.

Rocker Arm Shafts

The rocker-arm shafts MUST NOT be interchanged.

Note: The shaft with the hole in it is installed to the exhaust side and the one with the cut-out is installed to the inlet side (Fig. 23-29).

Lubricate with engine oil.

Cam Holder No. 1 and 4

Before installing apply 'Three Bond 14 I' or equivalent, sealing compound to the installation surfaces.

Grease between the lips of the, oil seal in No. 2 cam holder.

Install with the cam-holder number facing the pulser rotor (Fig. 23-30).

Rocker Arms, Springs and Collars

These components must be assembled in the positions shown and lubricated with engine oil - (Fig. 23-31).

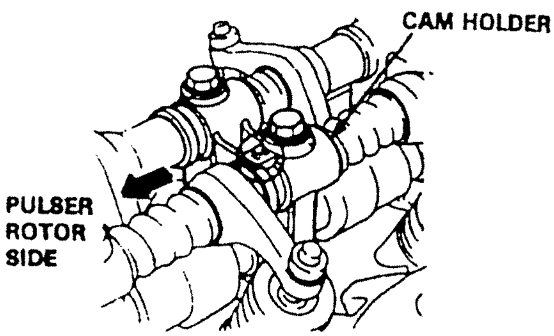


Fig. 23-30. Cam Holder Position

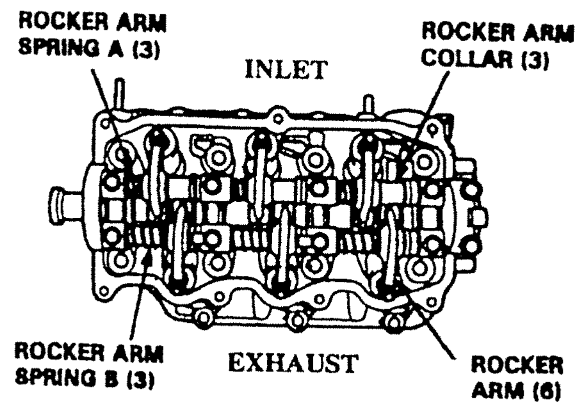


Fig. 23-31. Rocker Arms, Springs and Collars

6 x 70 and 6 x 35mm Flange Bolts

Install the eight 6 x 70mm and the two 6 x 35mm flange bolts and tighten in the sequence shown (Fig. 23-32). The 6 x 70mm bolts should be tightened to a torque of 10 ft/lbs. and the 6 x 35mm bolts to a torque of 9 ft/lbs.

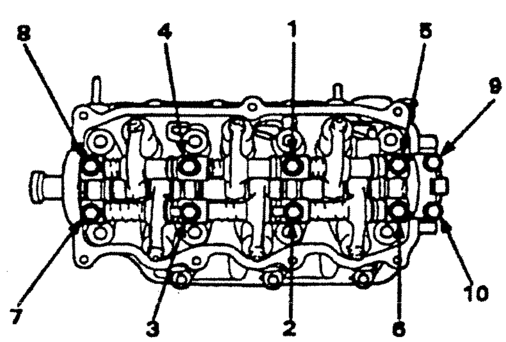


Fig. 23-32. Camshaft Holder Bolt Tightening

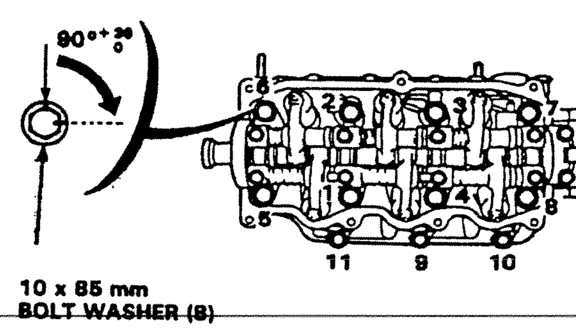


Fig. 23-33. Cylinder Head Bolt Tightening

10 x 85mm Bolts and 8 x 40mm Flange Bolts

Before installing the cylinder head and cylinder-head bolts, ensure that the eight 8 x 14mm dowel pins and the oil-path orifice and 'O' ring are installed in the joint face of the cylinder block. Install a new cylinder-head gasket, position the cylinder head on the block, lightly oil the bolts and install them in their correct locations.

Tighten the eight 10 x 85mm bolts and the three 8 x 40mm flange bolts in the sequence shown (Fig. 23-33). The 10 x 85mm bolts should be tightened to 28 ft/lbs then a further 90°+30. The 8 x 40mm flange bolts should be tightened to a torque of 20 ft/lbs.

Adjust valve clearances and tighten adjuster locknuts to a torque of 17 ft/lbs. (see SECTION 22).

Use a new head-cover gasket coated on both surfaces with 'Three Bond 1201 and 1215' or equivalent sealing compound.

Tighten the seven head-cover bolts to a torque of 9 ft/lbs.

Compression Check

Whenever work has been carried out involving valves, cylinder head or pistons and rings, a compression check may be performed as required, using the following procedure:
Remove all three spark plugs.
Fully open the throttle. Check that the choke is in the 'OFF' (inoperative) position.
Install a compression gauge in one of the spark plug holes.
Operate the starter motor until the highest pressure reading is obtained.
Install the compression gauge in each of the remaining plug holes in turn and obtain the highest pressure reading as previously described. The correct reading should be 212+/-14 PSI at 500 r.p.m.

CRANKCASE

To Remove

Disconnect and remove the battery.

Disconnect the exciter coil and charging-coil wires under the capacitor-discharge ignition cover (Fig. 21-1).

Drain the engine coolant. Then drain the engine oil.

Remove the pump unit. (see SECTION 16).

Remove the engine unit and mount in a suitable jig to enable engine-stripping operations to be performed safely.

Remove the flywheel. (see SECTION 21). Then remove the timing belt and pulleys. (see SECTION 22). Finally remove the cylinder head. (see SECTION 23).

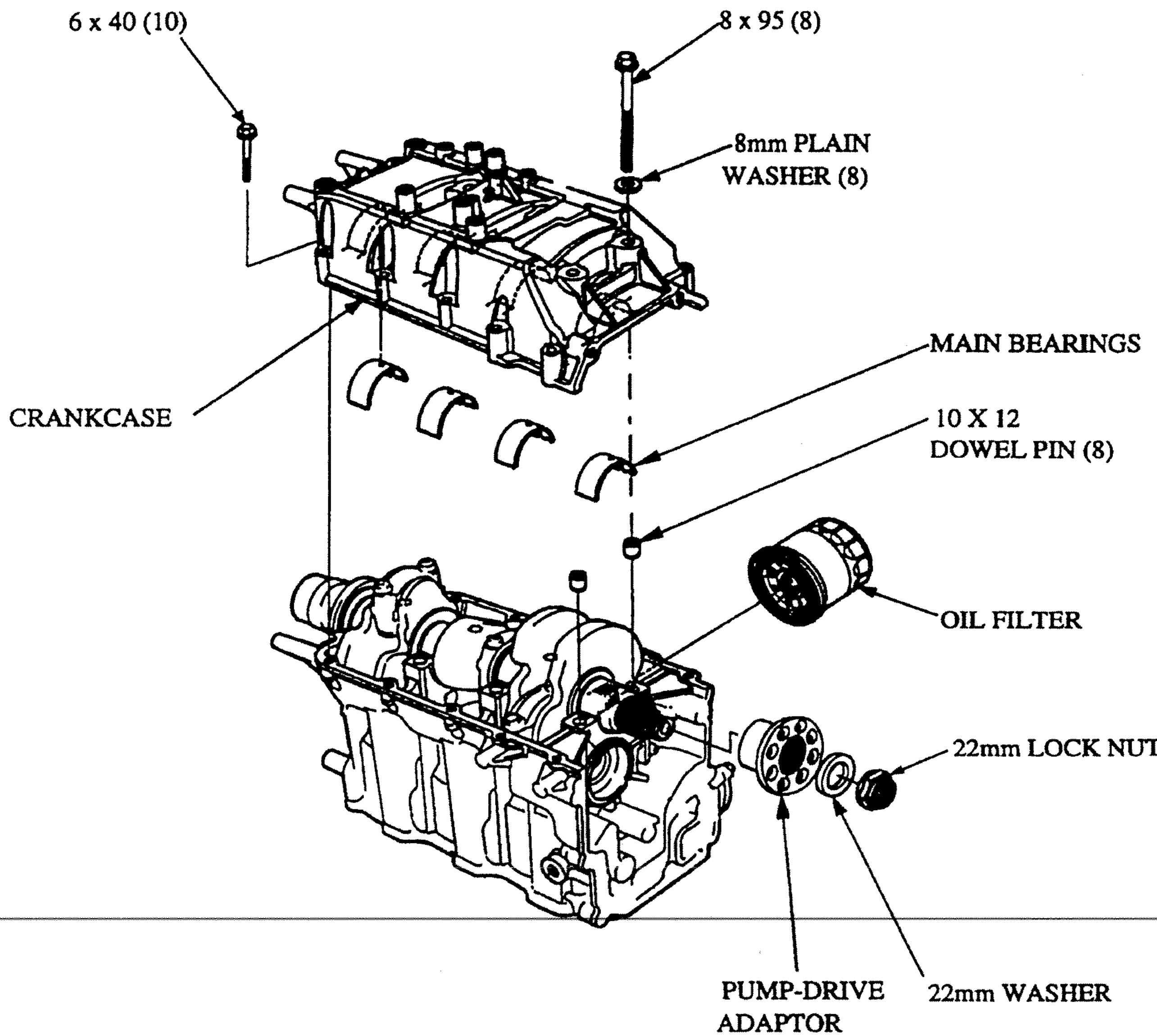


Fig. 24-1. Crankcase Components

Install the ring gear holder 07LPB - ZV 30100 to prevent the crankshaft from revolving.

Unscrew the eight nuts and bolts from the pump shaft-to-pump drive adapter and remove the pump shaft.

Using locknut wrench 07916 - 7500000 unscrew the M22 locknut securing the pump drive shaft adapter to the crankshaft. Recover the M22 washer and withdraw the adapter from the splines.

Progressively loosen the ten 6 x 40mm flange bolts around the perimeter of the crankcase and then the eight 8 x 95mm bolts from the raised part of the crankcase.

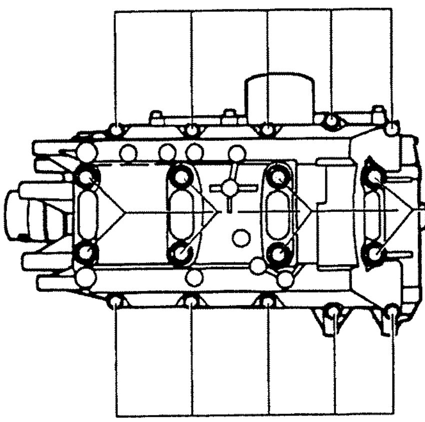


Fig. 24-2. Crankcase Flange Bolts

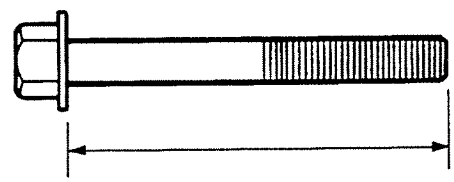


Fig. 24-3. Checking Flange Bolt Length

Check the length of the 8 x 95mm flange bolts. The standard length should be 3.681"-3.720" and the service limit is 3.756".
If the bolt is not within the service limit it MUST NOT be re-used; use a NEW bolt.

Maintenance

Thoroughly clean the crankcase, particularly the crankcase-to-cylinder block-joint faces.

Ensure that the new main bearing shells are correctly located with the locking lug of each shell in the corresponding notch in the crankcase.

Apply Molybdenum disulphide oil to the bearing working faces but not to the mating surface with the crankcase.

Check that the eight 10 x 12mm dowel pins are in position in the cylinder block.

To Reinstall

Apply 'Three Bond 1141C' or equivalent, liquid gasket to the crankcase-joint face (Fig. 24-4) -
DO NOT apply to the crankshaft journal or bolt holes.

Apply locking agent to the plain shank and oil threads and flange of the eight 8 x 95mm flange bolts - insert into their respective crankcase bolt holes. Remember to install the M8 plain washers.

. Insert the ten 6 x 40mm flange bolts into the remaining crankcase bolt holes after applying oil to the thread and flange of each bolt.

Tighten the 8 x 95mm flange bolts in the sequence shown (Fig. 24-5) to a torque of 21 ft/lbs. Mark the bolt heads and crankcase ,and tighten through a further 90°+30.

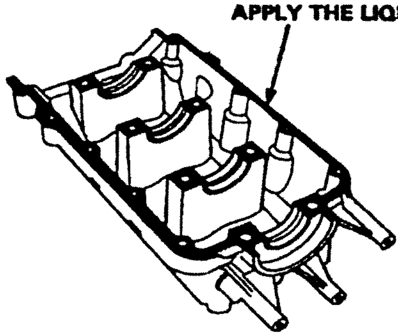


Fig. 24-4. Applying Liquid Gasket

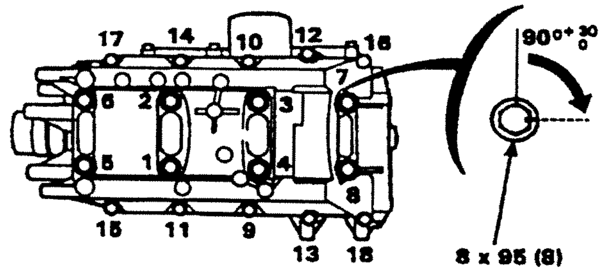


Fig. 24-5. Crankcase Bolt Tightening

Tighten the ten 6 x 40mm flange bolts in the sequence shown (Fig. 24-5) to a torque of 8 ft/lbs.

Secure the crankshaft with ring-gear holder Number 07LBP - ZV 30100.

Oil the threads of the crankshaft, install the pump-drive shaft adapter M22 locknut. Tighten to a torque of 68 ft/lbs using locknut wrench Number 07916 - 7500000.

Use the staking tool (Part Number 53563) to secure the locknut by staking it into the groove provided in the threaded portion of the crankshaft.

Check the run-out (concentricity) of the pump shaft adapter.

IMPORTANT: This MUST NOT EXCEED 0.00079" total indicator reading.

Note: Before staking, make absolutely sure that the adapter is fully-seated and recheck the torque loading on the locknut.

IMPORTANT: It is ESSENTIAL to use the staking tool when installing the PUMP shaft adapter locknut. FAILURE TO DO SO WILL ALLOW THE NUT TO BECOME LOOSE RESULTING IN SERIOUS ENGINE AND/OR PUMP DAMAGE.

Install a new engine oil filter. (see SECTION 28).

Reinstalling the remaining components is a reversal of the removal instructions. Refer to the appropriate sections.

SECTION 25

CYLINDER BLOCK, CRANKSHAFT AND PISTONS.

To Remove

Remove the crankcase (see SECTION 24), unscrew the connecting-rod nuts and lift off the connecting-rod cap.

Lift the crankshaft from the main bearings in the cylinder block and remove the 50x70x8mm oil seal from the flywheel-end of the crankshaft. Recover the two thrust bearings and the main bearings.

Remove the piston and connecting-rod assemblies and mate with the previously removed connecting-rod caps.

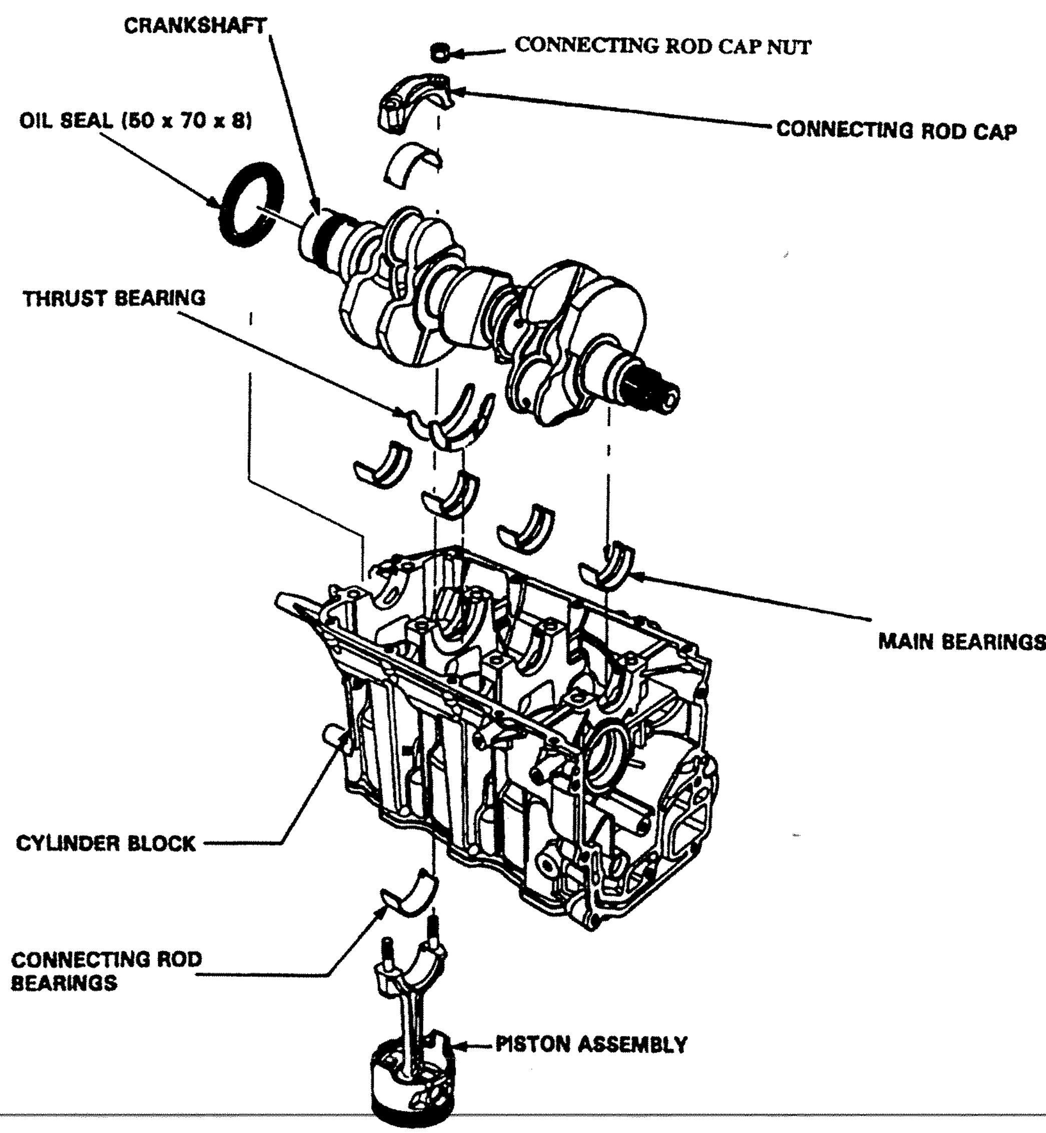


Fig. 25-1. Cylinder Block, Crankcase and Pintons

- Using a pair of needle-nosed pliers, remove the circlips from the piston taking care NOT to scratch or damage the piston body.

Push the piston pin from the piston. This action will also release the connecting rod assembly from the piston.

Carefully remove the two compression and the three-piece oil-control ring from the piston, again taking care not to damage the piston-ring lands.

Inspection and Maintenance

Piston Skirt O.D.

Measure and record the piston O.D. at 10mm from the bottom of the skirt at a point 90' from the piston pin bore (Fig. 25-2).

The standard O.D. is 2.7547"-2.7555" and the service limit is 2.7524".

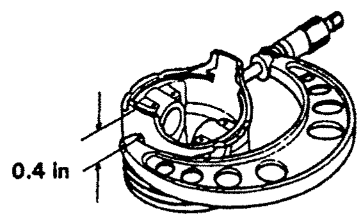


Fig. 25-2. Piston Outside Diameter

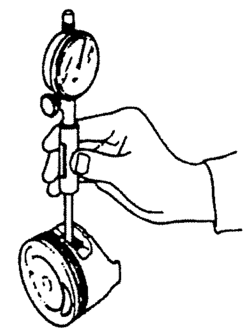


Fig. 25-3. Piston Pin Hole Diameter

Piston Pin Hole Diameter

Measure the bore of the piston pin hole (Fig. 25-3). The standard diameter is 0.7087"-0.7090" and the service limit is 0.7071".

Piston Pin O.D.

Using a micrometer measure the outside diameter of the piston pin at three points i.e. the two bearing surfaces which arc normally in contact with the piston pin hole and the area upon which the connecting rod operates (Fig. 25-4).

The standard diameter is 0.7084"-0.7087" and the service limit is 0.7068".

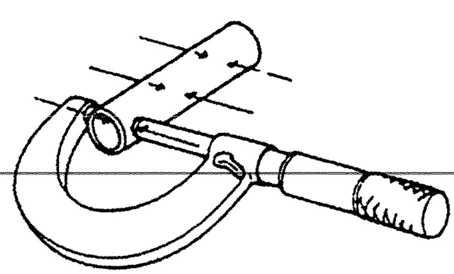


Fig. 25-4. Measuring Piston Pin O.D.

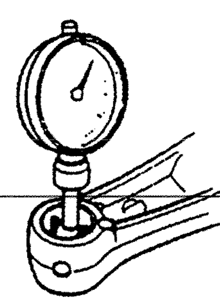


Fig. 25-5. Connecting Rod Small End I.D.

Measure the inside diameter of the connecting rod small end (Fig. 25-5). The standard diameter is 0.709"-0.701" with a service limit of 0.711".

Piston Ring Width

Measure the width of the top (chrome-plated) and the second piston rings (Fig. 25-6). The standard width is 0.039"-0.040" with a service limit of 0.039".

Piston Ring Side Clearance

Use a feeler gauge to determine the side clearance between the piston rings and the piston body (Fig. 25-7). The clearances should be as follows:
Top Ring standard clearance is 0.002"-0.003" and the service limit is 0.004".
Second ring standard clearance is 0.001"-0.002" and the service limit is 0.004".

Oil control ring standard clearance is 0.022"-0.006" and the service limit is 0.006".

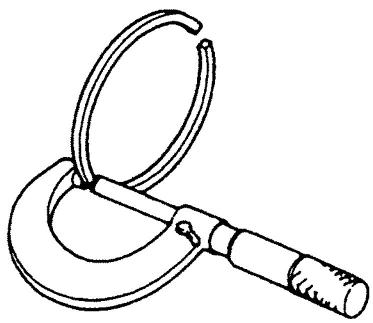


Fig. 25-6. Measuring Piston Ring Width

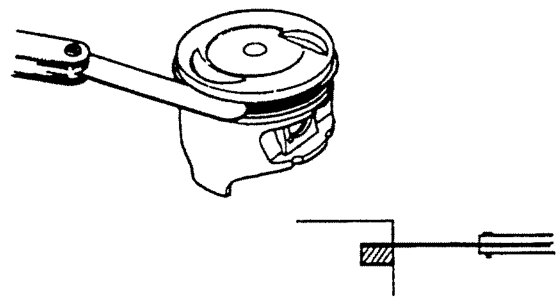


Fig. 25-7. Piston Ring Side Clearance

Cylinder Bore Diameter

Measure and record the cylinder bore diameter at three levels in both the X and Y axis (Fig. 25-8).
Use the maximum reading obtained to determine the cylinder bore wear. The standard bore measurement is 2.756"-2.757" with a service limit of 2.758.

Piston-to-Cylinder Clearance

This is calculated by comparing the piston diameter previously obtained with the cylinder bore diameter. The standard clearance is 0.0004"-0.0018" with a service limit of 0.004".

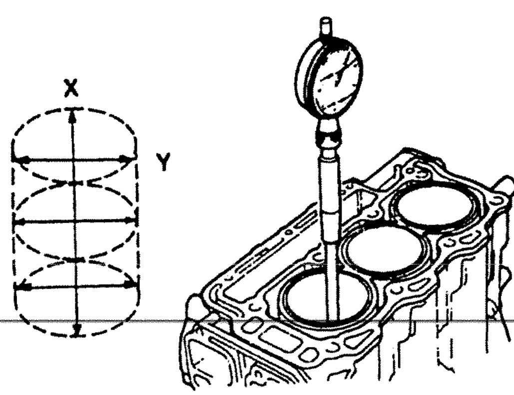


Fig. 25-8. Measuring Cylinder Bore

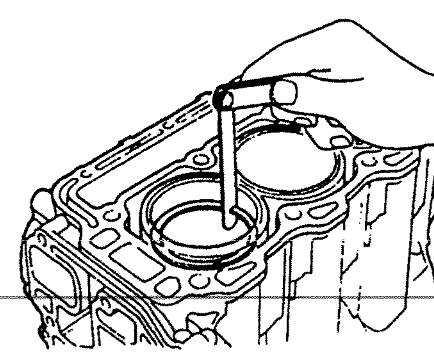


Fig. 25-9. Measuring Piston Ring Gap

Piston Ring End Gap

Insert each piston ring into the appropriate cylinder bore and measure the end gap (Fig. 25-9). The top ring standard gap is 0.006"-0.012" with a service limit of 0.032". The second ring standard gap is 0.012"-0.018" with a service limit of 0.037". The oil control ring standard gap is 0.0079"-0.0276" with a service limit of 0.039".

Crankshaft Main Journal O.D.

Measure the crankshaft main hearing journals O.D. (Fig. 25- 10). The standard size is 1.574"-1.575" with a service limit of 1.573".

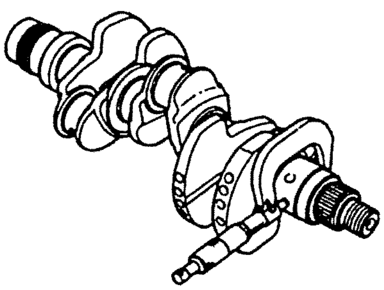


Fig. 25-10. Measuring Main Journal O.D.

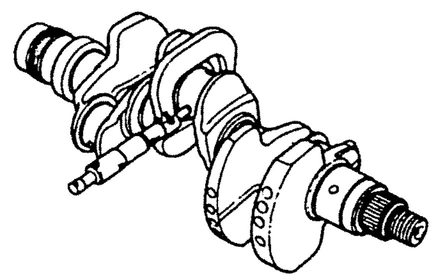


Fig. 25-11. Measuring Crankpin Journal O.D.

Crankpin (Big-End) Journal

Measure the crankpin journal O.D. (Fig. 25-11) The standard crankpin journal diameter is 1.495"-1.496" with a service limit of 1.494".

Connecting Rod Big-End Oil Clearance

Thoroughly clean all oil from the crankpin and connecting-rod bearing surfaces.

Position a piece of Plastigauge on the crankpin and assemble the connecting rod and cap and tighten nuts to a torque of 21 ft/lbs (Fig. 25-12).

Note: Do not rotate the crankshaft or connecting rod with Plastigauge in place.

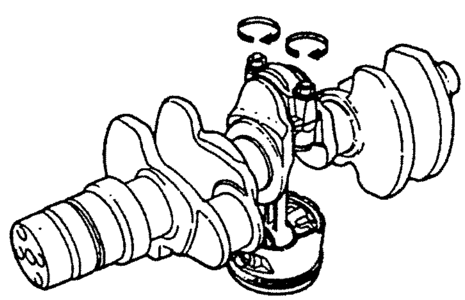


Fig. 25-12. Fitting Connecting Rod

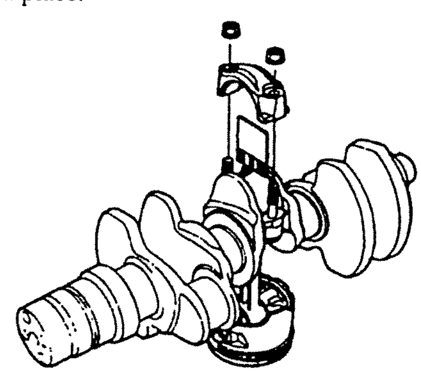


Fig. 25-13. Measuring the Plastigauge

Remove the nuts and connecting rod cap and measure the Plastigauge (Fig. 25-13).

The standard oil clearance is 0.001"-0.002" with a service limit of 0.003".

Connecting Rod Axial Clearance

Measure the axial clearance of the connecting rod with a feeler gauge (Fig. 25-14).

The standard clearance is 0.002"-0.008" with a service limit of 0.012".

Crankshaft Side Clearance

Measure the clearance with a feeler gauge (Fig. 25-15).

The standard clearance is 0.0020"-0.0120" with a service limit of 0.0177".

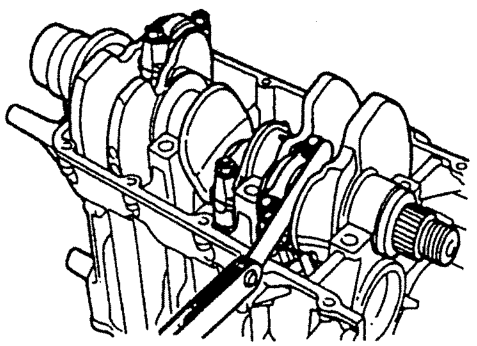


Fig. 25-14. Connecting Rod Axial Clearance

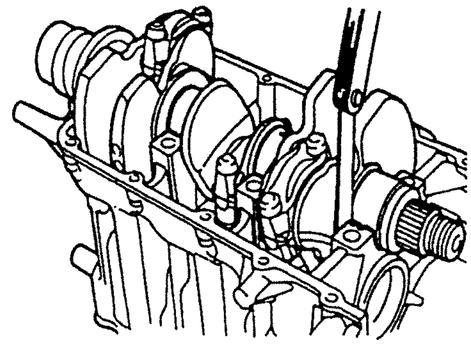


Fig. 25-15. Crankshaft Side Clearance

Bearing Selection

1. Main Bearing

Record the crankshaft main journal O.D. code numbers from the crankshaft web (Fig. 25-16). Alternatively, measure the main Journal O.D.

Record the crankcase identification code numbers (Fig. 25-17).

Note: Numbers on the crankcase are codes for the main bearing journal I.D. from front to rear.

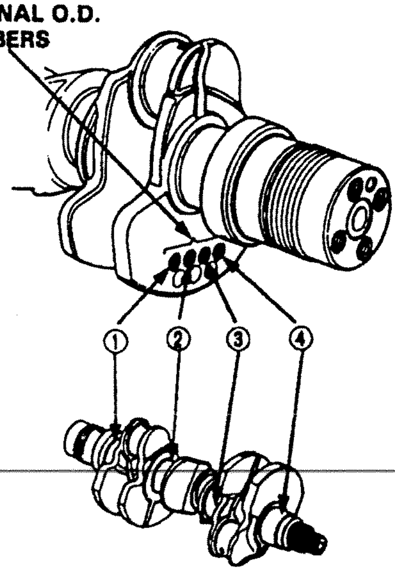


Fig. 25-16. Main Journal O.D. Code Numbers

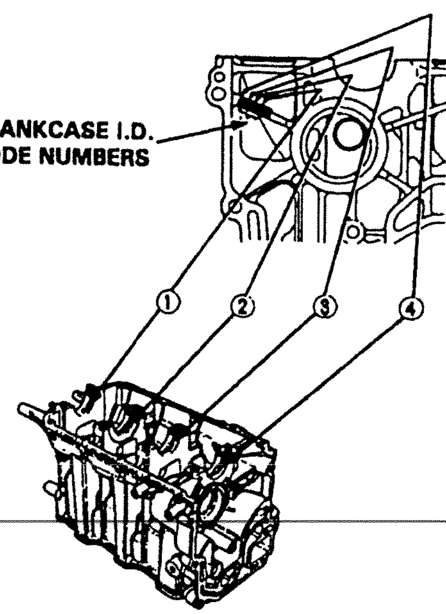


Fig. 25-17. Crankcase I.D. Code Numbers

- Cross reference the crankcase and journal codes to determine the replacement bearing color code (Fig. 25-18). The standard oil clearance is 0.008"-0.002".

Unit: in

Crankcase I.D. 44ø / Crankshaft O.D. 40ø		Mark A	Mark B	Mark C	Mark D
		0–Less than 0.0002	0.0002 – Less than 0.0005	0.0005 – Less than 0.0007	0.0007– Less than 0.0009
Mark 1	Less than 0.0002 –0	RED	PINK	YELLOW	GREEN
Mark 2	Less than 0– -0.0002	PINK	YELLOW	GREEN	BROWN
Mark 3	Less than -0.0002 – -0.0005	YELLOW	GREEN	BROWN	BLACK
Mark 4	Less than -0.0005 – -0.0009	GREEN	BROWN	BLACK	BLUE

Fig. 25-18. Main Journal Color Code

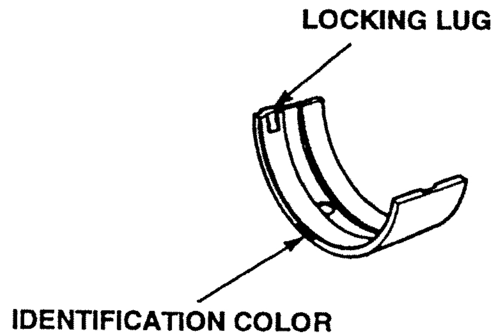


Fig. 25-19. Bearing Color Code

2. Connecting Rod Bearing

Record the crankpin O.D. code letters (Fig. 25-20). Alternatively, measure the crankpin journal O.D. The three crankpin locations are shown in Fig. 25-21.

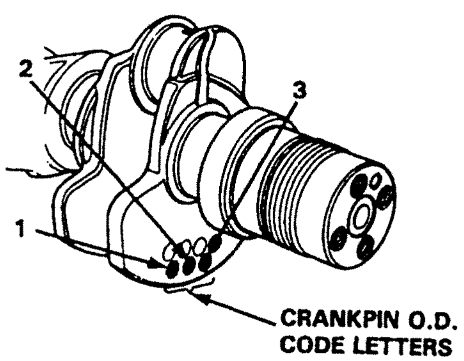


Fig. 25-20. Crankpin O.D. Code Letters

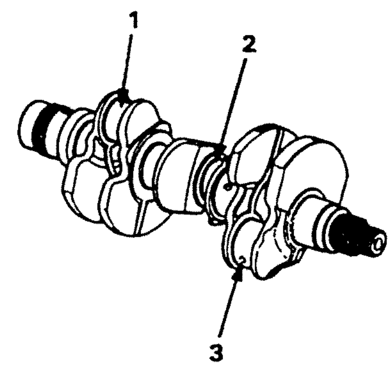


Fig. 25-21. Crankpin Locations

Record the connecting rod I.D. code letters (Fig. 25-22). Alternatively, assemble the connecting rod and end cap WITHOUT bearings and measure the I.D. of the big-end eye.

When reassembling the connecting rods, end caps and bearings ensure that the locking lug on each bearing is correctly located in the notch of the rod and end cap. Be careful not to damage the bearings in any way.

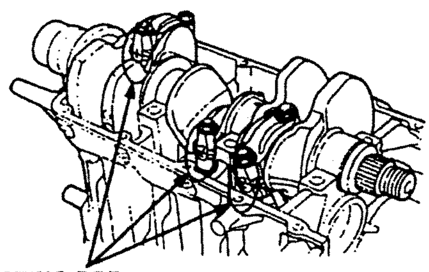


Fig. 25-22. Connecting Rod I.D. Code Letters

Unit: in

Crank pin O.D. 38φ / Connecting rod I.D. 41φ		Mark A	Mark B	Mark C	Mark D
		Less than 0--0.0002	Less than -0.0002--0.0006	Less than -0.0005--0.0007	Less than -0.0007--0.0009
Mark 1	0-Less than 0.0002	RED	PINK	YELLOW	GREEN
Mark 2	0.0002 - Less than 0.0005	PINK	YELLOW	GREEN	BROWN
Mark 3	0.0006 Less than 0.0007	YELLOW	GREEN	BROWN	BLACK
Mark 4	0.0007 - Less than 0.0009	GREEN	BROWN	BLACK	BLUE

Fig. 25-23. Crankpin Bearing Color Code

To Reinstall

When all inspections have been completed and replacement parts have been selected, rebuilding can commence.

Install the piston rings to the pistons ensuring that the end caps are 120° apart (Fig. 25-24). The three-piece oil control ring should be installed first. Position the bottom rail, spring rail and top rail with their end caps staggered at least 0.7874" apart. Do NOT align the end gaps with either of its neighbors, the piston pin or thrust faces. ALL PISTON RINGS MUST BE FITTED WITH THEIR MARKINGS UPPERMOST i.e. TOWARDS THE PISTON CROWN.

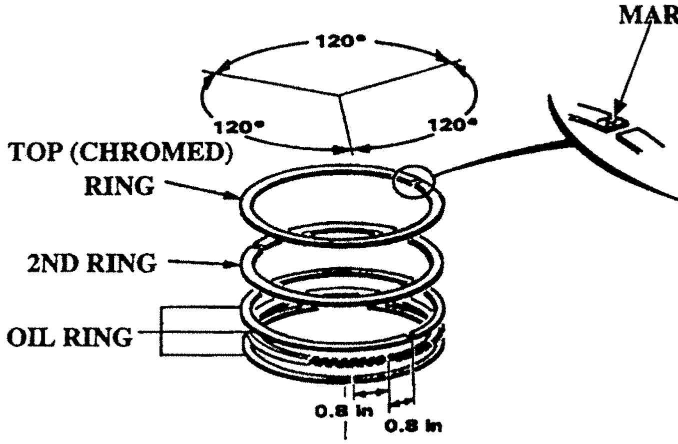


Fig. 25-24. Piston Ring Fitting

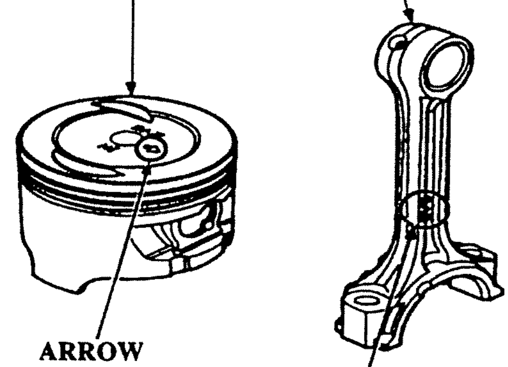


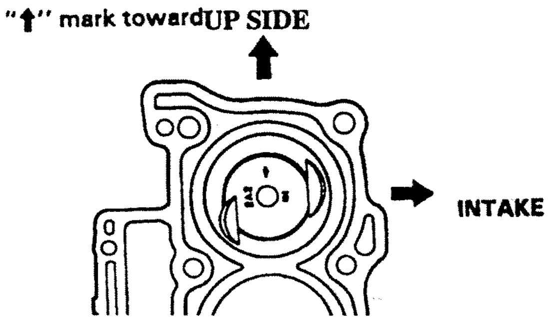
Fig. 25-25. Piston Connecting Rod Marks

Assemble the piston pin and connecting rod assembly to the piston. Install the piston-pin clips by first inserting one end of the clip into the groove and working the opposite end around into the groove, using a pair of needle-nosed pliers. Do NOT align the end gap of the clip with the notch in the piston.

Note: Ensure that the piston and connecting rod assembly has the arrow on the piston crown pointing in the same direction as the mark on the connecting rod (Fig. 25-25).

~~Oil the piston, piston pin connecting rod bearings and~~, using a commercially available piston ring compressor, install the piston and connecting-rod assembly into the cylinder block.

Note: Install the piston with the IN mark towards the intake (carburetor) side of the engine and the arrow towards the up side (Fig. 25-26).



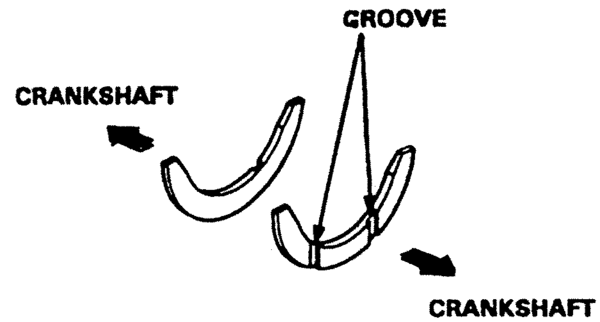


Fig. 25-26. Piston Markings

Fig. 25-27. Crankshaft Thrust Washers

After installation of the piston and connecting-rod assemblies, install the crankshaft bearings, crank-shaft and thrust washers. The thrust washers must be installed with their grooves towards the crankshaft (Fig. 25-27). Oil all parts before fitting.

Install the connecting rod end caps ensuring that the rod and cap markings are correctly aligned. Install the end cap nuts and tighten to a torque of 21 ft/lbs. Oil all parts before assembly including the connecting rod bolts but not the mating faces of the connecting rods and end caps.

Reinstall the crankcase. (see SECTION 24).

Reinstalling the remaining components is a reversal of the removal instructions. Refer to the appropriate sections.

OIL PUMP

The oil pump is of the trochoid-type construction, mounted on the cylinder head and driven by the end of the camshaft. An oil pressure relief valve is incorporated in the pump.

To Remove (Fig. 26-1)

Disconnect the battery, exciter coil and charging coil connections (Fig. 21-1). Drain the engine coolant.

Remove the cylinder head (see SECTION 23) and remove engine water pump.

Unscrew the four M6 flange bolts securing the oil pump to the cylinder head, disengage the pump drive from the crankshaft and remove the pump. Recover the 'O' section joint washer.

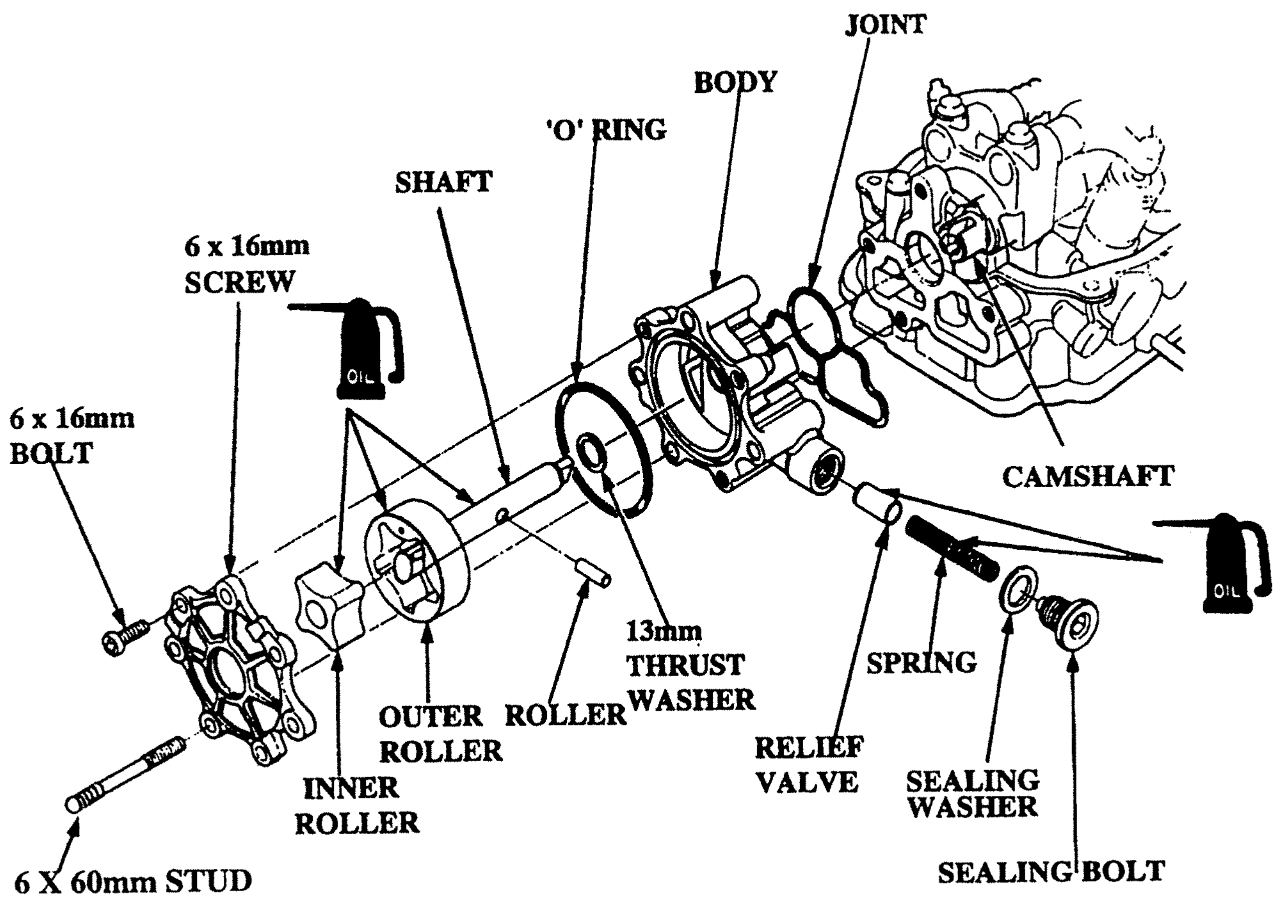


Fig. 26-1. Oil Pump Component Parts

Maintenance

Remove the three M6 screws and detach the oil pump cover. Recover the 'O' ring from the groove in the face of the pump body.

Withdraw the inner rotor, shaft, outer rotor and thrust washer from the pump body.

Remove the roller from the shaft.

Measure the pump body inner diameter at the point which is normally occupied by the outer rotor (Fig. 26-2). The standard diameter is 1.9744"-1.9756". The service limit is 1.9764".

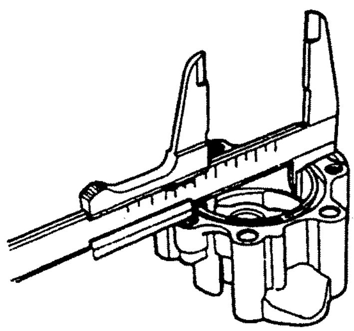


Fig. 26-2. Checking Body Inner Diameter

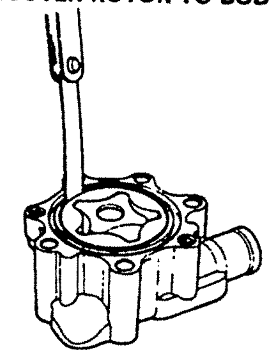


Fig. 26-3. Outer Rotor to Body Clearance

Install the outer rotor and measure the clearance between it and the body (Fig. 26-4). The standard clearance is 0.0059"-0.0087". The maximum permitted clearance is 0.0102". Install the inner rotor and measure the clearance between the inner and outer rotors (Fig. 26-4). The standard clearance is 0.0059" with a service limit of 0.0079"

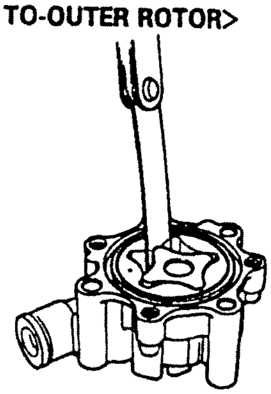


Fig. 26-4. Inner to Outer Rotor Clearance

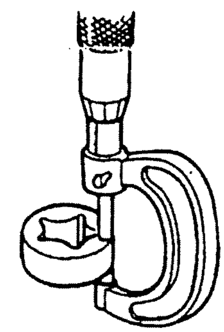


Fig. 26-5. Checking Height of Outer Rotor

Remove both rotors and measure the height of the outer rotor (Fig. 26-5) which should be 0.6685"-0.6693". The service limit is 0.7846".

Measure the depth of the pump body (Fig. 26-6). The clearance should be 0.6701"-0.6713" with a service limit of 0.6728".

Install the inner and outer rotors and using a known true straight-edge, measure the rotor end clearance (Fig. 26-7). The clearance should be 0.0008"-0.0028" with a limit of 0.0039".

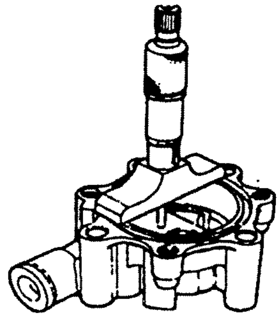


Fig. 26-6. Measuring Pump Body depth

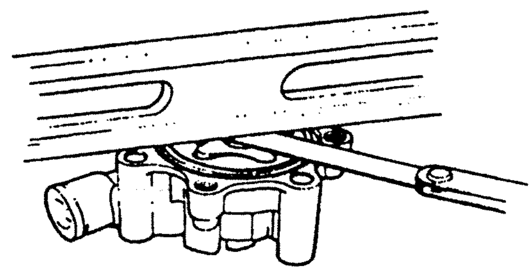


Fig. 26-7. Checking Rotor End Clearance

Unscrew and remove the sealing- bolt and washer and remove the oil pressure relief valve spring and valve (Fig. 26-1).

Note: Restrain the sealing bolt during removal as some spring pressure will still be present as the final threads of the bolt are unscrewed from the body.

Inspect the valve and the body seating for damage or scoring and replace parts as necessary. It is a sound policy to install a new spring at the same time.

To Reinstall

Reinstallation is a reversal of the removal instructions.

Liberally oil the oil pressure relief valve and spring before reassembly.

Do not omit the thrust washer or roller from the pump shaft.

Clean all parts thoroughly and install the outer rotor with the punch mark towards the cover.

Use a new 'O' ring and 'O' section joint washer.

Pour a small amount of engine oil into the pump before refitting to the cylinder head.

Ensure that the tongue of the pump shaft engages correctly with the camshaft slot, install the three M6 bolts and tighten to a torque of 10 ft/lbs.

ENGINE OIL PRESSURE TEST

Check the engine oil level and add oil to the correct level if necessary. Remove and detach the pressure switch wire. Unscrew and remove the pressure switch (Fig. 27-1).

Install the pressure gauge attachment 07406 - 0030000 and the oil pressure gauge 07506 -3000000 (Fig. 27-2). The pressure gauge has a scale calibrated up to 7 - 10kg/cm^2. Tighten the gauge attachment to 7 ft/lbs. Over-tightening will damage the threads.

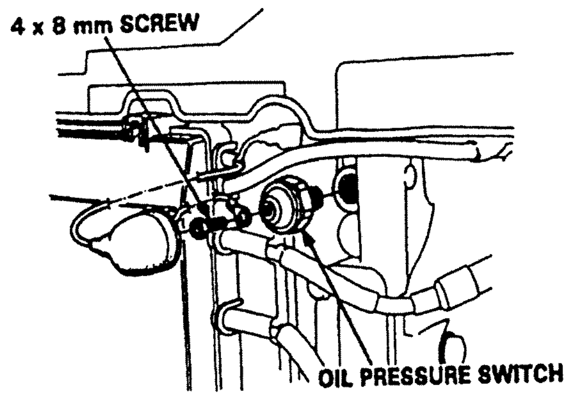


Fig. 27-1. Oil Pressure Switch Removal

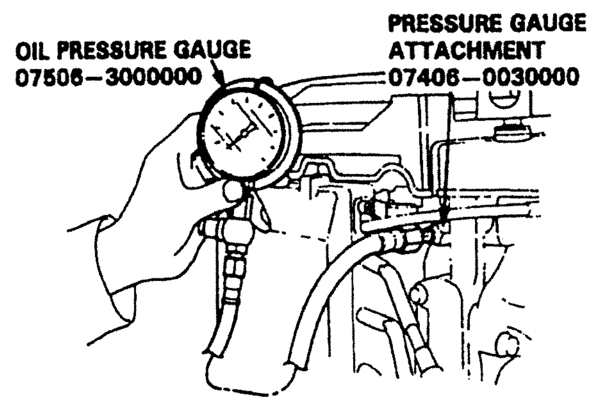


Fig. 27-2. Test Equipment Intalled

Connect a water supply to the pump and run the engine until its temperature reaches 176°F. Check the gauge reading, which should be 1.5kg/cm at 950 ±50 r.p.m. If the reading is less than above, check oil pump rotors and body for wear. (see SECTION 26).

Remove the test equipment.

Clean the oil pressure switch and apply liquid sealant (Three Bond 1215 or equivalent) to the threads before installing. Tighten to a torque of 7 ft/lbs. Overtightening will damage the threads.

ENGINE OIL AND FILTER

Engine Oil

Remove the oil sump drain plug and sealing washer and drain the oil into a suitable container. (see - ENVIRONMENTAL PROTECTION).

The oil will drain much more easily if it is warm, as much of the sludge-forming matter will still be in suspension.

When fully drained, reinstall the drain plug using a new sealing washer. Refill with new oil of the correct grade (see RECOMMENDED LUBRICANTS) up to the top of the knurled area of the dip-stick, but DO NOT OVER-FILL. The capacity is 2.5 quarts.

Oil Filter

Install Special Tool 07HAA - PJ70100 and unscrew the filter counter-clockwise (Fig. 28-1). Be prepared to catch the oil draining from the filter.

Clean the area around the face of the oil cooler taking care not to introduce foreign matter.

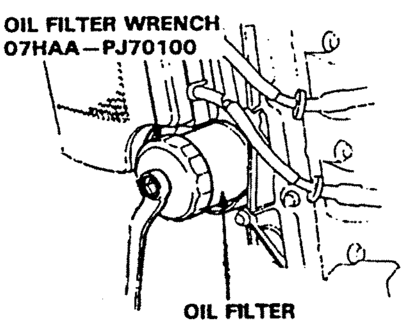


Fig. 28-1. Oil Filter Special Tool

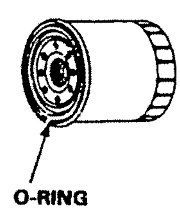


Fig. 28-2. Filter 'O' Ring Location

Apply 'Three Bond 1323 B' or equivalent, sealant to the adapter installed to the cylinder block.

Apply a light coating of engine oil to the filter 'O' ring (Fig. 28-2), screw on the filter and tighten by hand in a clockwise direction.

Install Special Tool 07Haa - PJ70100 and tighten the filter to a torque of 6 ft/lbs.

Run the engine for a few minutes (water supply connected to the pump) and then stop it. Wait a few minutes, then check the oil level on the dipstick and add oil if necessary. Check for leaks.

WATER JACKET, THERMOSTAT AND THERMO SWITCH

Water Jacket

To Remove

Disconnect and remove the battery.
Drain the engine coolant. Then remove the coolant tank and heat exchanger assembly (see SECTION 13). Disconnect the spark-plug leads. Release the water jacket (1) by removing the seven 6 x 22mm screws (2) around its periphery and remove the water jacket and packing (3) (Fig. 29-1).

Maintenance

The removal of the water jacket (1) will reveal an anode (5), which is secured by a 6 x 18mm-screw (4). This is a sacrificial device to prevent excessive corrosion in the coolant circuit. If excessively corroded, a new anode should be fitted.

To reinstall

Reinstallation is a reversal of the removal instructions.

Clean all joint (packing) faces and use a new packing (3).

Tighten the seven 6 x 22mm screws (2) to a torque of 9 ft/lbs.

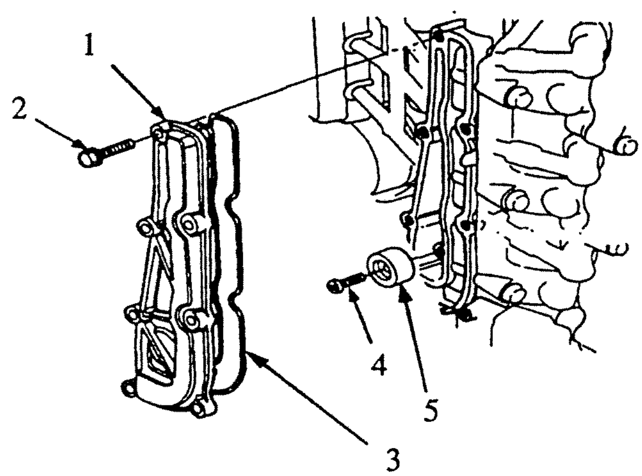


Fig. 29-1. Water Jacket and Anode

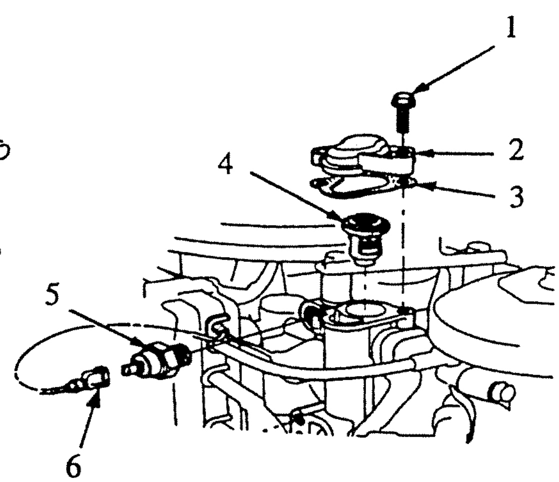


Fig. 29-2. Thermostat and Thermo Switch

Thermostat

To Remove

Drain the engine coolant.
Remove the two 6 x 20mm screws (1) securing the thermostat cover (Fig. 29-2).
Remove the cover (2) and the joint washer (3) and lift the thermostat (4) from its housing

Maintenance

Immerse the thermostat in water in a container capable of being heated (Fig. 29-3).

Heat the water and observe the operation of the thermostat as the temperature of the water increases. Note the temperature of the water at the point when the thermostat starts to open. This should be 125°F. Do not allow the thermostat to come into contact with the container as this may cause a false reading.

The thermostat should be fully open at 143°F. With it fully open, measure lift height. This should be more than 0.12". If it does not comply with these figures, install a new one.

To Reinstall

Reinstallation is a reversal of the removal instructions.

Use a new joint washer.

Tighten the two 6x20mm screws to a torque of 9 ft/lbs.

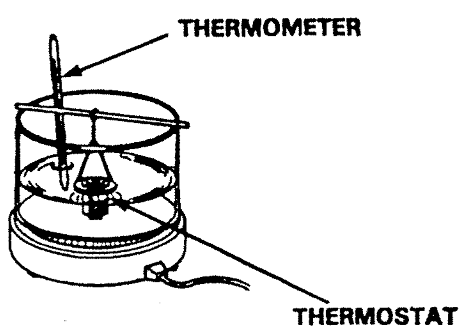


Fig. 29-3. Testing the Thermostat

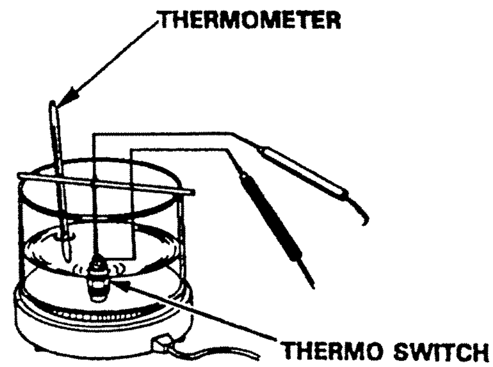


Fig. 29-4. Testing the Thermo Switch

Thermo Switch

To Remove

Disconnect the battery.

Detach the Lucar connector from the thermo switch and unscrew the switch.

The switch is located next to the thermostat housing (Fig. 29-2).

Maintenance

The thermo switch should be suspended in a container of coolant or oil.

Do not allow the switch to contact the container (Fig. 29-4).

Heat the liquid and note the temperature at which the thermo switch closes. With the switch at this temperature, check that continuity exists between the switch-lead terminal and the body.

Continuity of the switch (ON) should occur at 194° +/-2°F minimum.

As the switch cools, continuity should cease (OFF) between 38°F and 45°F below the temperature at which continuity occurred.

To Reinstall

Reinstallation is a reversal of the removal instructions.

FUEL PUMP, FILTER AND CONNECTOR

To Remove

NO SMOKING OR OPEN FLAMES.

Disconnect and remove the battery.

Remove the starter motor to improve access to the fuel pump, release the clips and remove the three fuel lines to the pump.

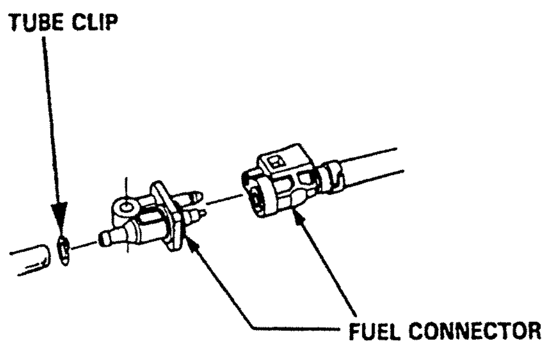


Fig. 30-1. Fuel Line Connector

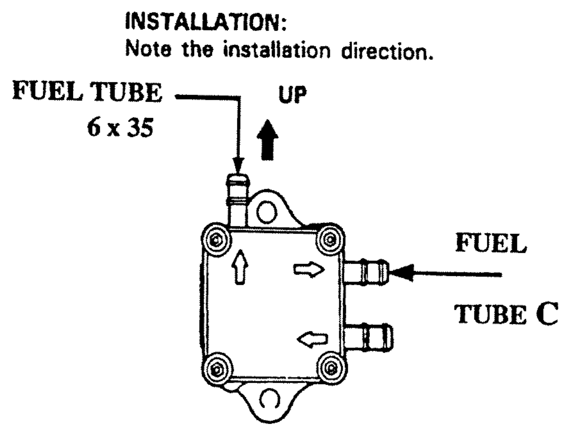


Fig. 30-2. Fuel Pump Orientation

Unscrew and remove the two 6 x 20mm screws securing the pump to the cylinder head and withdraw the pump.

The fuel filter is a sealed transparent unit. If excessive contamination is observed a new unit must be fitted. It is held in position in the fuel supply line by two clips.

The fuel connector is a two-piece assembly and is not serviceable. If any damage or leaks occur the complete assembly must be replaceed.

To Reinstall

Reinstallation is a reversal of the removal instructions.

Ensure that the pump is reinstalled correctly (Fig. 30-2).

Tighten the 6 x 20mm screws to a torque of 7 ft/lbs.

Check the fuel lines for deterioration or damage before installation and replace if necessary.

SECTION 31

AIR INTAKE SILENCER COVER

To Remove

Withdraw the breather tube from the hole in the silencer cover.
Unscrew the two 6 x 40mm bolts at the end of the intake silencer cover.
Recover the 6 x 18mm washer from under the head of each bolt, the collars and the silencer cover nuts.

Maintenance

No maintenance is required but the components should be cleaned before refitting.

To Reinstall

Locate the 6 x 40mm bolts and washers in the holes of the silencer cover.
Position the collars on the bolts between the cover and its base and install the cover onto the base.
Be careful to correctly locate the cover nuts (boomerang-shaped) below the base, enter and tighten the screws.

CARBURETORS

The variable-choke carburetors incorporating concentric floats are installed to the intake manifold and an air-intake silencer is also provided.

All three carburetors are connected together by a throttle link rod and a choke link rod to provide synchronized control. A dashpot check valve and diaphragm arrangement is installed to provide a smoother progression of the throttle-closing operation.

For reference purposes the standard carburetor is Number 3 carburetor, which is the lowest mounted one on the intake manifold. It also has the throttle-cam assembly installed to it. The throttle is cable-controlled and the choke uses a control-rod arrangement.

To Remove

NO SMOKING OR OPEN FLAMES.

Disconnect and remove the battery.
Turn the fuel tap to the 'OFF' position.
Remove the air intake silencer, cover. (see SECTION 31).

To remove the choke control linkage, pull the choke control fully out, hold the control rod and push the control fully in. The control rod will then be released from the control.

Disconnect the throttle-control cable link from the cam of Number 3 carburetor (Fig. 32-1).

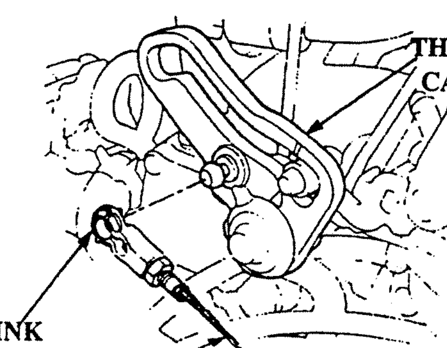


Fig. 32-1. Throttle Cam and Linkage

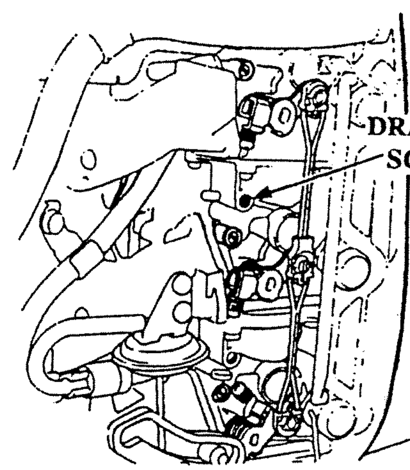


Fig. 32-2. Carburetor Drain Screws

WARNING: Remove the drain screw from the float chamber of each carburetor BEFORE attempting to remove OR dismantle the carburetors (Fig. 32-3).

Remove the 5.3 x 65mm fuel tube from the top connection on the fuel pump and the fuel tube 'C' from the upper of the two side connections on the fuel pump (Fig. 32-3).

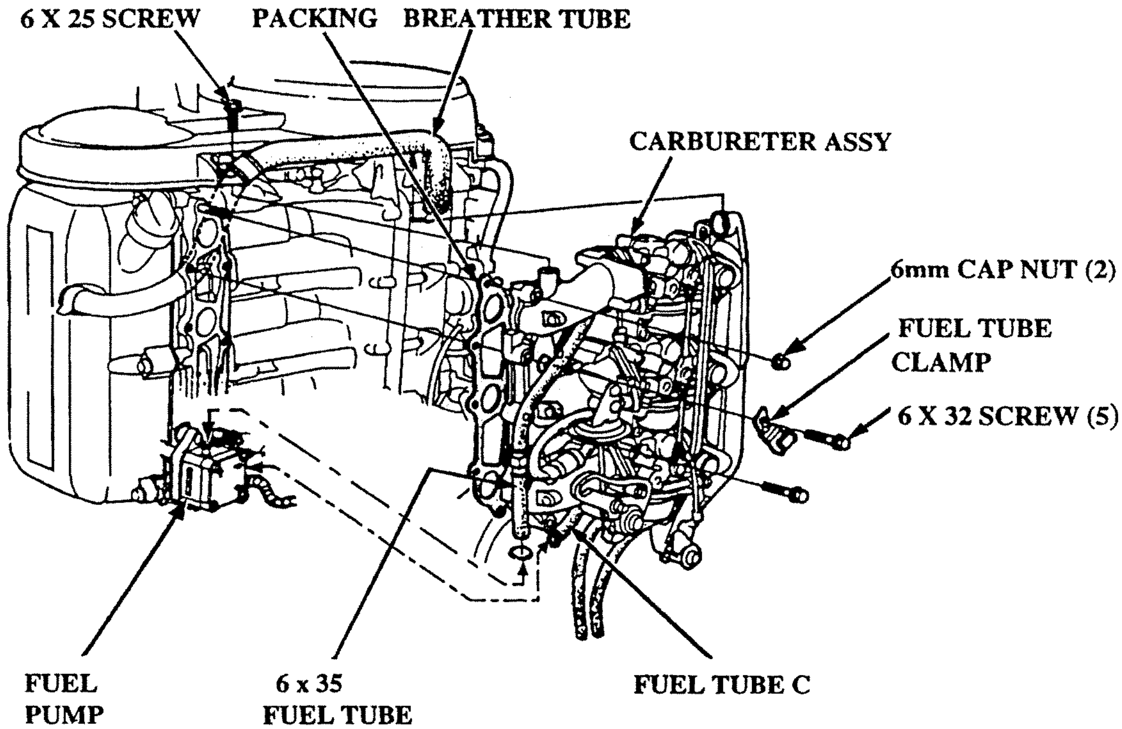


Fig. 32-3. Intake Manifold, Carburetors and Fuel Tubes

Unscrew the 6 x 25mm flange bolt, the five 6 x 32mm flange bolts and the two 6mm cap nuts securing the intake manifold to the cylinder head (Fig. 32-3).

Withdraw the complete intake manifold, carburetors and fuel-tube assembly from the cylinder head with the remaining fuel tubes.

With the assembly on the bench, unclip the dashpot check valve and remove both fuel tube 'D' and the 3.5 x 60mm fuel tube connected to the install pipe (Fig. 32-4).

Unscrew the two 5 x 10mm screws securing the install pipe to the intake manifold.

Detach the three 3.5 x 45mm fuel tubes from the carburetors and then remove the assembly (Fig. 32-4).

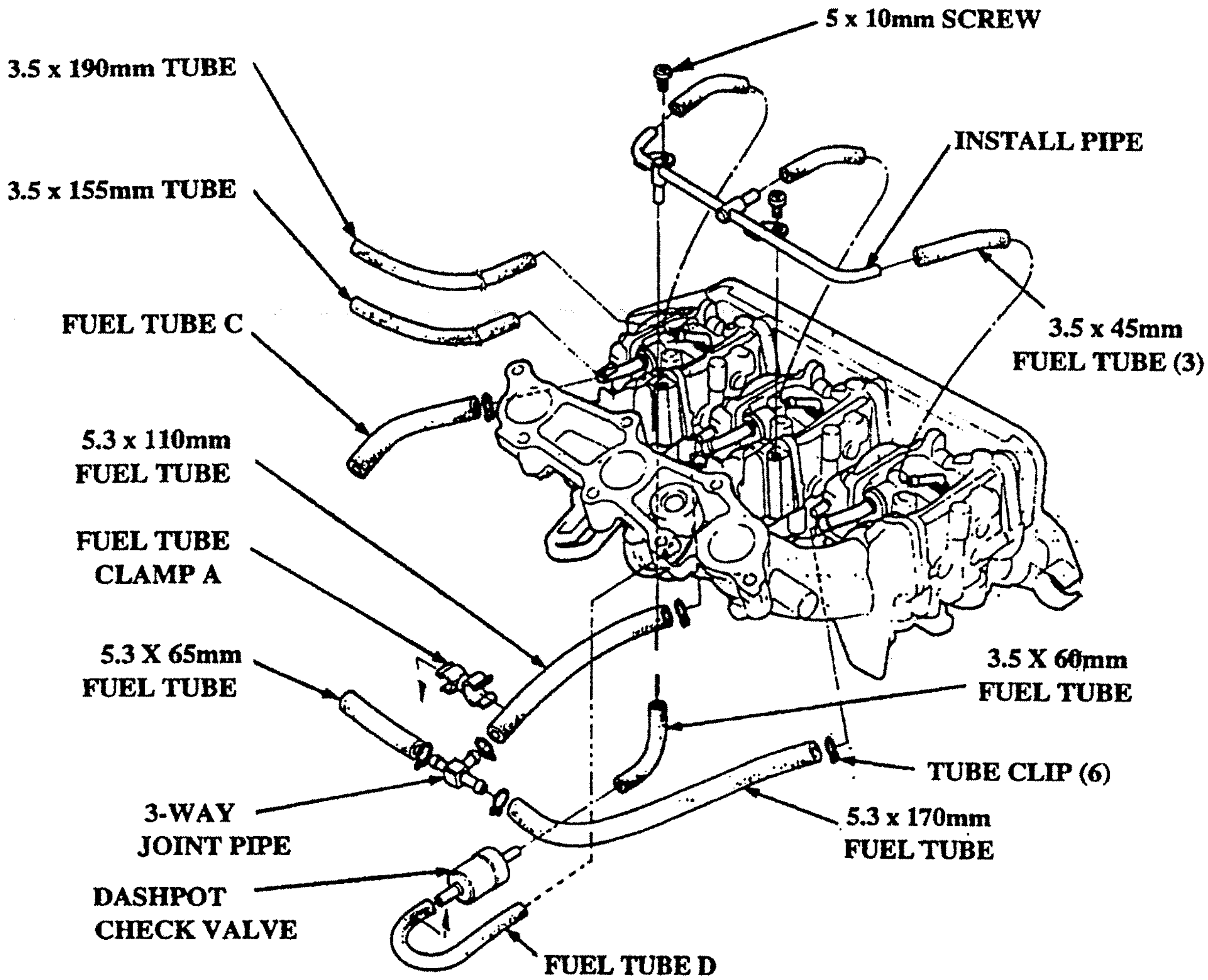


Fig. 32-4. Fuel Tube Location and Identification

Pry the throttle-link rod (which connects the butterfly-throttle shafts of the three carburetors together) from its location, taking, care NOT to bend it (Fig. 32-5).

Remove the choke link rod (which connects the choke of the three carburetors together) taking care NOT to break it (Fig. 32-5).

Release the fuel tubes from the clamp. Then remove the tube clips and detach the 5.3 x 110mm and the 5.3 x 170mm fuel tubes from the carburetors.

If the tube 'C' has not already been detached, remove this also (Fig. 32-4).

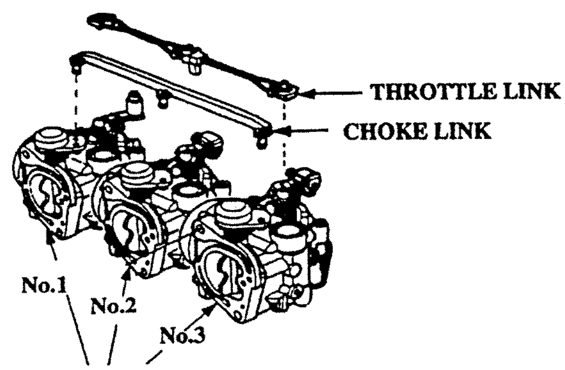


Fig. 32-5. Throttle and Choke Link Rods

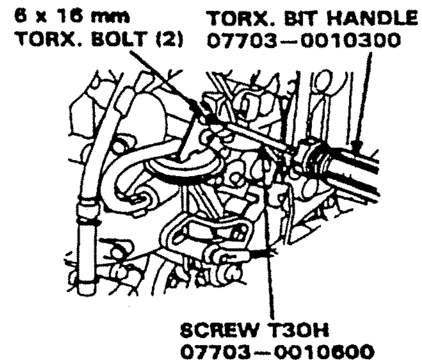


Fig. 32-6. Diaphragm Bolts and Tools

Using Special Tools T30H 07703 - 0010600 and 07703 - 0010300, remove the two Torx 6 x 16mm bolts securing the diaphragm unit to the intake manifold (Fig. 32-6). Unscrew the 6 x 40mm bolt and remove the throttle-cam assembly taking care to DISCONNECT the interconnected link from the choke arm.

Unscrew the 6 x 28mm bolt and remove the choke-arm assembly. Note: Try to keep the various assemblies in their groups to simplify reassembly and avoid losing component parts.

To separate the intake manifold, carburetors and silencer plate, unscrew the six 6 x 97mm bolts from the silencer plate which clamp the whole assembly together (Fig. 32-7).

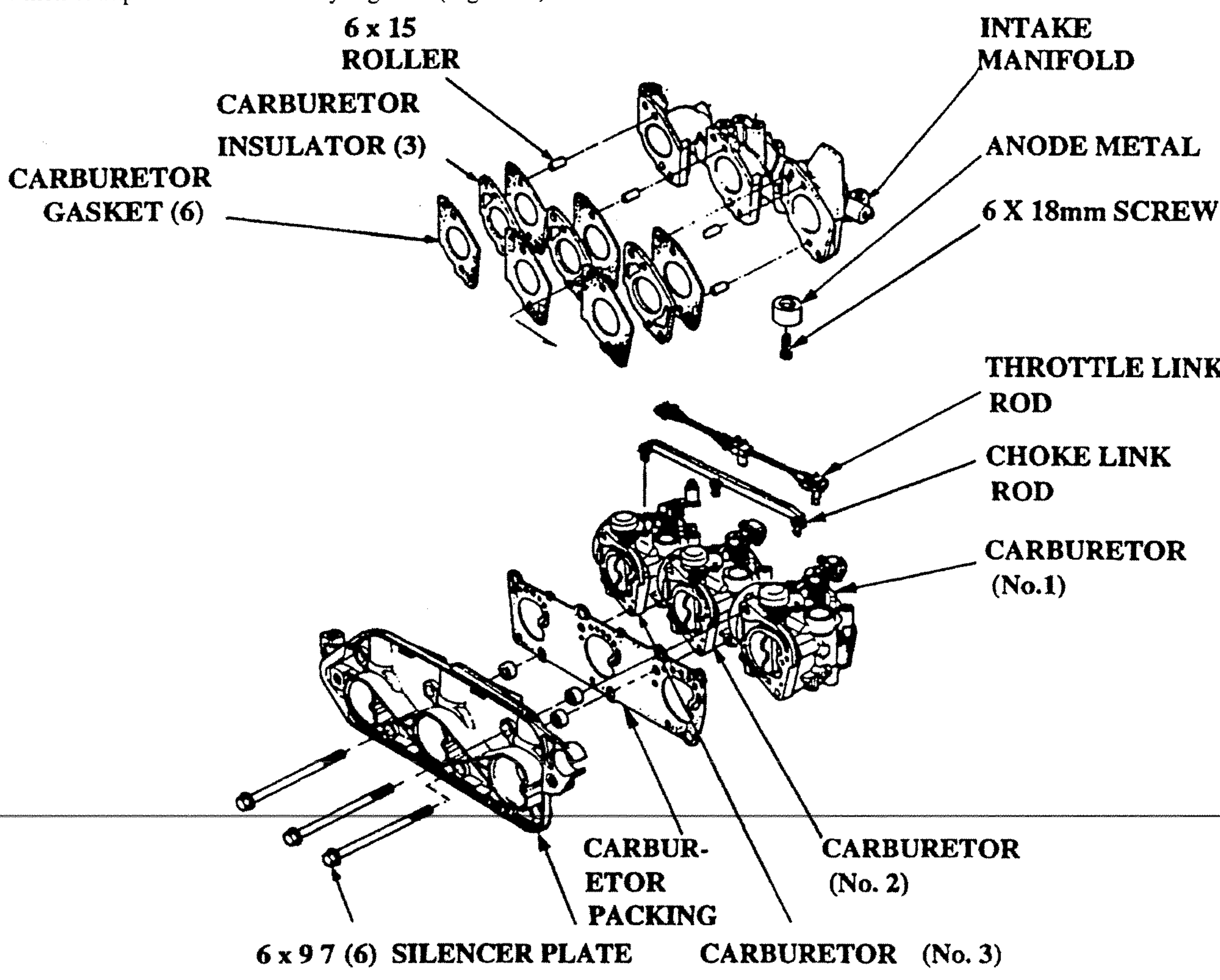


Fig. 32-7. Location of Intake System Components

- Recover the spacers, carburetor packing, carburetor insulators and gaskets from between the silencer plate and the carburetors.

Check that the six 6 x 15mm rollers are still located in the intake manifold.

The anode metal is installed to the intake manifold by a 6 x 18mm screw and may be removed if replacement is required.

Maintenance (Fig. 32-8)

Note: That Number One and Two carburetor assemblies are not the same as Number Three carburetor. This is described because this unit will have the throttle-control cam arrangement connected to it after refitting to the intake manifold.

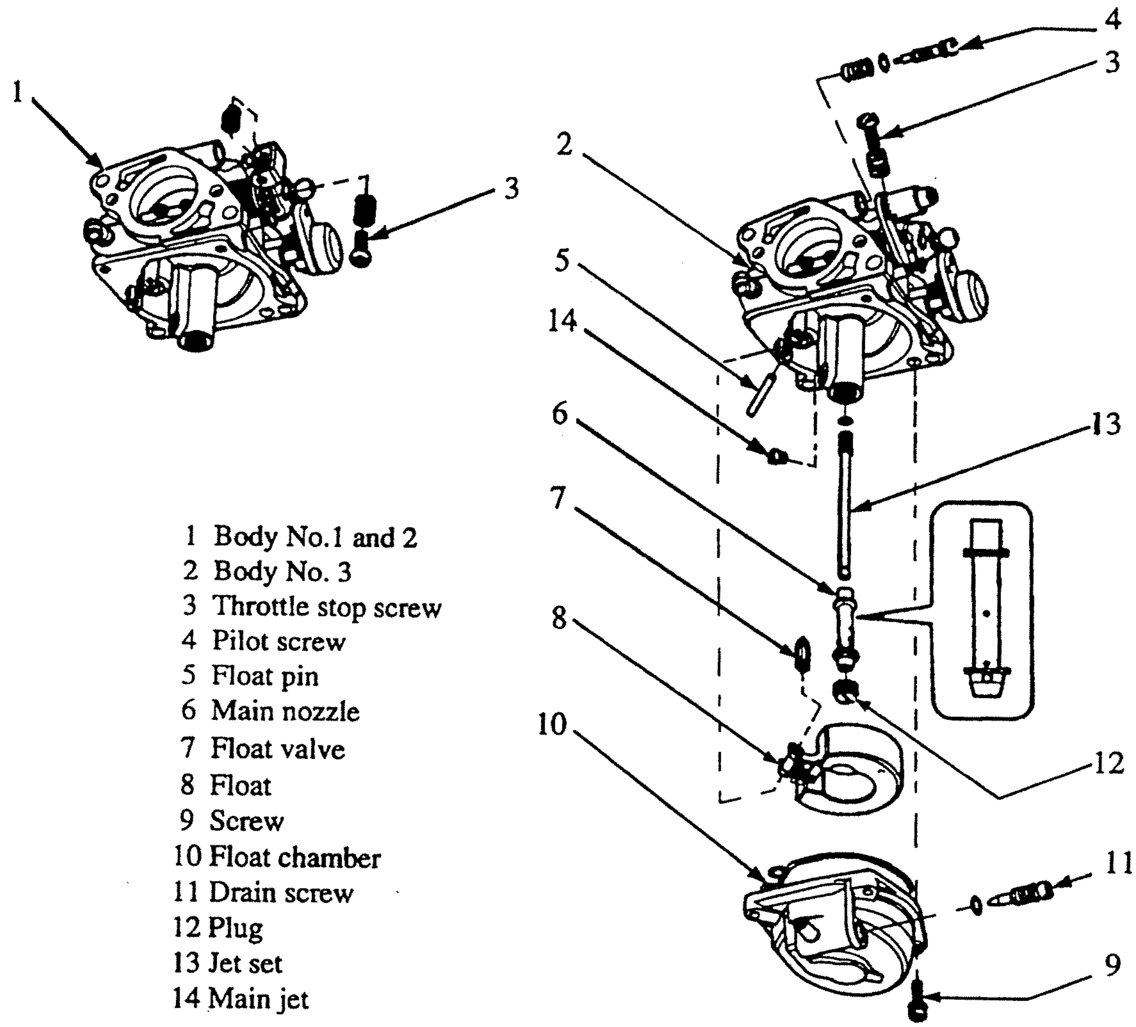


Fig. 32-8. Carburetor Components

Unscrew the four screws (9) securing the float chamber (10) to the carburetor body. Remove the chamber and recover the joint washer.

Withdraw the float pin (5) from the body to release the float (8). This will enable the float valve (7) to be removed.

The main jet (14) may be unscrewed from the extension of the carburetor body.

Unscrew the pilot screw (4) and recover the spring and washer.

Check both choke and butterfly for smoothness of operation.

IMPORTANT: When using compressed air to clear any obstruction ensure that adequate EYE PROTECTION is correctly worn.

Use compressed air to clear any foreign matter from the drill-ways and passages of the body.

Clean the main nozzle (6) the jet set (13) and the main jet (14) with compressed air BEFORE refitting. **USE EYE PROTECTION.**

Inspect the pilot screw (4) for wear or damage before installing. Turn it in fully (DO NOT FORCE IT) and then unscrew 2 1/8 turns.

Check the float valve (7) for wear and weak spring before refitting.

Locate the float (8) and float valve (7) and install the float pin (5). The components are shown disassembled in Fig. 32-9.

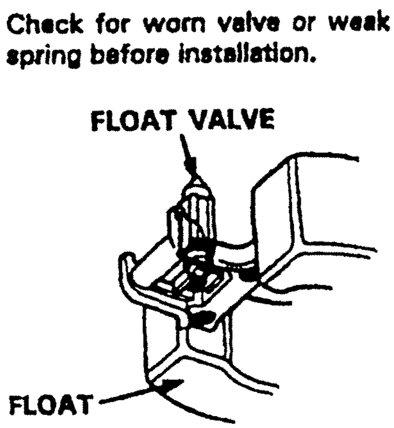


Fig. 32-9. Float and Valve Assembly

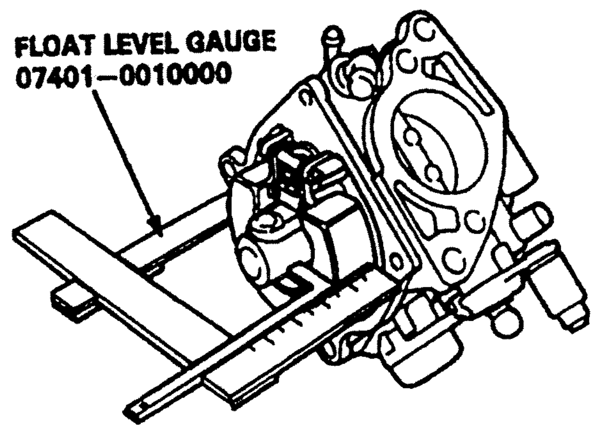


Fig. 32-10. Checking Float Level

Check for smooth operation after installation.

With the carburetor in an upright position, use the float-level gauge 07401 - 0010000 to measure the distance between the float top and the carburetor body when the float just contacts the float valve (Fig. 32- 10). The standard measurement is 14mm. If incorrect, install a new float and check its operation.

Use a new float chamber joint washer, reinstall the float chamber and tighten the four screws, ensuring that the drain-screw hole faces the pilot screw side of the body. Reinstall the drain screw using a new 'O' ring.

To Reinstall

Reinstallation is a reversal of the removal instructions.

Check that the six 6 x 15mm rollers are installed at the intake manifold and install new gaskets on each side of the carburetor insulator when reinstalling the carburetors (Fig. 32-11).

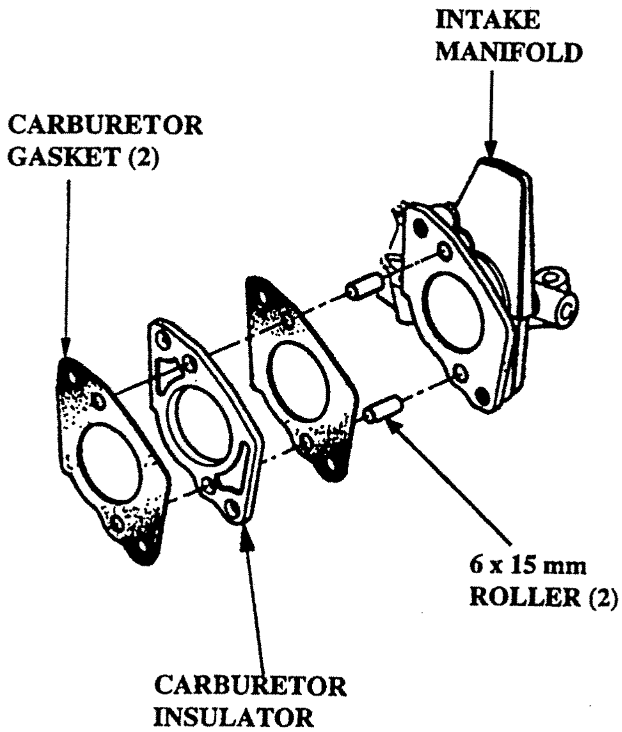


Fig. 32-11. Carburetor Gasket Arrangement

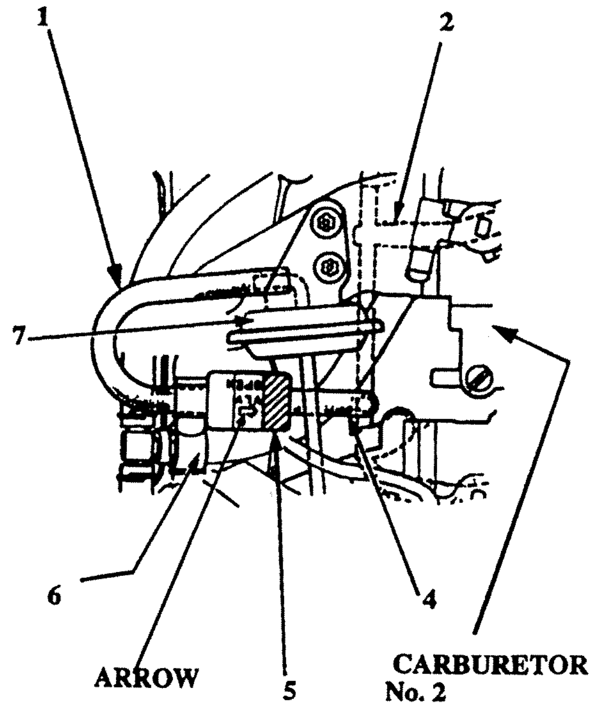


Fig. 32-12. Dashpot Check Valve Installation

Ensure gaskets and insulators are properly located on the rollers before installing the carburetors.

Check all fuel tubes for damage and deterioration and replace if necessary.

Install diaphragm unit (7) dashpot check valve (5) fuel tube (1) fuel tube (4) fuel-tube clamp (6) and the install pipe (2) - Fig. 32-12 refers.

Ensure that; a) the dashpot check valve is installed with the arrow pointing towards the carburetor side and b) the fuel tubes are securely installed into the clamp.

The order of assembly of the throttle-cam end-choke arm assemblies is shown in (Fig. 32-13).

The 6 x 40mm flange bolt (1) Should first have the 6mm plain washers (2) fitted.

The bore of the throttle cam (3) Should be greased and installed to the bolt followed by the assist spring (4) with its hook located on the cam projection (Fig. 32-14).

The throttle cam opener (5) should then be installed and the assist spring point 'A' located in the groove of the throttle cam with the assist plate projection point 'A' against the throttle cam.

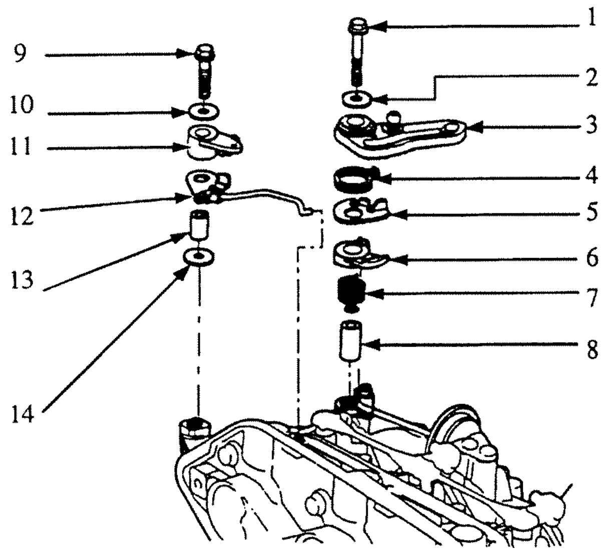


Fig. 32-13. Choke and Throttle Cam Assemblies

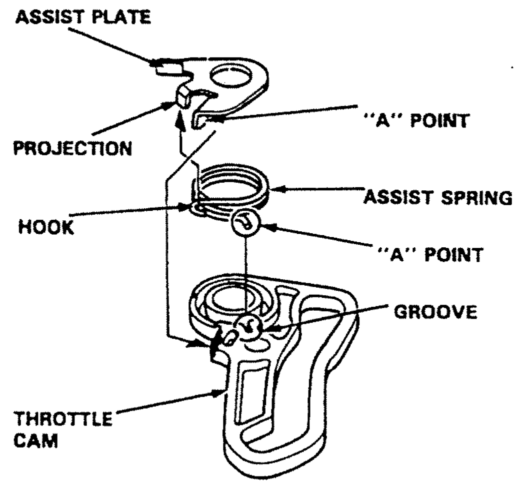


Fig. 32-14. Throttle Cam Details

The throttle-opener cam (6) the opener-cam return spring (7) and the 6.17 x 12.5 x 24mm collar (8) should be assembled to the bolt.

The complete assembly should then be installed to the intake manifold and the flange bolt tightened to a torque of 9 ft/lbs.

Note: DO NOT FORGET to install the control rod of the diaphragm unit to the hole in the throttle cam.

To reassemble the choke mechanism (Fig. 32-13 refers) proceed as follows:

1. Assemble the 6mm plain washer (10) to the 6 x 28mm bolt (9) followed by the choke arm.

2. The choke-control arm and choke-rod assembly (12) should then he installed followed by the 6.15 x 10.5 x 16mm collar (13) and 6mm plain washer (14).

3. Insert the choke rod assembly on the hole in the choke link before positioning the choke mechanism on the intake manifold.

4. Tighten the 6 x 28mm bolt (9) to a torque of 9 ft/lbs.

5. Install the throttle link rod to the carburetors with the 'UP' and arrow at the center of the rod facing upwards (Fig. 32-15).

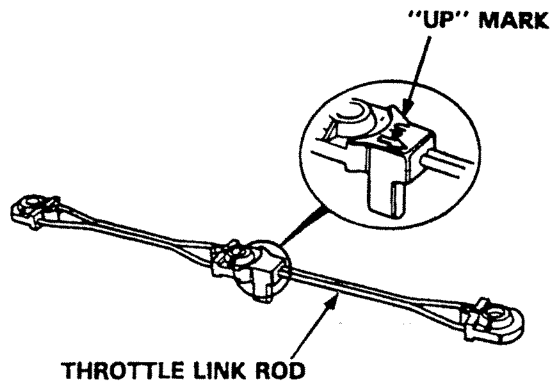


Fig. 32-15. Throttle Link Marking

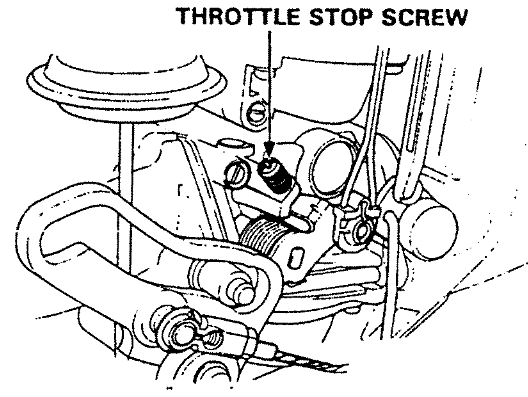


Fig. 32-16. Throttle Stop Screw Locations

Adjustments

Idle Speed

Idle-speed adjustment must be performed without any load imposed on the engine.

Start the engine and allow the engine speed to stabilize.

Turn the throttle-stop screw to achieve the correct idle speed of 950 +/- 50 r.p.m. (Fig. 32-16). If the idle speed does not stabilize, carburetor synchronization must be performed.

Synchronization

Screw-in the pilot screw of each carburetor until it stops - DO NOT FORCE IT (Fig. 32-17). Then turn each one out 2 1/8 turns.

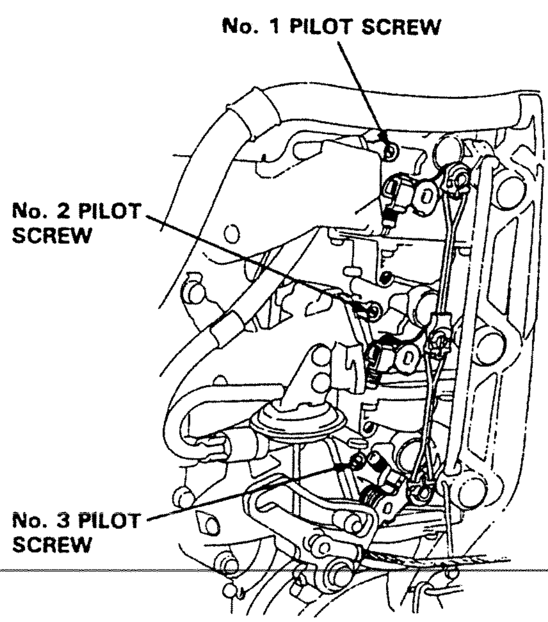


Fig. 32-17. Carburetor Pilot Screws

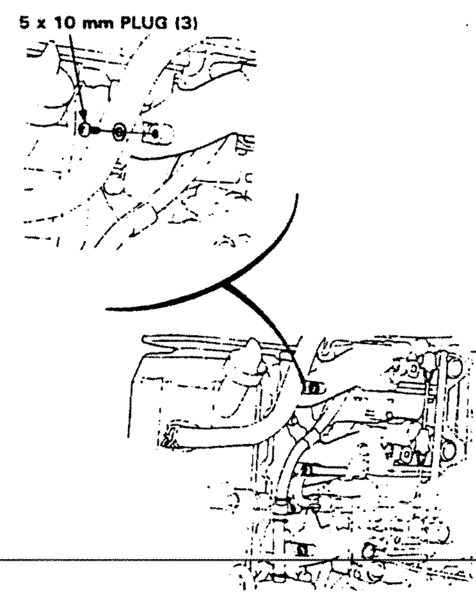


Fig. 32-18. Intake Manifold Plugs

Turn the throttle-stop screw to achieve 950 +/- 50 r.p.m. idle speed with NO LOAD on the engine.

Turn the pilot screw of Number Three carburetor (the standard carburetor) 1/8 of a turn, in or out, until the highest idle speed is obtained.

Perform the same operation on Number 1 and Number 2 carburetors.

Lightly 'snap' the throttle open several times and then adjust the throttle-stop screw to obtain an idle speed of 950 +/- 50 r.p.m. (Fig. 32-16).

Stop the engine and remove all three 5 x 10mm plugs from the intake manifold (Fig. 32-18).

Attach the vacuum gauge adapters to each of the threaded holes and correctly connect the vacuum gauge tubes of the vacuum gauge unit 07404 - 0030001.

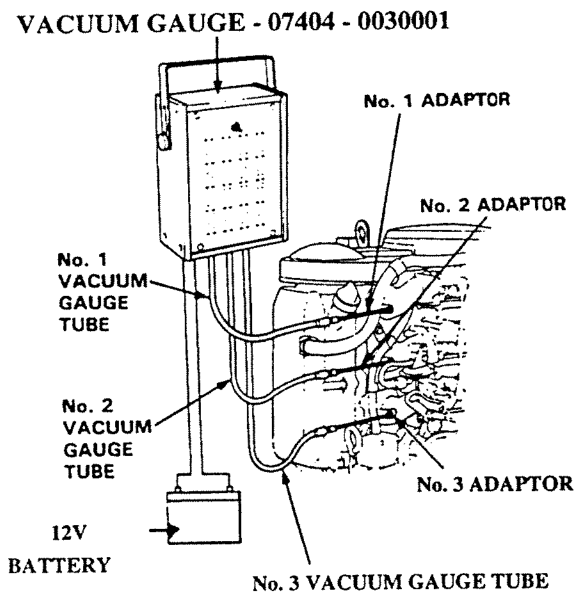


Fig. 32-19. Connecting Vacuum Gauge

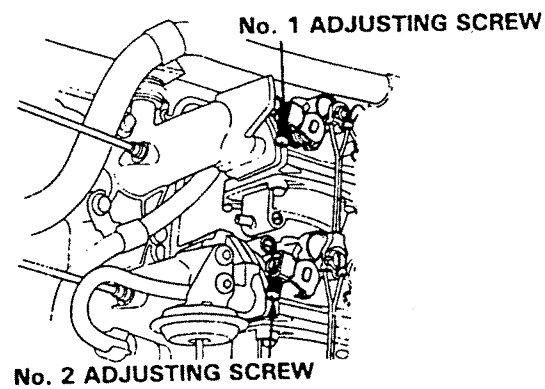


Fig. 32-20. Adjusting Screws

Start the engine and with it running at normal temperature, recheck the idle speed and adjust if necessary.

Check that the difference in vacuum reading between the cylinders is 0.79 in. Hg or less. If it is greater than 0.79 in. Hg, adjust as follows:

With the Number Three carburetor being the standard, run the adjusting screws on Number One and Number Two carburetor-adjusting screws, so that the vacuum-reading difference between Number One and Number Two carburetors is 0.79 in. Hg or less.

Snap the throttle open several times and recheck that the vacuum readings of Number One and Number Two carburetors is the same as Number Three carburetor.

Note: The less the difference between the three readings, one for each carburetor, the more stable the idle speed.

~~Remove the vacuum gauge, tubes and adapters from the intake manifold and reinstall the three 5 x 10mm plugs and~~ washers (Fig. 32-18).

Recheck and, if necessary, readjust the idle speed by turning the Number Three throttle-stop screw to obtain an idle speed of 950 +/- 50 r.p.m. (Fig. 32-16).

. **Diaphragm Adjustment**

The diaphragm should only be adjusted AFTER the idle speed has been adjusted.

Loosen the two 6 x 16mm Torx bolts securing the unit using the screw T30H 07703 - 0010600 and handle 07703 - 0010300 (Fig. 32-6).

Disconnect the throttle cable link from the throttle cam (Fig. 32-1).

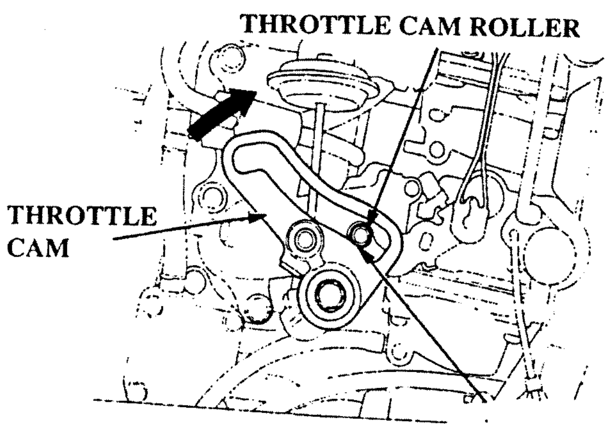


Fig. 32-21. Throttle Cam Position

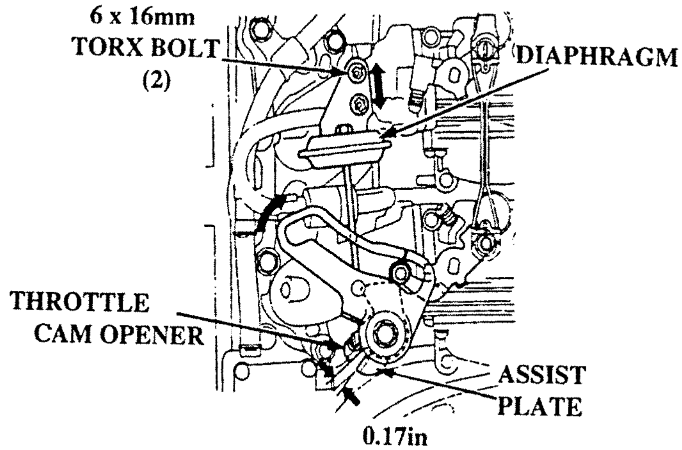


Fig. 32-22. Assist Plate/Throttle Opener Clearance

Move the throttle cam in the direction of the arrow until it contacts the roller of the throttle arm (Fig. 32-21).

Slowly move the diaphragm up and down until the clearance between the assist plate and the throttle-opener cam is .165" (Fig. 32-22).

Hold the diaphragm in this position and tighten the two 6 x 16mm Torx bolts.

Reinstall the throttle-cable link to the throttle cam and check that the full travel is available.

SECTION 33

ENGINE REMOVAL

To Remove

Disconnect and remove the battery.

Remove the fuel tank (See SECTION 14).

Drain the engine coolant.

Remove the header tank-and-heat exchanger assembly (See SECTION 11).

Disconnect the multi - pin plug of the wiring harness and two wires to the pressure gauge lamp.

Release the instrument panel by removing the screws securing it to the cradle.

Unscrew the union nut securing the compound gauge pipe at the volute.

Disconnect the throttle cable at the carburetor-end.

Disconnect the choke-control rod at the carburetor-end.

Unscrew the four pan-head screws and washers to release the floodlight mast-support panel from the cradle.

Remove the discharge valves to provide more space for maneuvering the unit.

Remove the screws securing the silencer outer heat shield and remove it.

Release the primer control rod at the exhaust primer-end by removing the split pin and washer.

Unscrew the two union nuts of the priming pipe at the exhaust primer unit and priming valve and remove the pipe.

Unscrew the two union nuts securing the oil drain pipe between the adapter housing and the engine oil sump and then remove the pipe.

Unscrew the two sleeve nuts and remove the thermal relief-valve pipe from the valve and the exhaust silencer (if equipped).

Remove the four nuts and washers and remove exhaust silencer - also releases inner heat shield.

Release the protective plate (skid-plate) from below the cradle by removing, the securing screws.

Remove the four self-locking nuts and washers from the engine and pump flexible mountings.

Using suitable, approved lifting equipment, maneuver the engine and pump unit together from the cradle. The pump may then be separated from the engine.

ELECTRICAL AND IGNITION SYSTEMS

Description

The engine is equipped with a capacitor-discharge ignition system (C.D.I.), which provides three independent circuits - one for each cylinder.

The system also incorporates electronic advancement of the spark, over-rev limiter, over-heating and oil-pressure alert and warning system.

No contact breakers, or other mechanical parts are used, so the system is maintenance-free and provides excellent sparking performance.

Electronic Advance C.D.I. System

Operation (Fig. 34-1 to 34-8).

As the flywheel rotates, the interaction of the flywheel magnets and the exciter coil generates electrical power. This is fed to the ignition condenser (dotted line on Fig. 37-1) which then becomes charged. At this point in the cycle the thyristor is 'OFF'.

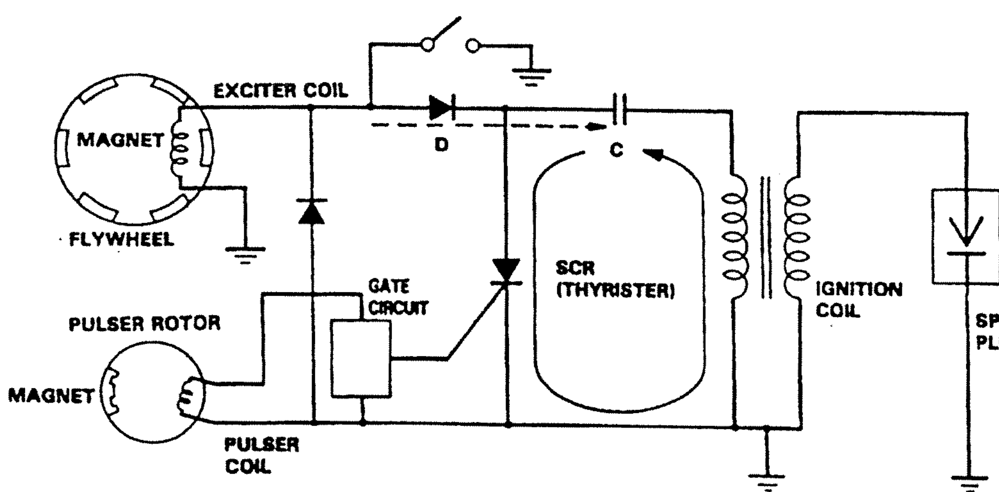


Fig. 34-1. Basic Circuit Diagram - Single Cylinder

When the magnet of the pulsar rotor passes the pulsar coil, the coil emits a signal by magnetic force. This signal passes the gate circuit, turns the thyristor 'ON' and the electric charge is discharged from the condenser. The discharge current flows through the ignition coil primary circuit including a high-voltage charge in the secondary circuit, which is then discharged across the electrodes of the spark plug (shown by a solid line in Fig. 34-1).

The electronic advance spark system advances the ignition timing when the gate circuit turns the thyristor 'ON' according to the engine speed to obtain high-speed power output.

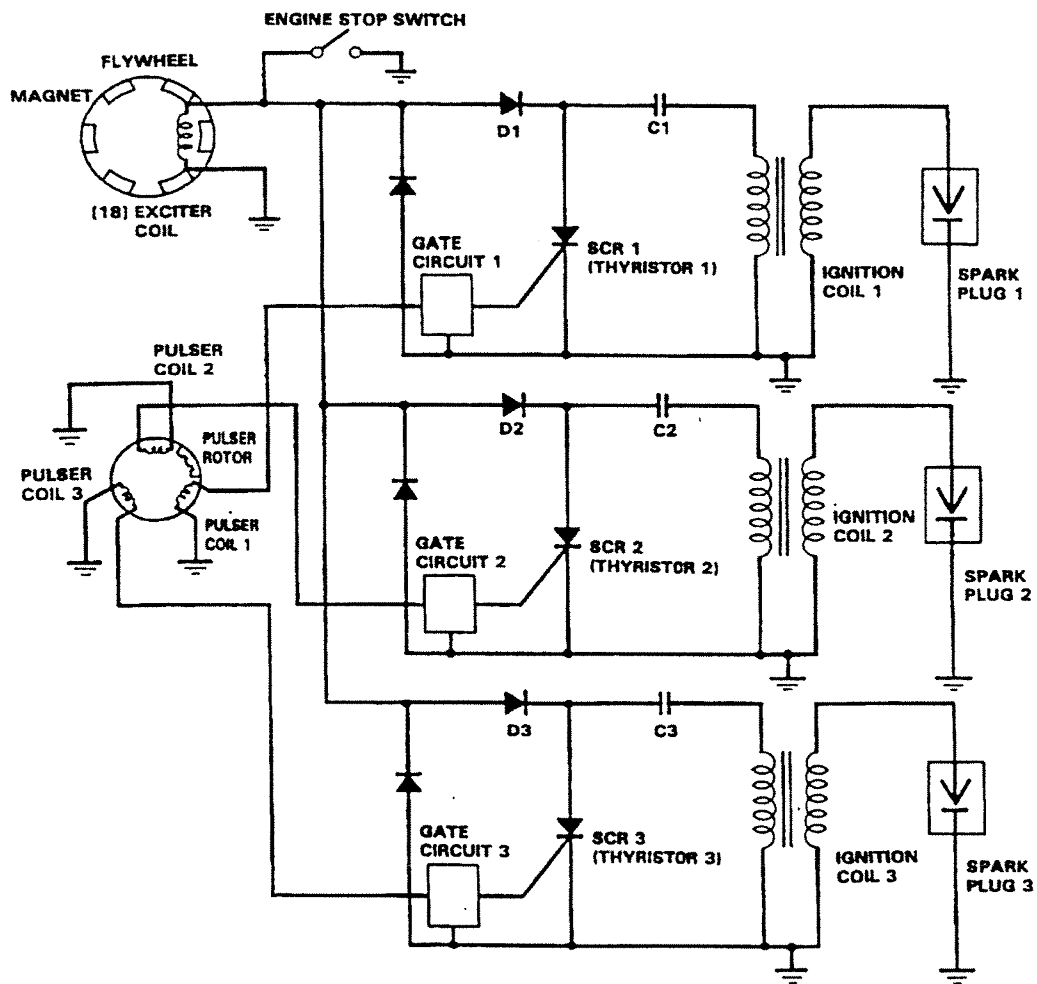


Fig. 34-2. Basic Circuit Diagram - Three Cylinders

The system is equipped with three ignition condensers and an independent system is provided for each of the three cylinders.

Over-rev Limiter

An over-rev limiter is provided in the C.D.I. unit to prevent the over-revving, of the engine (Fig.34-3). The speed limiter is set to 6600 +/- 200 r.p.m.

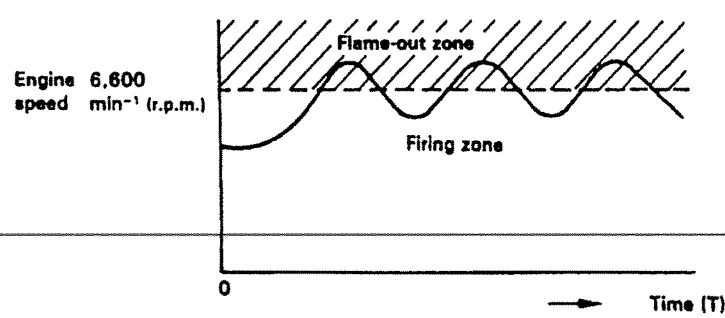


Fig. 34-3. Speed Limiter Firing and Flame-Out Zones

- **Overheat/ Oil Pressure Alert**

This system protects the engine by controlling its speed through the C.D.I. circuit if overheating or low engine-oil pressure occurs.

When trouble is detected, the system slows down the engine speed gradually as a sharp drop in the speed can be hazardous to the personnel operating at the discharge-end of the hose(s).

When the problem is solved the system gradually increases the engine speed once again up to the setting determined by the throttle opening.

Engine Speed Control

Firing and flaming-out is repeated electrically to control the engine speed.

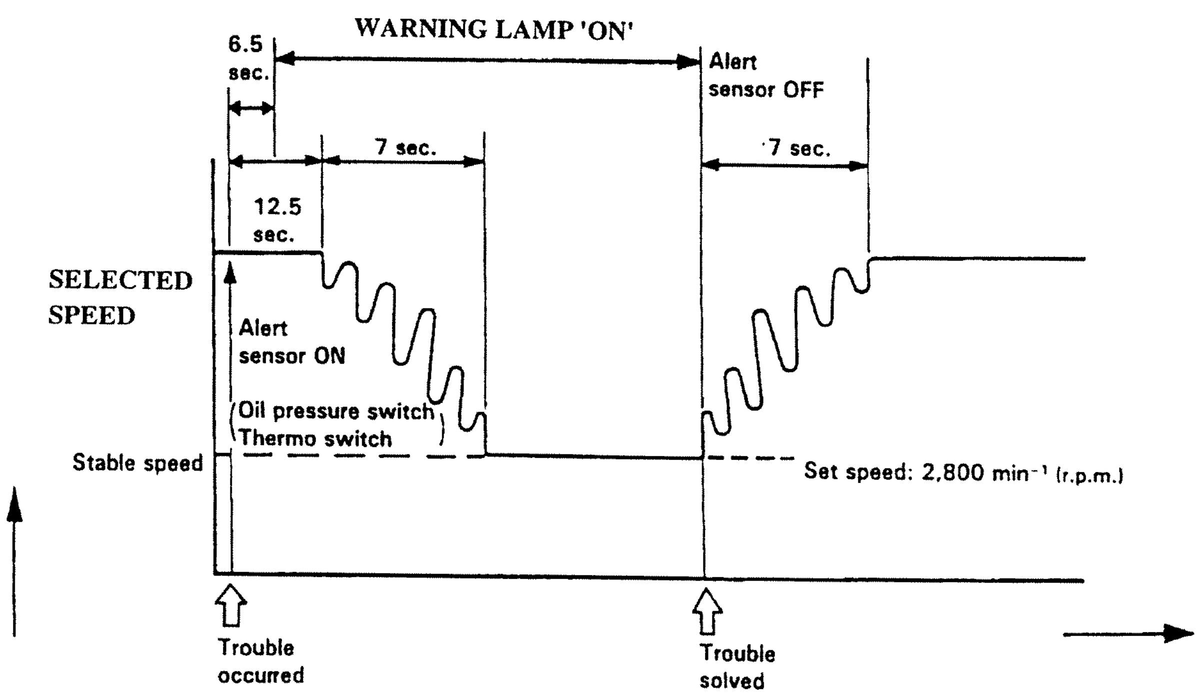


Fig. 34-5. Engine Speed Control

When the engine is below the stable speed (approximately 2800 r.p.m.) it is increased to the engine stable speed according to the throttle setting.

With the engine above the stable speed, it is slowed down gradually and stabilizes at the stable speed (approximately 2800). The engine speed does not increase regardless of throttle opening.

Warning System

The warning system sets the time of the timer before the engine-speed control is started and alerts the operator to the oil pressure or thermal-switch operation with the warning tamps on the instrument panel.

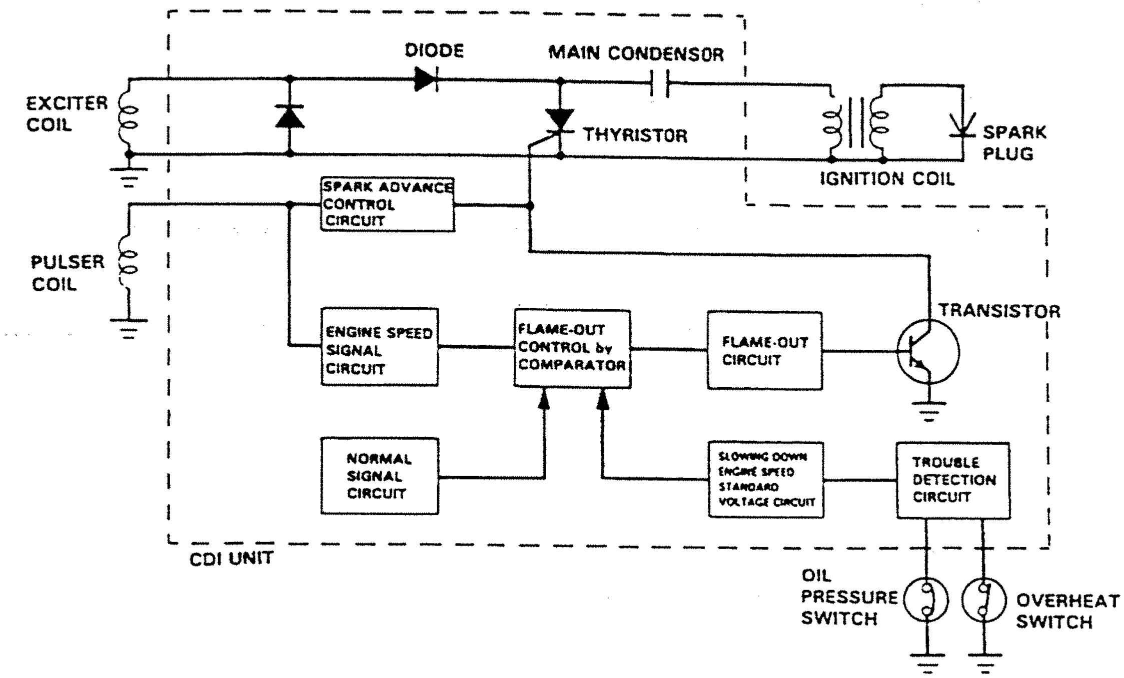


Fig. 34-6. Unit Alert System - Single Cylinder

Item	Colour of the lamp	When faulty
Oil pressure switch	Red	ON
Thermo-switch	Red	ON

<Detection>

Thermo switch: ON when temperature is above the set temperature

Oil pressure switch: ON when oil pressure is below the set pressure

When the oil-pressure switch or thermo-switch detects the 'trouble signal', the comparator circuit compares the condenser discharged-voltage curve of the slowing-down engine speed standard voltage circuit with the engine-speed voltage signal and detects whether the speed is above or below the specified speed.

Receiving the signal from the comparator, the flame-out circuit turns the transistor ON/OFF and controls the thyristor rate.

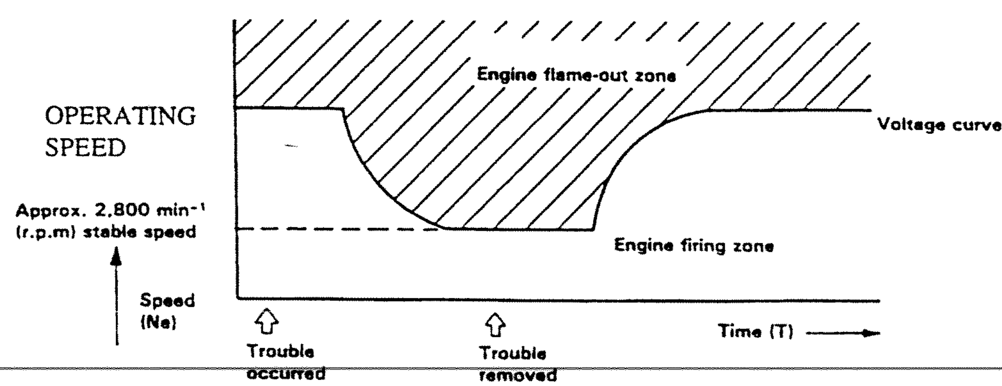


Fig. 34-7. Engine Speed Flame-Out and Firing Zones

- The slowing-down engine speed standard voltage stabilizes at the pre-set stable engine speed.
  The flaming-out and firing are repeated at this stable engine speed.

  When the oil-pressure switch or thermo-switch trouble is removed the 'trouble signal' stops and the alert system repeats the procedure.

Alert Indicator (Warning) Lamp Circuit (Fig. 34-8)

Direct current supplied by the charging coil and rectified to half-wave by the rectifier, flows to the thermo-lamp and oil lamp.

The thermo-switch turns ON when the temperature is above the set temperature and current flows through the lamp circuit. The alert ON signal is sent to the C.D.I. unit when the thermo switch is ON.

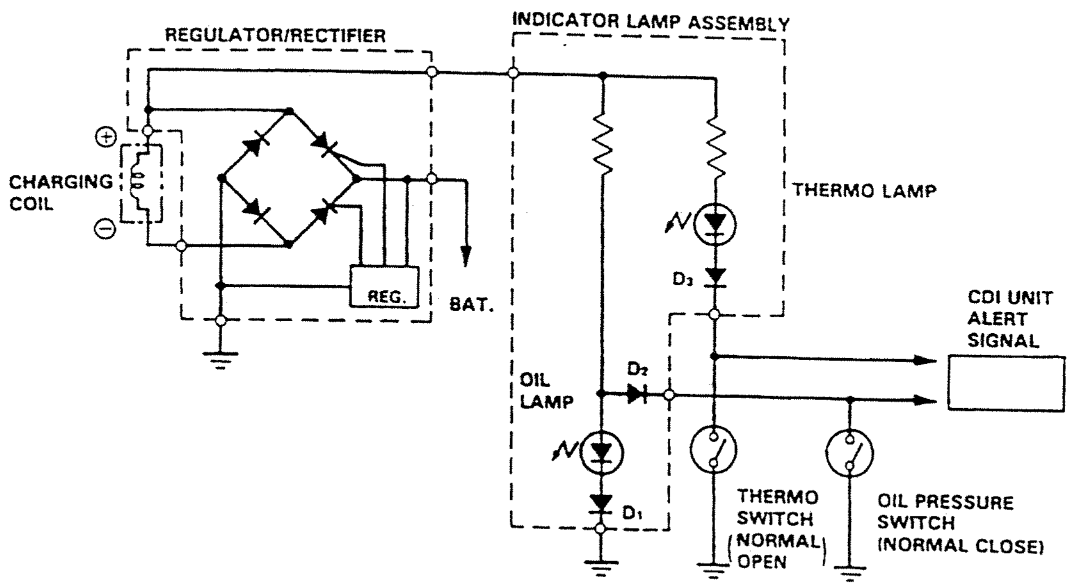


Fig. 34-8. Basic Circuit Diagram - Alert Indicator Lamps

The oil-pressure switch turns OFF and the current flows to the oil lamp when the oil pressure generated by the engine is above the pre-set limit.

When the oil pressure falls below the set pressure the switch turns ON, the current flows through diode D2 to the oil-pressure switch and the current to the oil lamp ceases and the lamp turns OFF.

The alert ON signal is sent to the C.D.I. unit when the switch is ON.

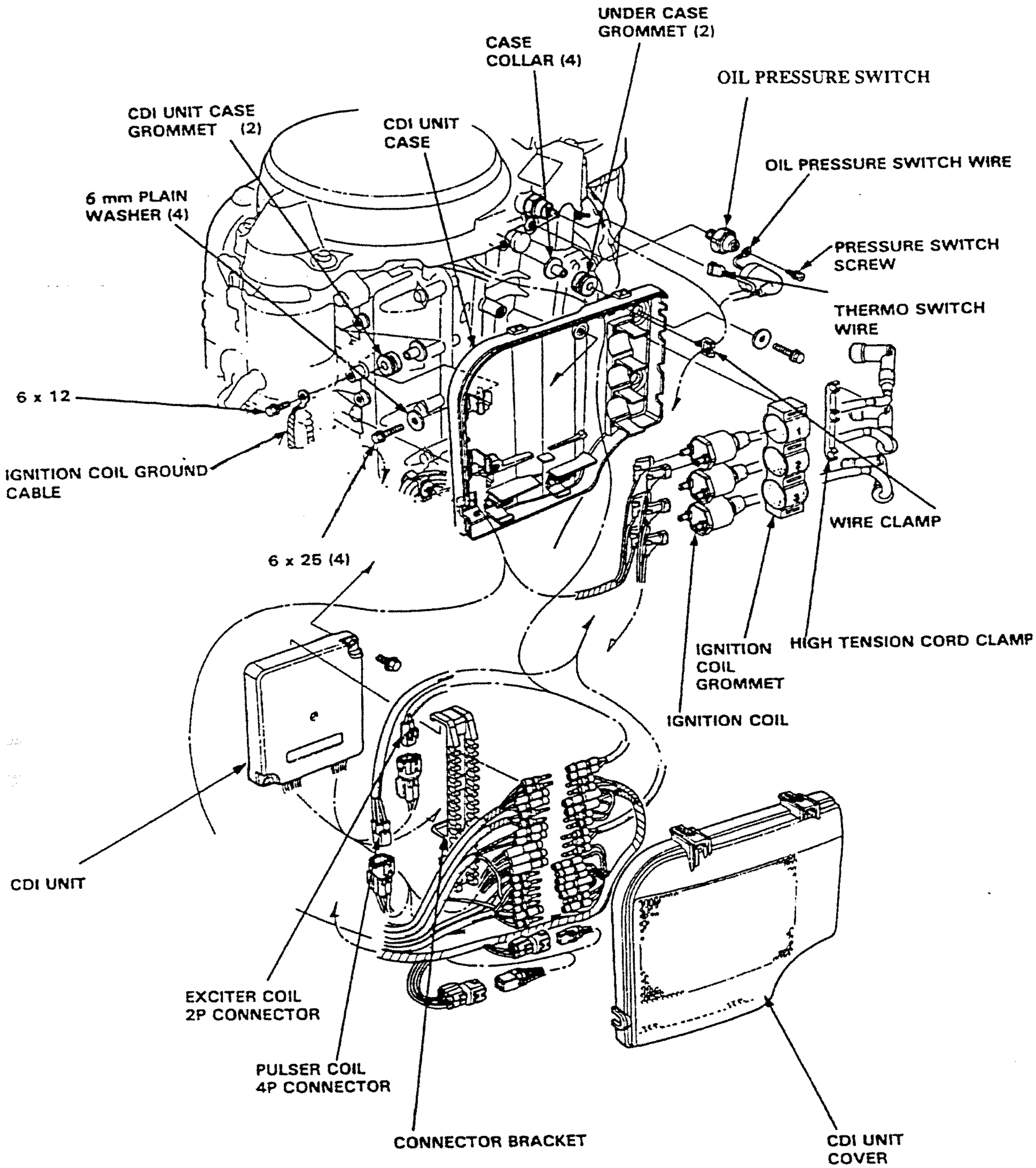


Fig. 34-9. Component Identification

Oil Pressure Switch

Testing

Peel back the protective cover and unscrew the 4 x 8mm screw securing the wire to the switch.

Attach the test apparatus probes between the center of the switch, previously occupied by the screw, and the switch body.

Check that there is continuity (Fig. 34-10). If no continuity exists, install a new coil-pressure switch.

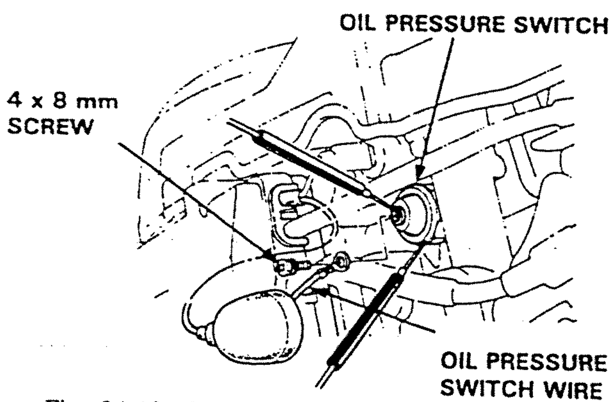


Fig. 34-10. Continuity Test - Oil Pressure Switch

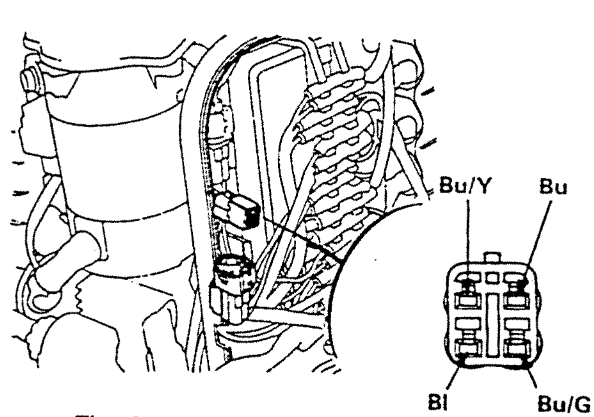


Fig. 34-11. Resistance Test - Pulser Coil

Pulser Coil

Testing

It is not necessary to remove the coil to conduct these tests.

Disconnect the pulsar coil-plug located under the C.D.I. cover on the side of the engine.

Connect the probes of an ohmmeter to each terminal and measure the resistance between these terminals (Fig. 34-11).

The readings should be as follows:

Reading

	PC1 (Bu)	PC2 (Bu/Y)	PC3 (Bu/G)
GND (Bl)	288—352 Ω	288—352 Ω	288—352 Ω

Colour code: Bl = Black Bu = Blue Bu/Y = Blue/Yellow Bu/G = Blue/Green

Exciter Coil

Testing

There is no need to remove the coil to conduct this test.

Measure the resistance between each terminal of the exciter coil connector (Fig. 34-12).
The resistance should be 168-227 ohms. If not within this range, install a new exciter coil (See SECTION 2).

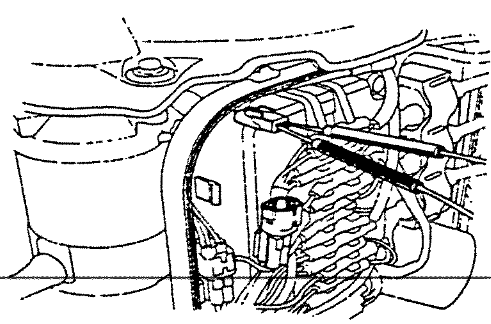


Fig. 34-12. Resistance Test - Exciter Coil

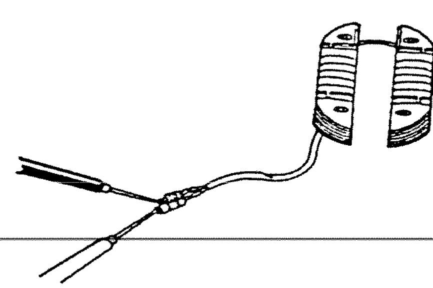


Fig. 34-13. Resistance Test - Charging Coils

Charging Coils

The charging coils are located inboard of the engine flywheel and have an output of 10 amps.

Disconnect the two connectors of the charging coil set under the C.D.I. cover.

Measure the resistance between the connectors of the charging coils set (Fig. 34-13). This should be 0.17 - 0.23 ohms. If the reading is outside these limits a new coil set must be installed (See SECTION 20).

Ignition Coils

Three independent ignition coils are fitted, one for each cylinder, located under the C.D.I. cover (Fig. 34-9).

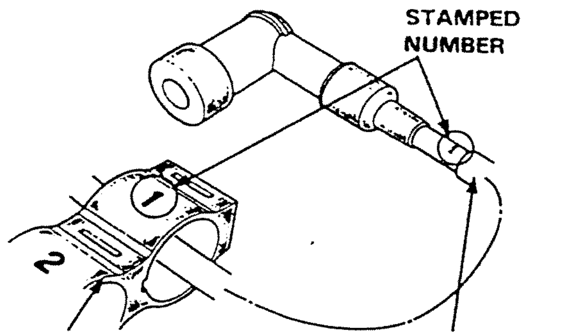


Fig. 34-14. Coil Grommet and H.T. Lead Numbers

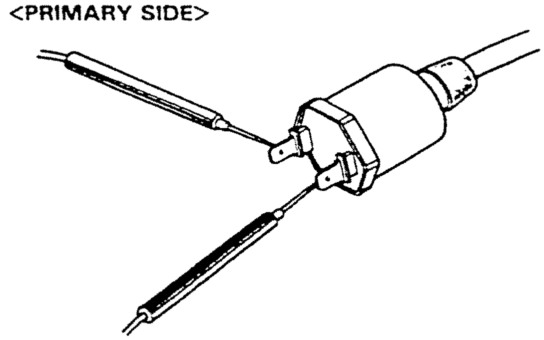


Fig. 34-15. Testing Coil Primary Circuit

To Remove

Identify the coil(s) to be removed.

Detach all three plug (H.T.) leads from the spark plug(s).

Disconnect the two wires from the appropriate coil, release the H.T. plug lead from its clamp and remove the spark-plug cap.

Carefully withdraw the coil from its grommet.

Testing

Connect the probes of an ohmmeter as shown in Fig. 37-15 to test the coil primary circuit.

The reading should be 0.19 - 0.23 ohms.

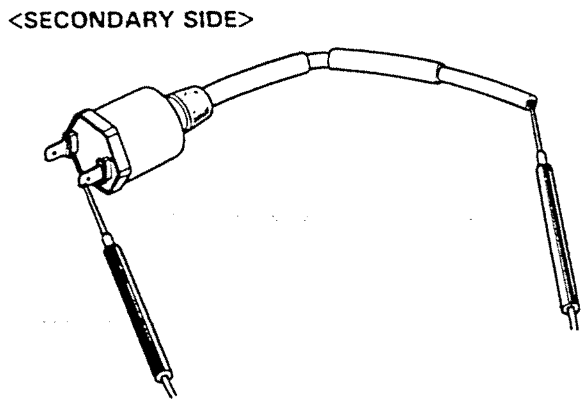


Fig. 34-16. Testing Coil Secondary Circuit

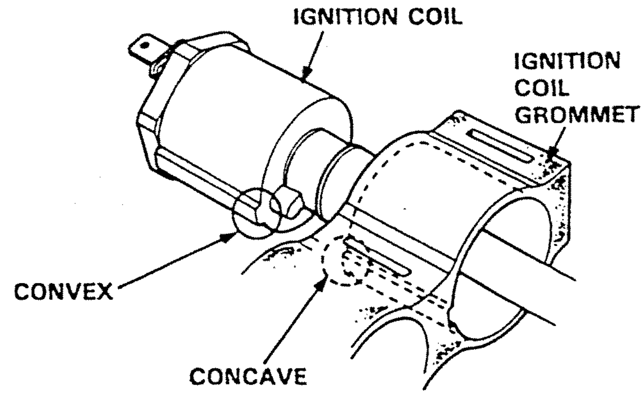


Fig. 34-17. Coil and Mounting Grommet

To test the coil secondary circuit: connect the ohmmeter probes between the end of the plug (H.T.) lead and the green terminal of the coil (Fig. 34-16).

The reading should be 2.8-3.4 ohms.

Note: A false reading will be obtained if the spark plug cap is not removed.

To Reinstall

If more than one coil has been removed, ensure that it is reinstalled in the appropriate mounting.

Align the key (convex) of the ignition coil with the concave (slot) in the grommet mounting, and then feed the plug (H.T.) lead through the grommet and finally push the coil into position in the grommet.

Connect the wiring to the ignition coils as shown (Fig. 34-18). The black/blue lead connects to No. 1 coil, the black/yellow lead to No. 2 coil and the black/green lead to No. 3 coil.

All the black leads are common ground leads.

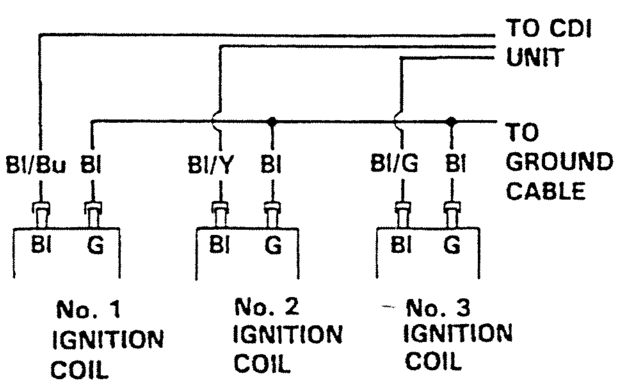


Fig. 34-18. Ignition Coil Connections

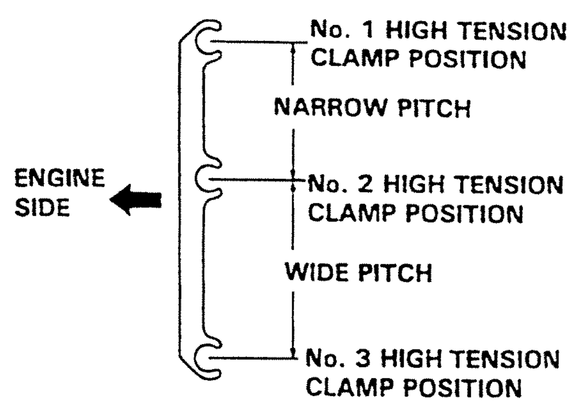


Fig. 34-19. Spark Plug (H.T.) Lead Clamps

Install the spark plug (H.T.) lead clamp with the narrow pitch side uppermost and the flat side towards the engine. Insert the leads securely in the clamp (Fig. 34-19).

Spark Plug Gap

Testing

Remove the spark-plug cap from the plug (H.T.) lead.

Using a suitable test meter, connect one probe to the input side of the cap and the other probe to the spark plug-end and measure the resistance (Fig. 34-20).

This should be 7.5 - 12.5 ohms.

If outside these readings, install a new spark-plug cap.

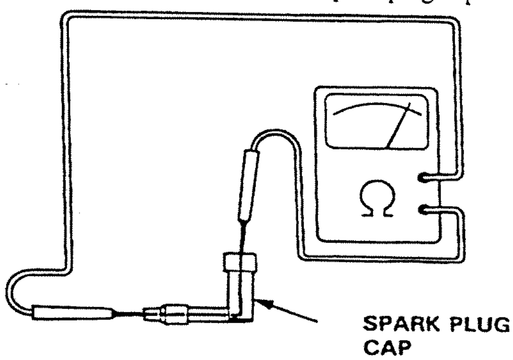


Fig. 34-20. Measuring Plug Cap Resistance

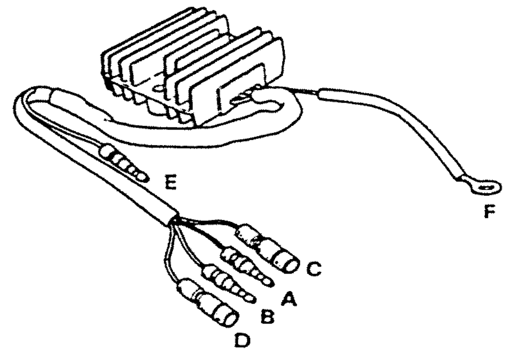


Fig. 34-21. Regulator/Rectifier Connections

Regulator/ Rectifier

Testing

Disconnect the unit at the connectors under the C.D.I. cover and measure the resistance between the connectors (Fig. 34-20).

If the measurements obtained are outside the readings in the table (Fig. 34-22) then a new unit must be fitted.

(Ω)

TESTER (+) / TESTER (−)		Gr A	Gr B	W/Bl, W D/E	Bl F
Gr	A		∞	∞	∞
Gr	B	∞			∞
W/Bl, W	D/E	1k–200k	1k–200k		500–100k
Bl	F	500–50k	100–50k	∞	

Fig. 34-22. Regulator/rectifier resistance readings

Capacitor Discharge Ignition Unit

To Remove

Disconnect the battery.

Remove the coolant tank and heat exchanger as an assembly (See PART A - SECTION 1).
Release the four clips of the C.D.I. unit cover and withdraw it.

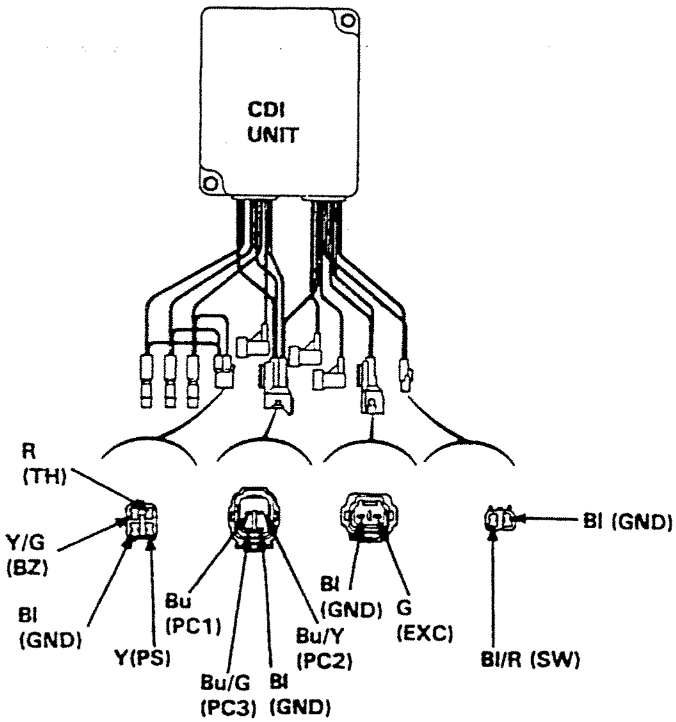
The wiring may be disconnected at the connectors on the connector bracket but their colors and positions should be carefully noted.

Unclip the connector bracket from the C.D.I. unit.

Unscrew the two 6 x 18mm screws securing, the C.D.I. unit to the casing, to allow it to be removed.

Testing

Measure the resistance between the C.D.I. unit terminals. The measurement must confirm to the ranges shown in Fig. 34-23.



COLOUR CODE

Bl	BLACK	Br	BROWN
Y	YELLOW	O	ORANGE
Bu	BLUE	Lb	LIGHT BLUE
G	GREEN	Lg	LIGHT GREEN
R	RED	P	PINK
W	WHITE	Gr	GRAY

(KΩ)

COLOUR	Tester(−) / Tester(+)	PC1	PC2	PC3	EXC	SW	IG1	IG2	IG3	PS	TH	GND	BZ
Bu	PC1		10−500	10−500	10−500	∞	∞	∞	∞	∞	∞	3−300	∞
Bu/Y	PC2	10−500		10−500	10−500	∞	∞	∞	∞	∞	∞	3−300	∞
Bu/G	PC3	10−500	10−500		10−500	∞	∞	∞	∞	∞	∞	3−300	∞
G	EXC	10−500	10−500	10−500		∞	∞	∞	∞	∞	∞	0.5−50	∞
Bl/R	SW	20−500	20−500	20−500	0.5−50		∞	∞	∞	∞	∞	0.5−50	∞
Bl/L	IG1	∞	∞	∞	∞	∞		∞	∞	∞	∞	∞	∞
Bl/Y	IG2	∞	∞	∞	∞	∞	∞		∞	∞	∞	∞	∞
Bl/G	IG3	∞	∞	∞	∞	∞	∞	∞		∞	∞	∞	∞
Y	PS	10−500	10−500	10−500	10−500	∞	∞	∞	∞		∞	0.5−50	∞
R	TH	3−300	3−300	3−300	3−300	∞	∞	∞	∞	∞		0.5−50	∞
Bl	GND	3−300	3−300	3−300	3−300	∞	∞	∞	∞	∞	∞		∞
Y/G	BZ	10−500	10−500	10−500	10−500	∞	∞	∞	∞	∞	∞	0.5−500	

TESTER (−) / TESTER (+)	PC.E	EXC.E.	IND.E.	SW.E.
GND	Continuity	Continuity	Continuity	Continuity

NOTE

- RECOMMENDED MULTITESTERS:
  TH−5H (KOWA Analogue type)
  SP−10D (SANWA Analogue type)
- Select the following range.
  Kowa: R x 100 Ω
  Sanwa: kΩ

Fig. 34-23. Test Meter readings for C.D.I. Unit

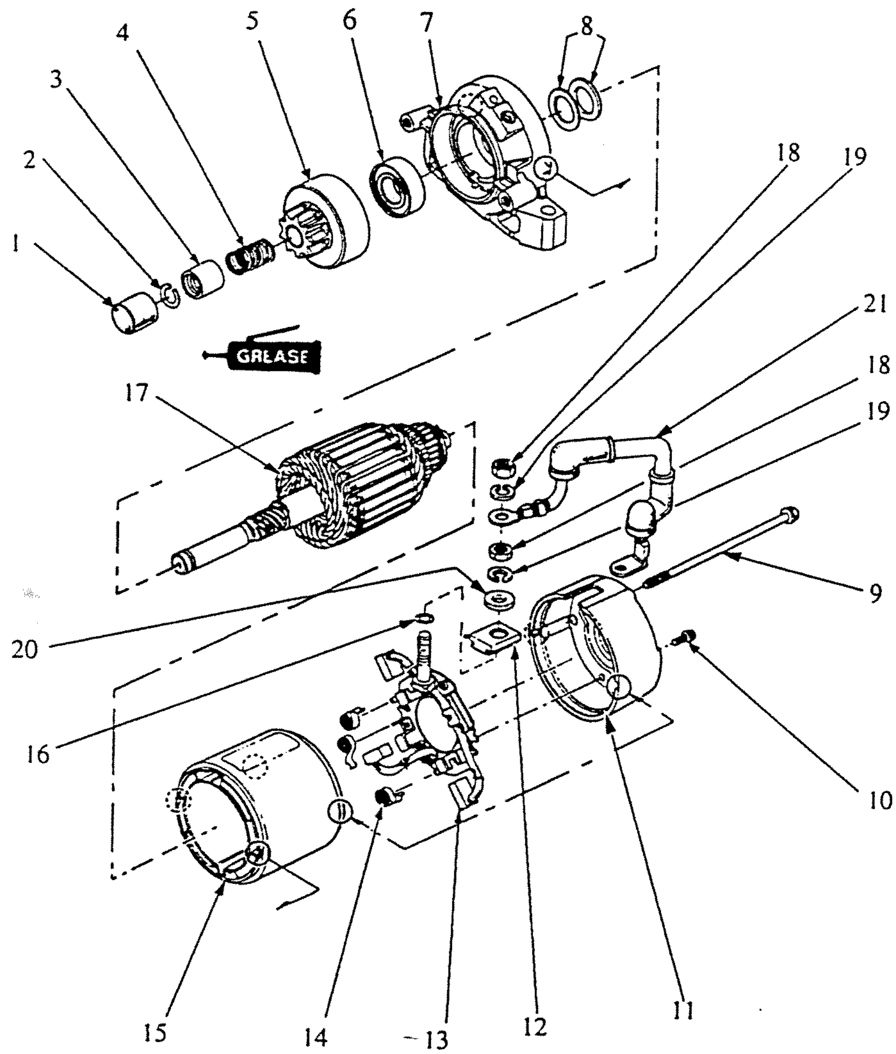
To Reinstall

Reinstallation is a reversal of the removal instructions.

Retighten the C.D.I. unit screws to a torque of 4 ft/lbs.

Starter Motor

The starter motor of the inertia-engagement type (1.2 HP rating) and also incorporates unidirectional (over-run) clutch-and-pinion assembly. The solenoid (magnetic switch) is mounted separately to the starter motor and connected to it by heavy-duty cable. Both units are mounted on the crankcase.



1. Cover
2. Snap ring
3. Stopper collar
4. Spring
5. Uni-directional clutch
6. Ball race
7. Front cover
8. Washers
9. Belt
10. Screw
11. Rear cover
12. Bushing
13. Bush holder
14. Bush spring
15. Yoke
16. 'O' ring
17. Armature
18. Flange nut
19. Spring washer
20. Washer
21. Cable assembly

Fig. 34-24. Starter Motor Components

To Remove

Disconnect and remove the battery.

Unscrew the 8 x 12mm flange bolt and detach the negative (-) cable from the starter motor body.

Peel back the protective cover of the positive (+) cable, unscrew the 8mm flange nut securing it to the starter-motor bushing and finally, recover the 8mm spring washer and cable (Fig. 34-25).

Remove the three flange bolts securing the starter motor to the crankcase and remove the starter motor.

. Place the starter in an upright position (starter-pinion uppermost).

Position an off-set wrench over the stopper collar and push the collar down. This will expose a snap ring which should then be removed (Fig. 34-26).

The collar and unidirectional clutch can then be withdrawn from the armature shaft.

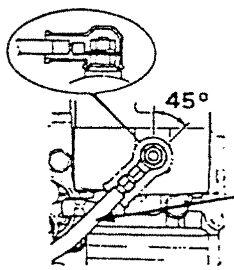


Fig. 34-25. Magnetic Switch Cable

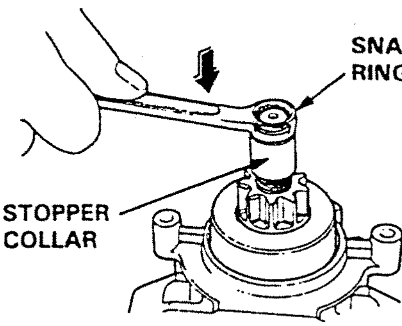


Fig. 34-26. Removing Snap Ring

Maintenance

To dismantle the starter motor refers to Fig. 37-24 and proceeds as follows:

Unscrew the two long bolts (9) clamping the rear cover (11) yoke (15) and front cover (7) together.

Remove the rear cover and brush-holder assembly and the yoke (15).

The armature (17) may then be withdrawn from the ball race (6) located in the front cover (7). Recover the washers (8).

Inspection and Testing

Brushes

Pull each brush spring away from the brush and withdraw the brush from its holder.

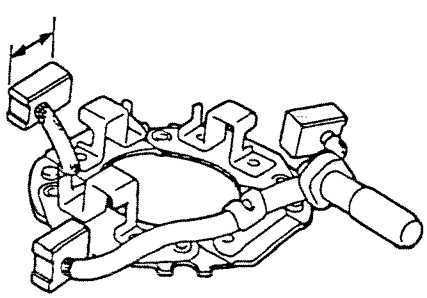


Fig. 34-27. Measuring Brush Length

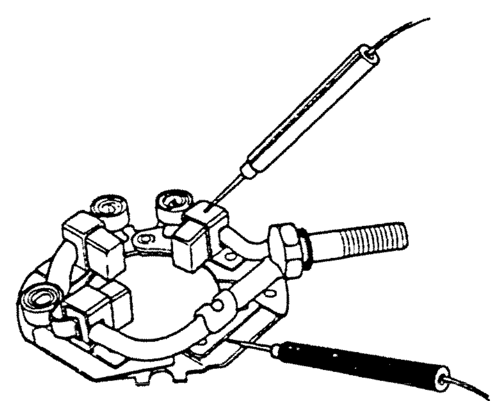


Fig. 34-28. Testing Brush Insulation

Measure the length of each brush (Fig. 34-27). The standard is 0.6" and the service limit is 2". If less than the service limit, install a new set of brushes.

With the brushes reinstalled to their holders, check for any continuity between the brushes (Fig. 37-28). Should continuity exist, install a new brush-holder assembly. To do this, unscrew the nut (18) and two screws (10) securing it to the end cover (11). See Fig. 34-24.

Mica Depth

Check the grooves between the commutator segments for depth, which should not be less than 0.0079" (Fig. 34-29). If less than this figure or if clogged, recut the grooves using a hacksaw blade or suitable small file.

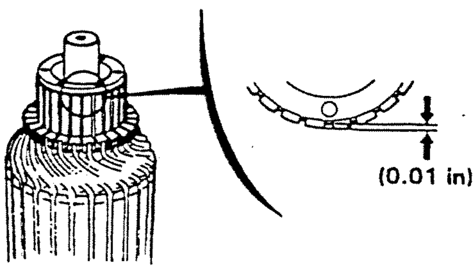


Fig. 34-29. Measuring Mica Depth

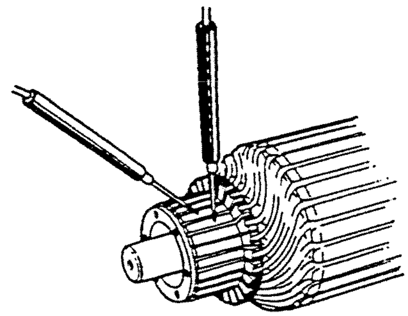


Fig. 34-30. Armatrure Continuity Check

Continuity Check

Check for continuity between the armature segments (Fig. 34-30). If no continuity exists (open-circuit) between the two segments, install a new armature.

Short-Circuit Test, Core-to-Commutator

Check for continuity between the commutator and armature-coil core (Fig. 34-31). If continuity exists, install a new armature.

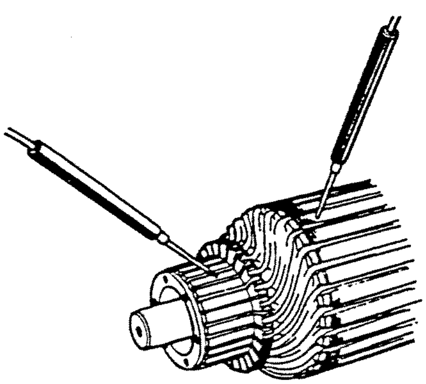


Fig. 34-31. Short-Circuit Test - Core to Commutator

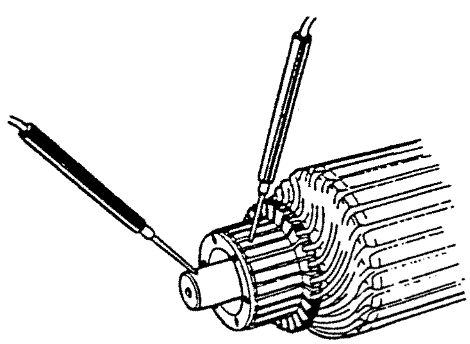


Fig. 34-32. Short-Circuit Test - Shaft to Commutator

Short-Circuit Test, Shaft-to-Commutator

Check for continuity between the commutator and armature shaft (Fig. 34-32). If continuity exists, install a new armature.

Short-Circuit Test, Armature

Place the armature in an armature test unit, (this is commercially available). Hold a hacksaw blade or similar metal strip, close to (but not touching) the armature (Fig. 34-33).

If the blade vibrates, or is attracted to the core when the test unit is turned on, there is a short circuit in the armature. Install a new armature if short-circuited.

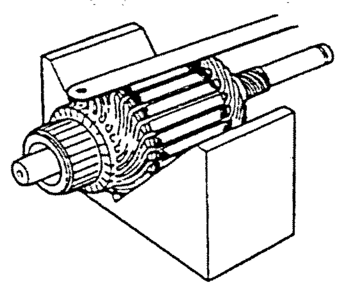


Fig. 34-33. Armature Short-Circuited

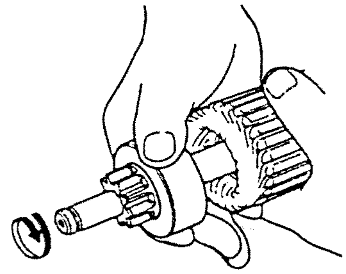


Fig. 34-34. Checking Uni-Directional Clutch

Uni-directional Clutch

The clutch should first be checked for smooth axial movement. Oil should be applied but if still unsatisfactory, install a new clutch unit (Fig. 34-34).

Check the operation of the clutch by holding the unit stationary and turning the armature (Fig. 34-35). The clutch should turn freely in the counterclockwise direction, but should NOT turn clockwise.

Check the pinion teeth for wear or damage and if unsatisfactory, install a new one. If this is necessary, check the flywheel teeth for excessive wear or damage. Replace if necessary.

Inspect the armature for dust, rust or any other damage. Wipe clean with a clean lint-free, cloth. If rusted or damaged, dress with a fine emery cloth. Make sure that no metallic material is attached to the armature before replacing.

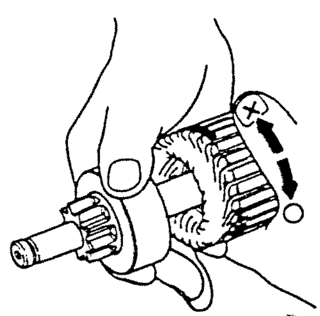


Fig. 34-35. Checking Clutch Operation

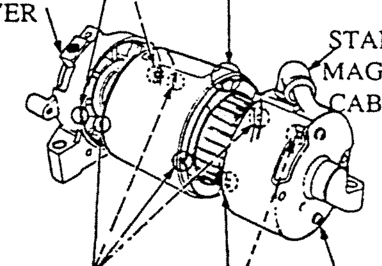


Fig. 34-36. Yoke and Covers Relationship

Check the front and rear bearings for excessive movement and replace if necessary.

When reassembling, align the projections on the yoke with the recesses in the rear cover ensuring that the 'A' Point on the yoke faces the starter magnetic switch cable (Fig. 34-36). The front cover recesses should be aligned with the projections on the yoke, in a similar manner.

Apply an adhesive compound (e.g. Cemedain 575 or equivalent) to the bushing to rear cover joint.

Magnetic Switch (Solenoid)

Testing

Ensure that the battery is in good condition and fully-charged before performing this test.

Connect the black/white wire of the switch to the positive (+) terminal of the battery and the black wire to the negative (-) terminal (Fig. 34-37).

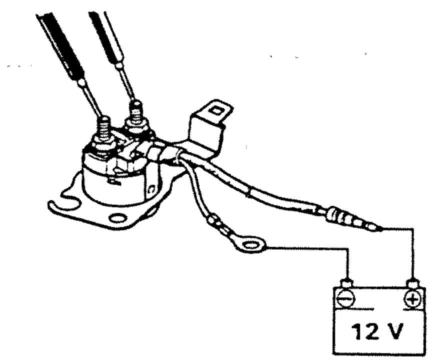


Fig. 34-37. Continuity Test - Solenoid

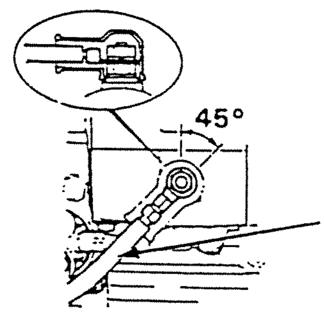


Fig. 34-38. Starter Cable Installation

Connect the probes of the test apparatus, one to each solenoid terminal and check for continuity (Fig. 34-37). There should be continuity with the battery connected, but no continuity with the battery disconnected. If faulty, install a new solenoid.

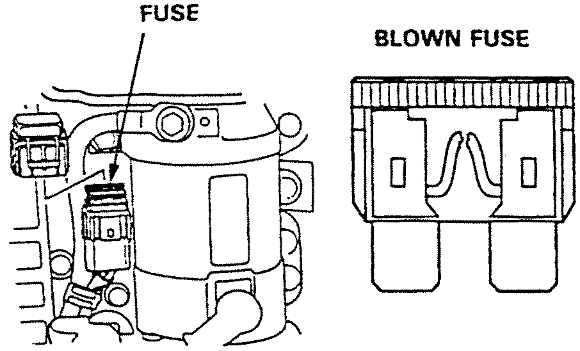


Fig. 34-39. Fuse Location and Condition

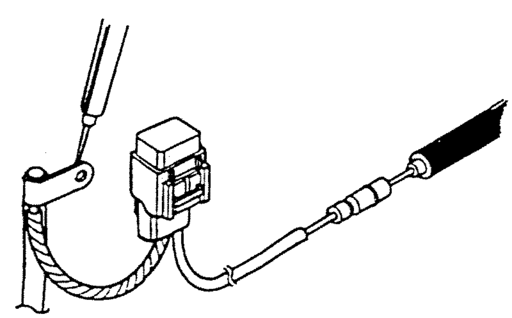


Fig. 34-40. Checking Fuse Continuity

Fuse and Fuse Case

The fuse case is located adjacent to the starter motor (Fig. 34-39).
The fuse plugs into the top of the case and should be checked either visually or electrically to determine its condition (Fig. 37-39).

If 'blown', install a new fuse.

Testing

Using a 'known' good fuse plugged into the fuse case, connect the probes of the test apparatus as shown (Fig. 34-40) and check the fuse case for continuity.

If no continuity, replace the fuse case.

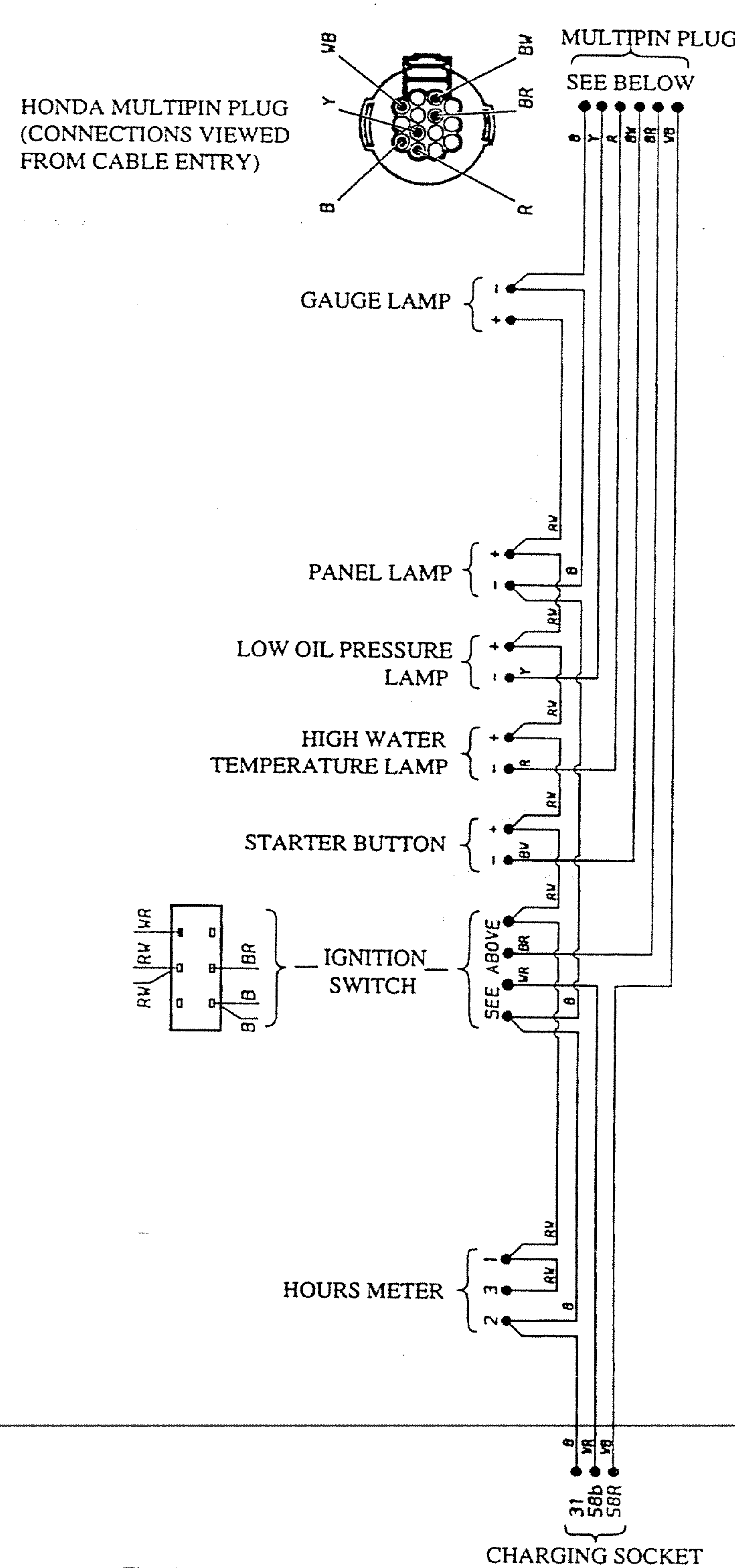


Fig. 34-41. Schematic Wiring Diagram - Hale Part

SECTION 35

MAINTENANCE SCHEDULE

REGULAR SERVICE ITEM	PERFORM AT EVERY INDICATED MONTH OR HOUR INTERVAL WHICHEVER COMES FIRST	EACH USE	FIRST MONTH OR 20 HRS	EVERY 6 MONTHS OR 100 HRS	EVERY YEAR OR 200 HRS	EVERY 2 YEARS OR 400 HRS	REFER TO SECTION
ENGINE OIL	CHECK LEVEL CHANGE	X 	 X		 X		10 10
ENGINE OIL FILTER TIMING BELT	CHANGE CHECK-READJUST				 X	X 	10 2
CARBURETOR LINKAGE IDLING	CHECK READJUST		X X	X X			14 14
VALVE CLEARANCE	CHECK-READJUST		X		X		4
SPARK PLUGS	CHECK-CLEAN		X		X		16
FUEL FILTER	CHECK CHANGE			X 		 X	12 12
THERMOSTAT	CHECK				X		11
FUEL	CHECK (REPLACE IF NECESSARY)	X 				 X	
BATTERY FLUID CABLE CONNECTION	CHECK-REFILLING CHECK-TIGHTNESS	X 	 X	 X			16 16
BOLTS AND NUTS	CHECK-TIGHTNESS		X	X			

TECHNICAL DATA

UNITS: INCHES

PART	ITEM		STANDARD	SERVICE LIMIT
ENGINE	IDLE SPEED		950 +/- 50 MIN (RPM)	
	CYLINDER COMPRESSION		212 +/- 14 PSI AT 500 MIN (RPM)	
CARBURETOR	MAIN JET		#125	
	PILOT SCREW OPENING		2-1/8 TURNS OUT	
	FLOAT HEIGHT		0.6	
SPARK PLUG	GAP		0.024-0.028	
VALVES	VALVE CLEARANCE	IN	0.005-0.007	
		EX	0.008-0.010	
	STEM O.D.	IN	0.2157-0.2161	0.215
		EX	0.2150-0.2154	0.213
	GUIDE O.D.	IN/EX	0.2165-0.2170	0.218
	SEAT WIDTH	IN	0.049-0.061	0.08
		EX	0.049-0.061	0.08
	SPRING FREE LENGTH	IN/EX	1.45	1.39
	STEM-TO-GUIDE-CLEARANCE	IN	0.0004-0.0013	0.0024
		EX	0.0012-0.0020	0.004
ROCKER ARM	ROCKER ARM I.D.		0.5516-0.5523	0.553
	ROCKER ARM SHAFT O.D.		0.5502-0.5509	0.549
	ROCKER ARM SHAFT-TO-ROCKER ARM CLEARANCE		0.0006-0.0020	0.003
PISTON	SKIRT O.D.		2.7547-2.7555	2.7524
	PISTON-TO-CYLINDER CLEARANCE		0.0004-0.0018	0.0035
	PIN HOLE I.D.		0.7087-0.7090	0.709
	PIN O.D.		0.7084-0.7086	0.7068
	PIN-TO-HOLE CLEARANCE		0.0001-0.0005	0.0016
PISTON RING	RING SIDE CLEARANCE	TOP	0.0016-0.0026	0.004
		SECOND	0.00059-0.0018	0.004
		OIL	0.0022-0.0055	0.006
	RING AND GAP	TOP	0.006-0.012	0.03
		SECOND	0.012-0.018	0.037
		OIL	0.0079-0.028	0.04
	RING WIDTH	TOP	0.0390-0.0404	0.038
		SECOND	0.0469-0.0482	0.0457
CYLINDER/ CYLINDER HEAD	CYLINDER SLEEVE I.D.		2.7559-2.7565	2.758
	DISTORTION OF CYLINDER HEAD		0.0019	0.004
	I.D. OF CAMSHAFT		0.9055-0.9063	0.908

UNITS: INCHES

PART	ITEM		STANDARD	SERVICE LIMIT
CONNECTING ROD	SMALL END I.D.		0.7093-0.7100	0.711
	BIG END OIL CLEARANCE		0.0006-0.0016	0.0019
	BIG END AXIAL CLEARANCE		0.0019-0.0079	0.012
	CONNECTING ROD BEARING OIL CLEARANCE		0.0008-0.0015	0.003
CRANKSHAFT	JOURNAL O.D.	MAIN	1.5741-1.5750	1.572
		PIN	1.4951-1.4961	1.494
	CRANKSHAFT MAIN BEARING OIL CLEARANCE		0.0008-0.0015	0.0019
	CRANKSHAFT SIDE CLEARANCE		0.0019-0.012	0.018
CAMSHAFT	SHAFT AXIAL CLEARANCE		0.0012-0.0043	0.012
	SHAFT RUNOUT		0.0012 MAX	0.0019
	JOURNAL O.D.		0.9039-0.9047	0.903
	CAM HEIGHT	IN	1.3751-1.3877	1.3665
		EX	1.3769-1.3895	1.3682
	SHAFT OIL CLEARANCE		0.0008-0.0026	0.003
OIL PUMP	BODY I.D.		1.974-1.975	1.976
	INNER ROTOR-TO-OUTER ROTOR CLEARANCE		0.006 MAX	0.0079
	OUTER ROTOR-TO-BODY CLEARANCE		0.006-0.009	0.0102
	OUTER ROTOR HEIGHT		0.6685-0.6693	0.667
	PUMP BODY DEPTH		0.670-0.671	0.673
	PUMP AND CLEARANCE		0.0008-0.0028	0.004
IGNITION COIL	RESISTANCE	PRIMARY	0.19-0.23 💧	
		SECONDARY	2.8-3.4 k💧	
CHARGING COIL	RESISTANCE		0.20-0.26 💧	
EXCITER COIL	RESISTANCE		168-227 💧	
PULSER COIL	RESISTANCE		288-352 💧	

TIGHTENING TORQUES

Item	Thread Dia. (mm) and pitch (length)	Nm	Torque Values kgm	ft. lb.
ENGINE				
Crank case bolt *	M8x1.25	28	2.8	20.2
	M6x1.0	11	1.1	8.0
Oil filter cartridge	M20x1.5	8	0.8	5.6
Water jacket cover bolt	M6x1.0	12	1.2	8.7
Thermostat cover bolt	M6x1.0	12	1.2	8.7
Cylinder head bolt *	M10x1.25	38	3.8	27.5
	M8x1.25	27	2.7	19.5
Cylinder head cover bolt	M6x1.0	12	1.2	8.7
Fuel pump bolt	M6x1.0	10	1.0	7.2
Camshaft holder bolt	M6x1.0	14	1.4	10.1
	M6x1.0	12	1.2	8.7
Throttle cam	M6x1.0	12	1.2	8.7
Choke arm bolt	M6x1.0	12	1.2	8.7
Intake manifold bolt, nut	M6x1.0	12	1.2	8.7
carburetor bolt	M6x1.0	10	1.0	7.2
Connecting rod nut	M6x0.75	28	2.8	20.2
Pump drive adapter nut	M22x1.2	92	9.2	66.5
Valve adjusting nut	M7x0.75	23	2.3	16.6
Oil drain bolt	M12x1.5	23	2.3	16.6
Exhaust pipe bolt	M6x1.0	10	1.0	7.2
	M8x1.25	21	2.1	15.2
Oil pan bolt	M6x1.0	10	1.0	7.2
Oil pump bolt	M6x1.0	13	1.3	9.4
Timing pulley bolt	M48x1.51	130	13.0	94.0
Timing belt tensioner bolt	M10x1.25	45	4.5	32.5
Timing belt adjusting spring bolt	M6x1.0	12	1.2	8.7
Flywheel bolt	M10x1.0	66	6.6	47.7
Pulser rotor bolt	M10x1.25	57	5.7	41.2
Oil pressure switch	PT 1/8	9	0.9	6.5
Thermo switch	M16x1.5	12	1.2	8.7
Starter solenoid (Switchside)	M6x1.0	5	0.5	3.6
(Starter motor side)	M8x1.25	7	0.7	5.1
CDI unit bolt	M6x1.0	5	0.5	3.6

*Tighten the crankcase bolts to 20.2 ft/lbs and the cylinder head bolts to 27.5 ft /lbs then tighten them $90^{\circ+30}$ further.

STANDARD TORQUE VALUES

Item	Thread Dia	Nm	Torque values kgm	ft /lbs
Blot and nut	5mm	5	0.5	3.6
	6mm	10	1.0	7.2
	8mm	21	2.1	15.2
	10mm	35	3.5	25.3
	12mm	55	5.5	40.0
Flange bolt and nut	6mm (RH Flange bolt)	9	0.9	6.5
	6mm	12	1.2	8.7
	8mm	27	2.7	19.5
	10mm	35	3.5	25.3
	12mm	60	6.0	43.4
Screw	5mm	4	0.4	2.9
	6mm	9	0.9	6.5

SPECIAL TOOLS

Item No.	Tool Name	Tool Number	Application
1	Float-level gauge	07401 - 0010000	Inspection for carburetor float level.
2	Vacuum 4ch tester set	07404 - 0030001	Carburetor vacuum pressure inspection.
3	Oil pressure gauge	007506 - 300000	Inspection for oil pressure
3-1	Attachment for Item 3	07406 - 0030000	
4	Torx bit handle	07703 - 0010300	For Torx bits
4-1	Screw T20H	07703 - 0010400	Fuel pump disassembly /reassembly
4-2	Screw T30H	07703 - 0000100	Diaphragm adjustment
5	Valve guide driver 5.5 mm	07742 - 0010100	Valve-guide removal/installation
6	Valve-spring compressor	07757 - 0010000	Valve cotter removal
7	Valve-seat cutter 45°29 dia.	07780 - 0010300	Valve-seat reconditioning EX
8	Valve-seat cutter 45°33 dia.	07780 - 0010800	Valve-seat reconditioning IN
9	Valve-seat cutter 32°30 dia.	07780 - 0012200	Valve-scat reconditioning EX
10	Valve-seat cutter 32°33 dia.	07780 - 0012900	Valve-seat reconditioning IN
11	Valve-seat cutter 60°30 dia.	07780 - 0014000	Valve-seat reconditioning EX
12	Valve-seat cutter 60°37.5 dia.	07780 - 0014100	Valve-seat reconditioning IN
13	Cutter holder 5.5mm	07781 - 0010101	Valve-seat reconditioning EX 14
14	Valve-guide rearner	07894 0 2000001	Valve-guide reaming
15	Oil-filter wrench	07HAA - PJ0100	Oil-filter replacement
16	56mm lock-nut wrench	07LPA - ZV30200	Pulser rotor 45mm locknut removal/installation
17	Ring-gear holder	07LBP - ZV30 1 00	Flywheel 22mm locknut removal/installation
18	Stakiro tool	53563	Stakina 22mm locknut Securing pump
19	Pump adapter puller	56566	Removing pump adapter from crankshaft
20	Seal and seating tool	56571	Fitting silicon-carbide seal and seating to impeller

Special Tools (Continued)

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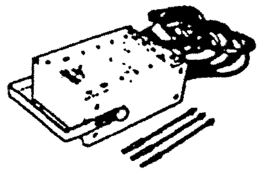

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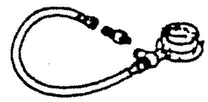

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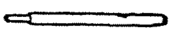

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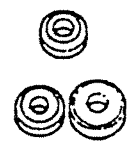

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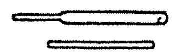

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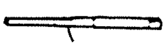

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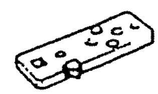

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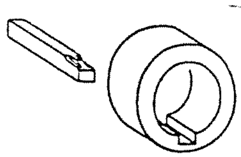

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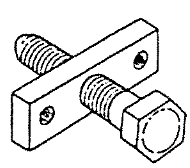

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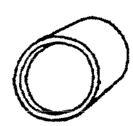


20

ENGINE FAULT-TRACING CHART

ENGINE WILL NOT START

POSSIBLE FAULT	REMEDY
1. Fuel tank empty	Refill tank.
2. Fuel pump not functioning	Install new pump.
3. In-line filter clogged	Install new filter.
4. Water or impurities in fuel system	Clean out fuel pump, carburetors, fuel tank and fuel pipelines. Refill tank with fresh fuel.
5. Blockage in fuel pipeline	Disconnect and clear.
6. Carburetor setting fault	Adjust carburetor.
7. Carburetor flooding	
a) Over-choked	Release choke, turn engine over with the throttle wide open.
b) Needle-valve sticking	Remove and clean needle-valve.
8. Carburetor air vent blocked	Clean vent hole.
9. Insufficient choke	Check and correct.
10. Throttle open too wide	Check and close.
11. Faulty speak plugs	Install new plugs.
12. Plug leads loose, broken or poorly-fitted.	Examine leads, if necessary, replace leads.
13. Fuel pipe incorrectly-fitted	Check and rectify.
14. Fuel pipe twisted or trapped	Check and reposition.
15. Position of plug leads incorrect	Refit leads correctly.
16. Ignition not switched ON	Switch ignition ON.
17. Quick-release fuel connector disconnected.	Reconnect connector

ENGINE MISSES AT LOW SPEEDS ONLY

POSSIBLE FAULT	REMEDY
1 Air leaks in system.	Check Joints between:
	a) Cylinder head-and-intake manifold.
	b) Carburetor-and-intake manifold.
2. Carburetor setting faulty.	Adjust carburetor.
3. Valve not seating properly due to:	
a) Incorrect valve clearance	Check and adjust.
b) Burnt or bent valve(s)	Remove cylinder head and replace parts.

ENGINE MISSES AT ALL SPEEDS

POSSIBLE FAULT	REMEDY
1. Carburetor flooding	a) Remove and clean needle valve.
	b) Check float is not punctured or damaged.
2. Faulty spark plugs	Remove, clean and set plug points and, if needed install new plugs.
3. Plug lead(s) loose or damaged	Examine and, if necessary, install new plugs.
4. Plug lead(s) insulation Faulty	Replace leads.
5. Faulty valve operation due to:	
a) Broken votive spring	Examine and replace detective parts.
b) Valve sticking in guide	Check and clean valve
c) Incorrect valve dentifrice	Check and adjust.
d) Bent valve(s)	Remove cylinder head and install new valve(s).
6. Weak mixture due to:	
Fuel filter being partially-blocked.	Replace filter.

ENGINE MISSES AT HIGH SPEEDS ONLY

POSSIBLE FAULT	REMEDY
1 Faulty spark plugs, or incorrect electrodes gap.	Remove, clean and set plug-electrodes gap and, if necessary, install new plugs.
2. Faulty valve operation due to:	
a) Incorrect valve clearance.	Check and adjust.
b) Valve sticking in guide.	Examine and replace detective parts.
c) Bent or badly-fitting valve*.	

*Defective valve(s) indicated by:

Popping or spitting in the carburetor - inlet; 'banging' in the exhaust silencer, examine and replace defective parts.

ENGINE LACKS POWER

POSSIBLE FAULT	REMEDY
1. Water supply low in engine cooling system.	Refill and check all coolant hoses and clips for safety.
2. Air leaks in induction system.	Check the Joints between: a) The cylinder head-and-intake manifold. b) The carburetor-and-intake manifold. If necessary, install new, joints/tighten nuts.
3. Carburetor(s) setting faulty.	Adjust carburetor(s).
4. Choke in "rich" position.	Return choke-control to correct position.
5. Defective heat exchanger.	a) Clear blockage (back-flush). b) Install new heat exchanger.
6. Oil diluted or of incorrect grade.	Drain the oil system and refill with the correct grade of oil.
7. Faulty thermostat	Test thermostat - replace if necessary.

DIFFICULT STARTING

POSSIBLE FAULT	REMEDY
1. Weak spark due to:	
a) Faulty spark plugs.	Install new spark plugs.
b) Wet or fouled spark plugs.	Clean or replace.
2. Low compression	Check for: a) Correct valve clearance. b) Loose cylinder head. c) Blown cylinder-head gasket. d) Loose spark plug(s). e) Damaged or burnt valves. f) Worn piston rings. g) Worn cylinder heads.

ENGINE RUNS HOT

POSSIBLE FAULT	REMEDY
1. Water level low in cooling system	Refill and check all coolant hoses and clips for safety.
2. Air leaks in induction system.	Check the joints between: a) The cylinder head-and-intake manifold b) The carburetor-and-Intake manifold. If necessary, install new joints/tighten nuts.
3. Carburetor(s) setting faulty.	Adjust carburetor(s).
4. Choke in rich position	Return choke-control to correct position.
5. Defective heat exchanger or oil cooler.	a) Clear blockage (back -flush). b) Install new heat exchanger or oil cooler.
6. Oil diluted or of incorrect grade.	Drain oil system and refill with correct grade of oil.
7. Faulty thermostat.	Test thermostat - replace if necessary.
8. Insufficient differential pressure in system.	Increase pump pressure to minimum raw water 43.5 PSI differential.
9. Blocked strainer in raw water feed	Remove strainer and clean. from manifold.

PUMP FAULT-TRACING CHART

DEFECT	REMEDY
HIGH VACUUM GAUGE READING RELATIVE TO SUCTION LIFT	
Suction strainer choked.	Remove and clean.
FAILURE TO LIFT OR HOLD WATER	
1. Suction-hose joints leaking.	Check and tighten.
2. Suction strainer not completely immersed.	Check and submerge.
3. Defective exhaust primer.	Check and rectify.
4. Leaking priming valve.	Check and rectify.
5. Discharge valve leaking.	Check and rectify.
BROKEN JETS WITH 'AIR CRACKLE'	
1. Suction strainer: a) Not completely immersed. b) Too near the surface of the water supply.	Check and submerge.
2. Slight leaks on suction side of pump.	Check joints and tighten nuts.
THERMAL RELIEF VALVE ACTUATES	
1. Pump water overheating.	Avoid prolonged pumping with closed nozzles.

If the remedies presented here do not clear the fault, then proceed with the MONTHLY PUMP TEST as previously described.

HP550
PORTABLE FIRE PUMP
SPARE PARTS MANUAL

Please Note:

RECOMMENDED SPARES

Thank you for choosing a HALE Fire Pump - designed and built to provide many years of trouble-free service.

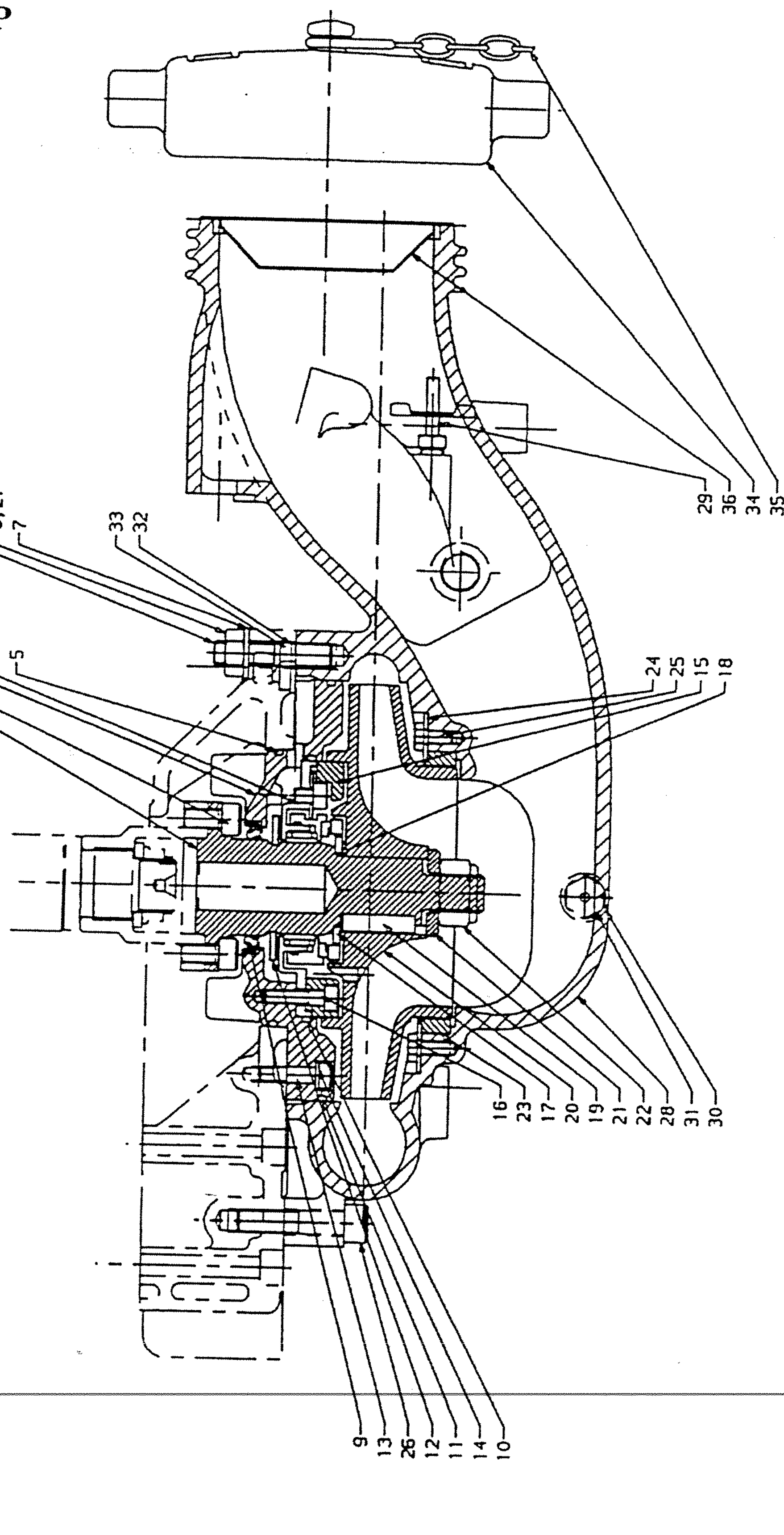
While we consider it to be the very best fire pump available today, we also recognize that any 'rotating' machinery is subject to wear and therefore we feel it necessary to bring to your attention our 2-years' Recommended Spares Listing - at the back of Part A for the PUMP and at the back of Part B for the ENGINE - in this book.

This stock-holding will enable you to maintain your pump in cases where minor defects occur and will also minimize any possibility of the pump being 'out of service' for extended periods of time.

HOW TO USE THE SPARE PARTS LIST

Select the appropriate group for the part required e.g. 'EXHAUST GAS EJECTOR'. Refer to the illustration to identify the particular part and note the 'Item No.' - this can be found in the parts list opposite - along with the appropriate 'Part No.', 'Description' and Quantity ('Qty') to enable an order to be correctly-placed.

PUMP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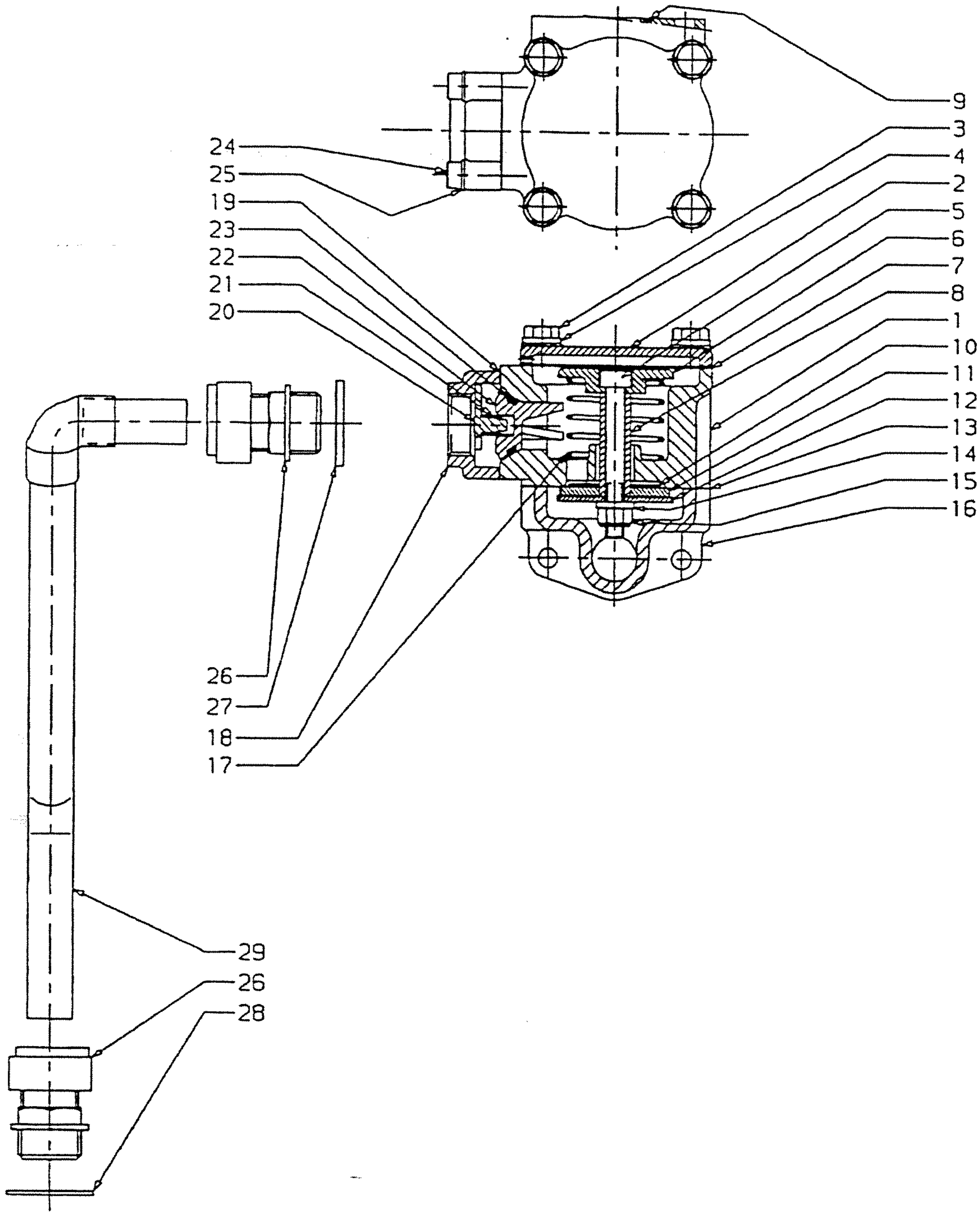
PUMP

Item No.	Part No.	Description	Qty	Remarks
1	55823/01	Pump drive shaft	1	
2	MS64/16	Screw M8, socket-head	6	
3	55697	Seal housing	1	
4	55824/01	Carbon seal assembly	1	
5	55831	'O' Ring	1	
6	MS149/35	Stud M10	5	Volute
7	MS25/10	Washer M10	5	-to-
8	MS35/9	Nut M10	4	adapter housing
9	56183	Seal, double lip	1	
10	55830	'O' Ring	1	
11	55832	'O' Ring	1	
12	55825	Flinger ring	1	
13	MS163/25	Screw M6, socket -head	4	
14	MS133/6	Dowty seal	4	
15	56091	Upper wear ring	1	
16	MS163/25	Screw M6, socket-head	4	
17	55826	Spacer ring	1	
18	52814	'O' ring	1	
19	MS180/3	Key	1	Impeller-to-shaft
20	55735/01	Impeller	1	
21	56187	Washer, impeller	1	
22	MS41/8	Nut MI 6, self-locking	1	
23	56070/01	Lower wear ring	1	
24	56182	Washer	2	Wear ring -
25	MS104/12	Screw M6	2	retaining.
26	MS65/45	Screw M10, socket-head	1	Volute-to-
27	56499	Extended nut M10	1	adapter housing
28	55696	Volute 4" R.T.	1	
-	55696/02	Volute 4 1/2" B.S.P.	1	
29	52119	Drain tap, volute 1		
30	UFP2303/5	Sealing washer 1/4m. BSP.	1	Plug
31	S64/2	Plug 1/4" BSP	1	
32	UFP2303/5	Sealing washer 1/4" BSP	1	Union
33	56403	Union 1/4" BSP	1	
34	FWP2004	Blank cap (4" R.T.)	1	
35	FWP 1062	Chain, blank cap	1	
36	52125/01	Suction strainer 4"	1	

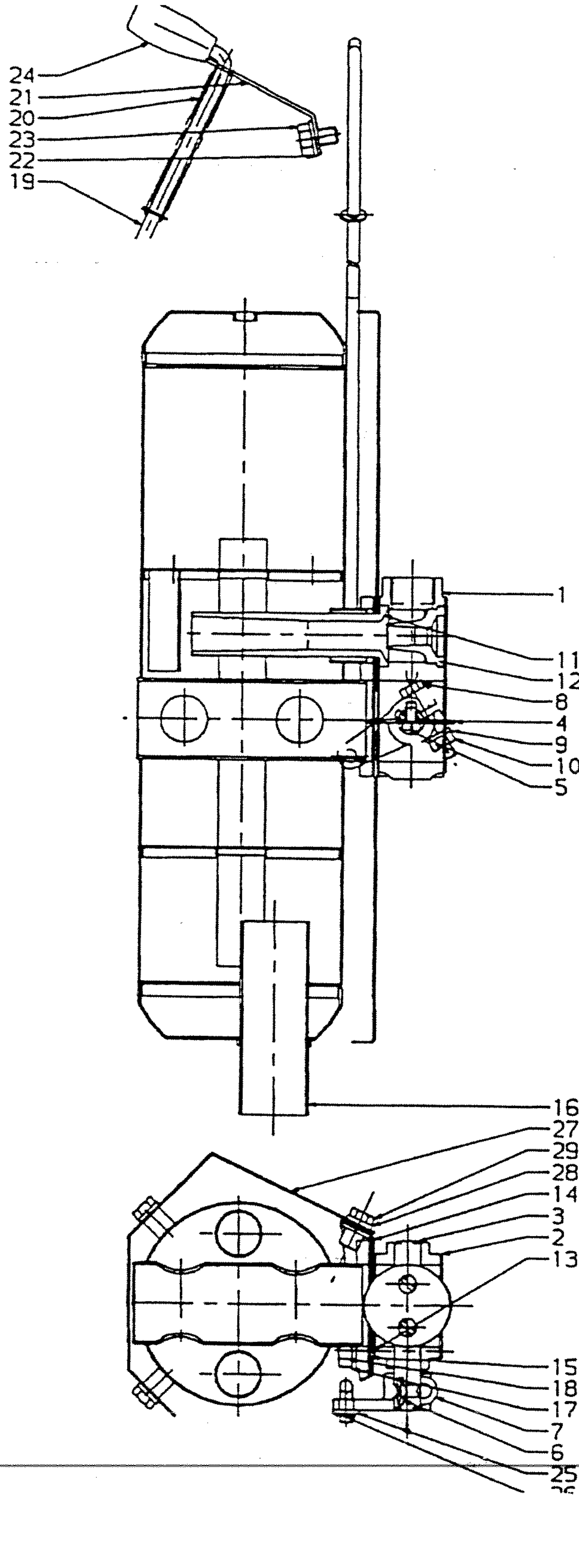
PRIMING VALVE



PRIMING VALVE

Item No	Part No.	Description	Qty	Remarks
-	56125	Priming valve assembly	1	
1	56119	Body	1	
2	56120	Diaphragm cover	1	
3	MS16/60	Bolt M6	4	Diaphragm cover-to-
4	MS25/7	Washer M6	4	priming valve assembly
5	MS163/50	Screw,socket head	1	
6	55666	Thrust rod	1	
7	56123	Diaphragm	1	
8	55665	Spacer	1	Between thrust pad and seal-support washer
9	56128	'O' ring	1	Between outlet valve & priming-valve body
10	55668	Seal retaining washer	1	
11	55669	Seal washer	1	
12	55670	Seal-support washer	1	
13	56124	Inlet gasket	1	Inlet housing-to-priming valve body
14	MS125/7	Washer M6	1	For
15	MS141/4	Nut M6,self-locking	1	seal support
16	56121	Inlethousing	1	
17	UMP9811	Spring	1	Between thrust pad and priming-valve body
18	56122	Outlet housing	1	
19	56127	Outlet gasket	1	Outlet housing-to-priming valve body
20	56378	Spring locator	1	
21	THC2198	Spring	1	Over Item 20
22	THC2194	Valve	1	
23	THA123/118	'O'ring	1	
24	MS62/20	Screw M5, sockethead	4	Outlet housing-to-
25	MS25/6	Washer M5	41	priming valve body
26	55873	Straight coupler assembly	2	
27	UFP2303/8	Sealing washer 1/2" BSP	1	
28	S41/10	Sealing washer (copper)	1	
29	55829	Priming pipe	1	
-	MS04/20	Screw M6	21	Priming valve-to-
-	MS25/7	Washer M6	2	suction tube

EXHAUST GAS EJECTOR



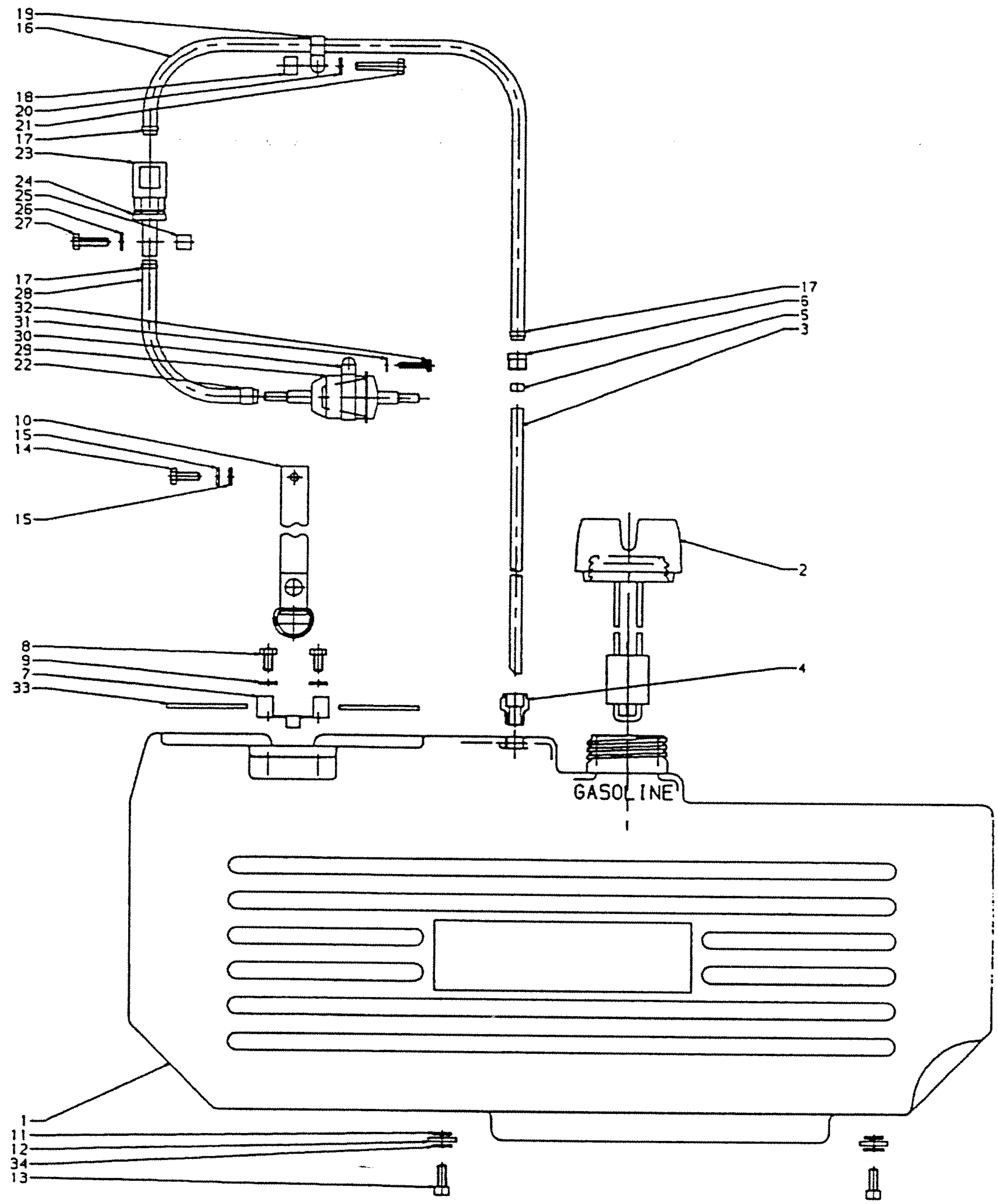
EXHAUST GAS EJECTOR

Item No.	Part No.	Description	Qty	Remarks
1	55737/01	Primer ejector housing	1	
2	55844	Gasket	1	Exhaust flange
3	GPR11743/1	Shaft, butterfly	1	
4	GPR11742	Butterfly valve	1	
5	MS171/48	Screw M5, cheese head	2	Volute-to-shaft
6	S25/3	Woodruff key	1	
7	FWMB 1160/3	Operating lever	1	Butterfly shaft
8	MS16/35	Bolt M6	1	Operating lever-
9	MS25/7	Washer M6	1	to-
10	MS35/7	Nut M6	1	shaft
11	55738	Primer ejector diffuser	1	
12	FWP1098/3	Ejector nozzle	1	
13	55844	Gasket	1	Ejector-to-heat shield
14	56174	Inner heat shield	1	
15	55844	Gasket	1	Heat shield-to-silencer
16	55739/01	Silencer	1	
17	MS25/9	Washer M8	4	Silencer -
18	MS35/8	Nut M8	4	to-ejector
19	55846	Primer operating rod	1	
20	GPR 11745	Compression spring	1	Primer rod return
21	56207	Guide brackets	1	Primer rod
22	MS25/9	Washer M8	1	Bracket-to-
23	MS05/12	Screw M8	1	discharge-manifold
24	52855	Handle	1	
25	MS27/3	Washer M6	1	
26	S31/C5	Split pin	1	
27	56173	outer heat shield	1	
28	MS127/3	Washer M6	8	Heat shields-
29	MS104/10	Screw M6	8	to-silencer
30	55177/01	Taper Plug	1	

COOLING SYSTEM

Item No.	Part No.	Description	Qty	Remarks
1	55752	Header tank	1	
2	56341/01	Clamp washer	3	
3	MS/127/3	Washer M6	3	
4	MS116/40	Screw M6	3	
5	56191	Filler cap, coolant	1	
6	55800/70	Starter rope	1	
7	MS82/5	Hose clip, 25-40mm range	1	Not shown
8	56096	Threaded cap, rope compartment	1	
9	55755/02	'O' ring	1	Header tank-to-heat exchanger
10	55753/05	Heat exchanger	1	
11	56168/01	Oil cooler	1	
12	56170	'O' ring, oil cooler	1	
13	MS63/16	Screw M6, socket head	1	
14	MS25/7	Washer M6	1	
15	UFP2303/7	Sealing washer 3/8" BSP	1	
16	55739/01	Restrictor Assembly	1	
17	51171	Tubing nut	4	
18	51170	Sleeve	4	
19	56221/03	Nylon tubing 12mm dia x .33mm	1	
20	56491	Formed tube .230mm	1	
21	56491/01	Formed tube .235mm	6	
22	56284	Elbow adapter	6	12mm to 3/8" BSP
23	56000	Elbow 15 mm to 3/8" BSP	1	
24	56309	Tee-piece assembly	1	
25	52119	Drain tap, volute	1	
26	56307	Hose, silicone rubber 15mm	1	
27	56306	Hose, silicone rubber 22mm	1	
28	MS82/3	Hose clip 20-32mm range	2	
29	56308	Pipe, swaged 15mm dia.	1	
30	55535	Tube nut 15mm dia.	1	
31	55536	Tubing sleeve 15mm dia.	1	

FUEL TANK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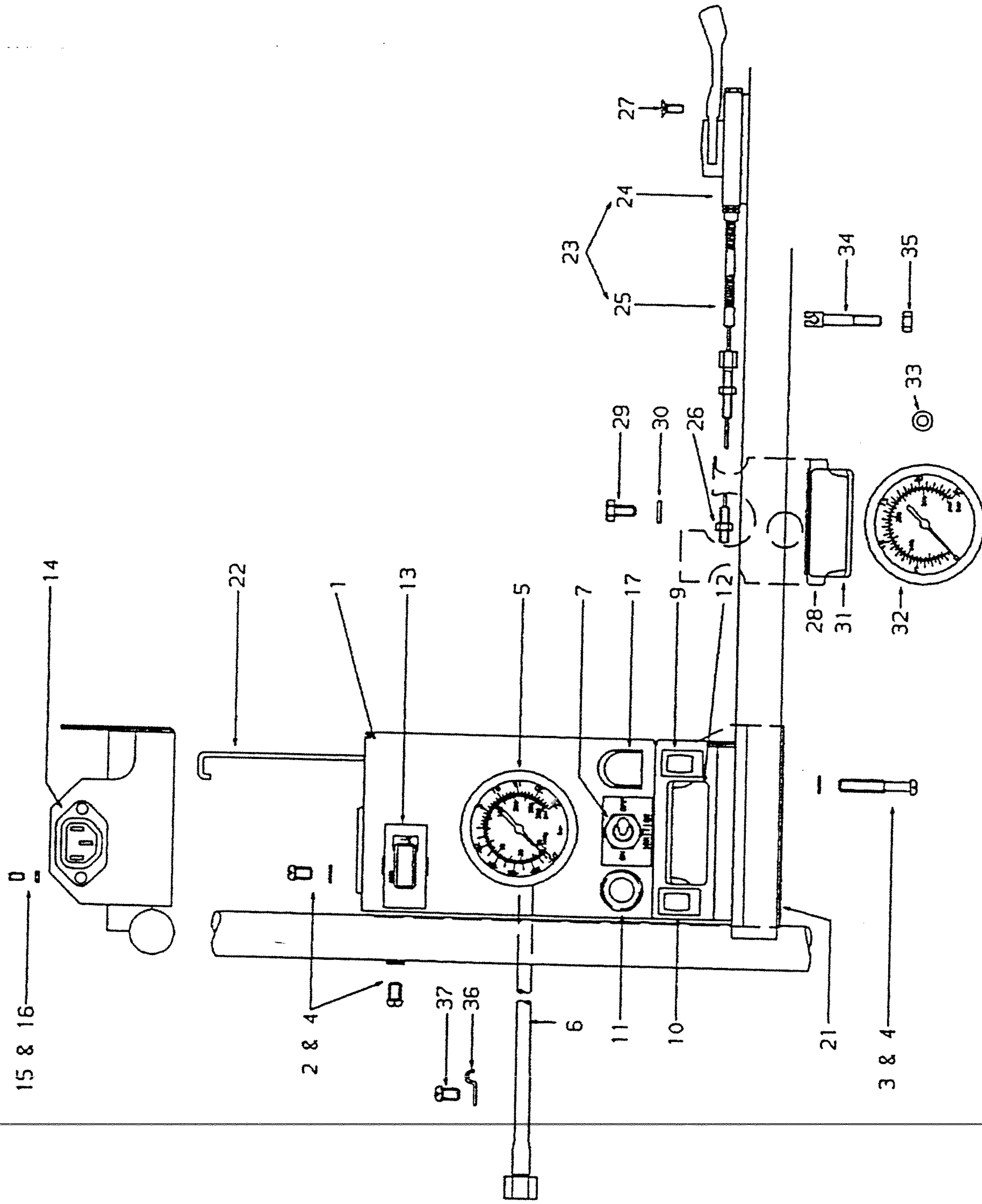
GASOLINE

FUEL TANK

Item No.	Part No.	Description	Qty	Remarks
1	55757	Fuel tank	1	
2	55881	Fuel gauge	1	
3	56531	Fuel suction pipe	1	
4	56532	Male adapter	1	
5	52799	Tubing sleeve 8mm	1	
6	GPNI2353	Tubing nut 8mm	1	
7	56142	Retaining bracket, battery	1	
8	MS04/12	Screw M6	2	Bracket-to-
9	MS25/7	Washer M6	2	tank
10	11796/03	Retaining strap, battery	1	
11	MS127/3	Washer M6	4	
12	56224/01	Rubber washer	4	
13	MS163/16	Screw M6, socket-head	4	
14	MS04/16	Screw M6	11	Battery strap-to-
15	MS27/3	Washer M6	2	fuel tank
16	56518	Fuel pipe	1	
17	9993	Tie, nylon insulated	3	
18	56167/01	Spacer	1	
19	53708/04	Clip, conduit	1	
20	MS25/7	Washer M6	1	
21	MS16/30	Bolt	1	
22	MS81/1	Hose clip	2	
23	55800/51	Connector A, fuel hose	1	
24	55800/50	Connector B, fuel hose	1	
25	55800/52	Collar 6mm	1	In Connector B
26	MS25/7	Washer M6	1	
27	MS04/20	Screw M6	1	
28	56518/01	Fuel pipe	1	
29	56088	Fuel filter, in-line	1	
30	56089	Clip, fuel filter	1	
31	MS25/4	Washer M4	11	Fuel-filter clip,
32	MS02/20	Screw M4	1	fuel pump
33	56539	Self-adhesive foam	2	
34	MS127/3	Washer M6 - large, heavy	4	

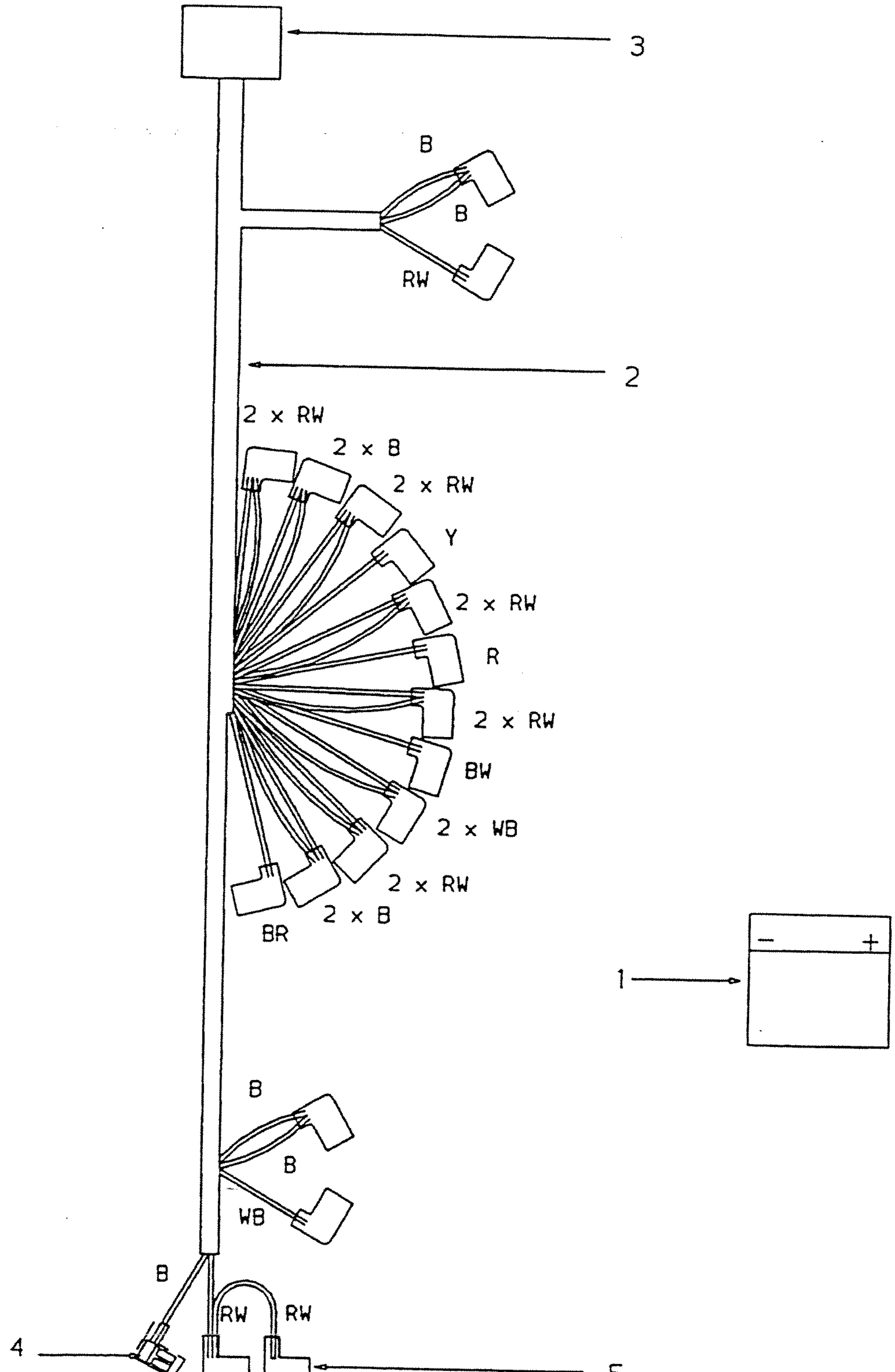
INSTRUMENTS AND CONTROLS



INSTRUMENTS AND CONTROLS

Item No.	Part No.	Description	Qty	Remarks
1	55911105	Instrument panel	1	
2	MS171/48	Screw M5, cheese-head	3	Instrument panel-
3	MS171/55	Screw M5, cheese-head	2	to-
4	MS125/6	Washer M5	5	cradle
5	56556	Compound gauge	1	
6	55891	Gauge-pipe assembly	1	
7	56342	Ignition switch	1	
8	FWMP7522	Seal, ignition switch	1	Not shown
9	56361	Warning lamp, oil pressure	1	
10	56361/01	Warning lamp, coolant temperature	1	
11	56362/01	Starter switch, push-button	1	
12	51599	Panel lamp, gauge illumination	1	
13	55871/01	Hours meter	1	
14	51594	Socket floodlight/battery-charging	1	
15	MS72/30	Screw M3, countersunk	2	
16	MS35/4	Nut M3	2	
17	55800/40	Choke knob	1	
18	55800/41	Guide, choke knob	1	Not shown
19	56040	Open grommet	1	Not shown
20	56041	'O' ring	1	Not shown
21	56245	Guard	1	
22	56112	Choke-operating rod	1	
23	56118	Throttle-cable assembly	1	Comprises Items
24	53670/03	Throttle control	1	
25	56117	Throttle-cable sub-assembly	1	
26	MS135/6	Nut M5	1	
27	MS172/49	Screw M5, countersunk	2	
28	55892/01	Illuminating-lamp bracket	1	
29	MS25/7	Washer M6	1	Bracket-to-
30	MS04/12	Screw M6	1	engine
31	51599	Illuminating-lamp, pressure gauge	1	
32	56557	Pressure gauge 0-25 bar	1	
33	50470	Washer	1	
34	56115	Cable anchor	1	Throttle cable
35	MS35/7	Nut M6	1	
36	56572	Tubing Clip	1	
37	MS171/48	Screw M5, cheese head	1	

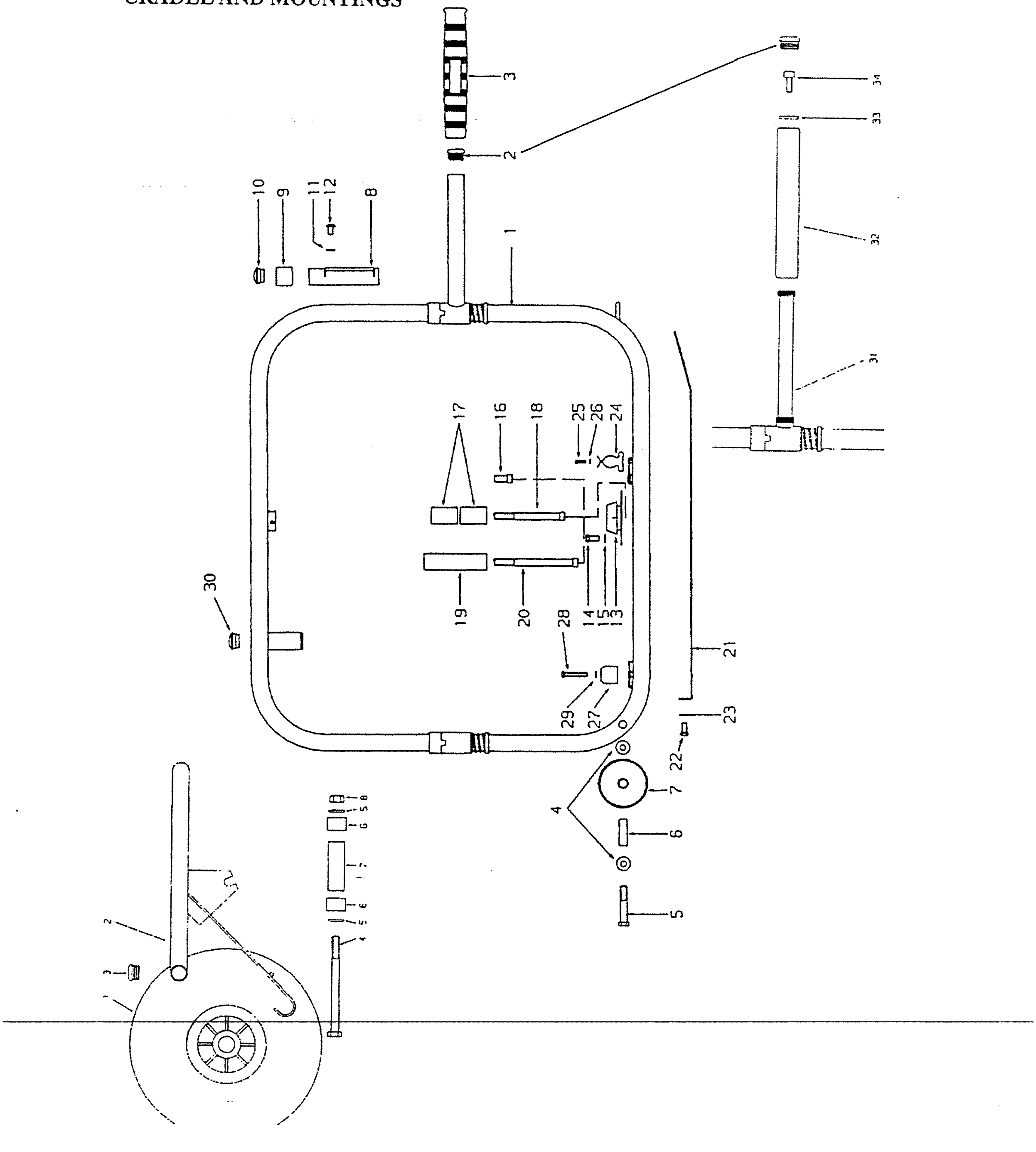
ELECTRICS - PUMP



ELECTRICS - PUMP

Item No.	Part No.	Description	Qty	Remarks
1	53627	Battery 18 Amp/hr	1	
2	55890/01	Wiring harness	1	
3	55800/62	Multi-pin plug	1	
-	56461	Loose pins	14	
-	56485	Terminal seal	6	Multi-pin plug
-	56486	Blanking plug	8	
4	56903	Flag Terminal	3	
5	56904	Terminal sleeve	3	

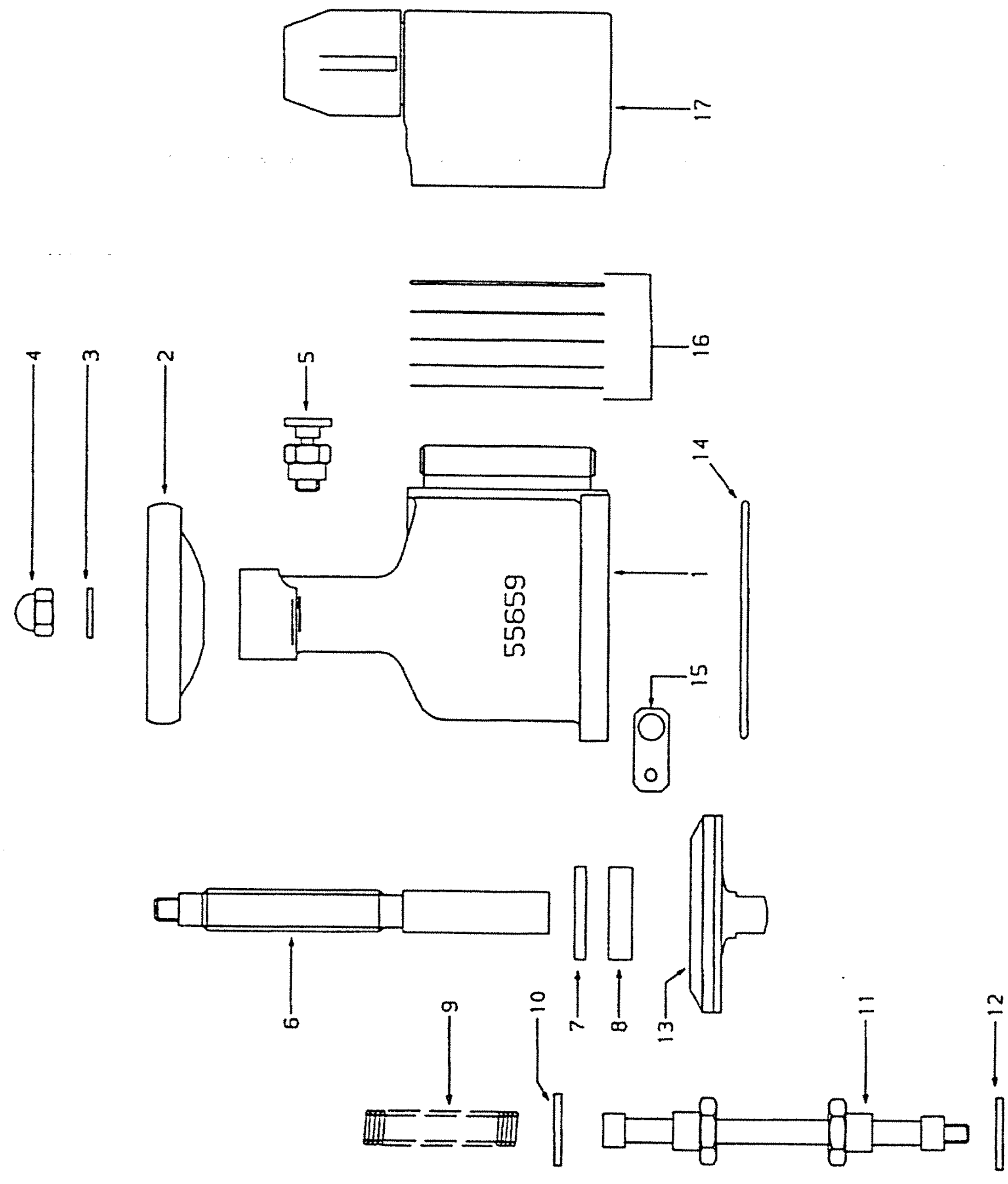
CRADLE AND MOUNTINGS



CRADLE AND MOUNTINGS

Item No.	Part No.	Description	Qty	Remarks
1	55689/02	Cradle	1	
2	50471/01	Blanking plug, handle	4	
3	50096	Grip, handle	4	
4	MS127/4	Washer M8	4	
5	MS117/55	Bolt M8	2	
6	55368/01	Wheel axle	1	
7	55370	Wheel, nylon	2	
8	56029	Cross member	1	
9	56030	Conduit bush, P.V.C.	1	Flood lamp support
10	56031/01	End plug	1	
11	MS125/7	Washer M6	4	Flood lamp-support
12	MS170/40	Screw M6, pan-head	4	cross member
13	56490	Anti-vibration mount	4	Mountings
14	MS104/16	Screw M6, hex-head	8	Mountings
15	MS125/7	Washer M6	8	Mountings
16	MS64/20	Screw M8, socket-head	2	Mountings
17	55854/01	Insulator	2	Mountings
18	MS64/100	Screw M8, socket-head	1	Mountings
19	56492	Spacer	1	Mountings
20	MS64/120	Screw M8, socket-head	1	Mountings
21	56422	Skid plate	1	
22	MS104/16	Screw M6, hex-head	4	
23	MS125/7	Washer M6	4	
24	56190	Clip	2	Secures
25	MS160/12	Screw M3, socket-head	2	suction
26	MS125/2	Washer M3	2	blank
27	56220	Wrench locator	2	cap
28	MS103/35	Screw M5	2	wrenches
29	MS125/6	Washer M5	2	to cradle
30	50471/02	Blanking Plug	1	
(Optional Extending Handles Unit)				
31	55689/03	Cradle	1	
32	56967	Handle - outer	4	
33	56969	Handle retainer	4	
34	MS64/20	Screw M8, socket-head	4	
Wheelbarrow Assembly - 56582				
1	56586	Wheel	1	
2	56583	Wheel frame	1	
3	50471/01	Blanking plug	2	
4	MS19/150	Bolt M 12, hex-head	1	
5	MS25/11	Washer MI 2	2	
6	56585	Spacer	2	
7	56584	Axle	1	
8	MS41/7	Nut M12, Nylon	1	

DISCHARGE VALVES



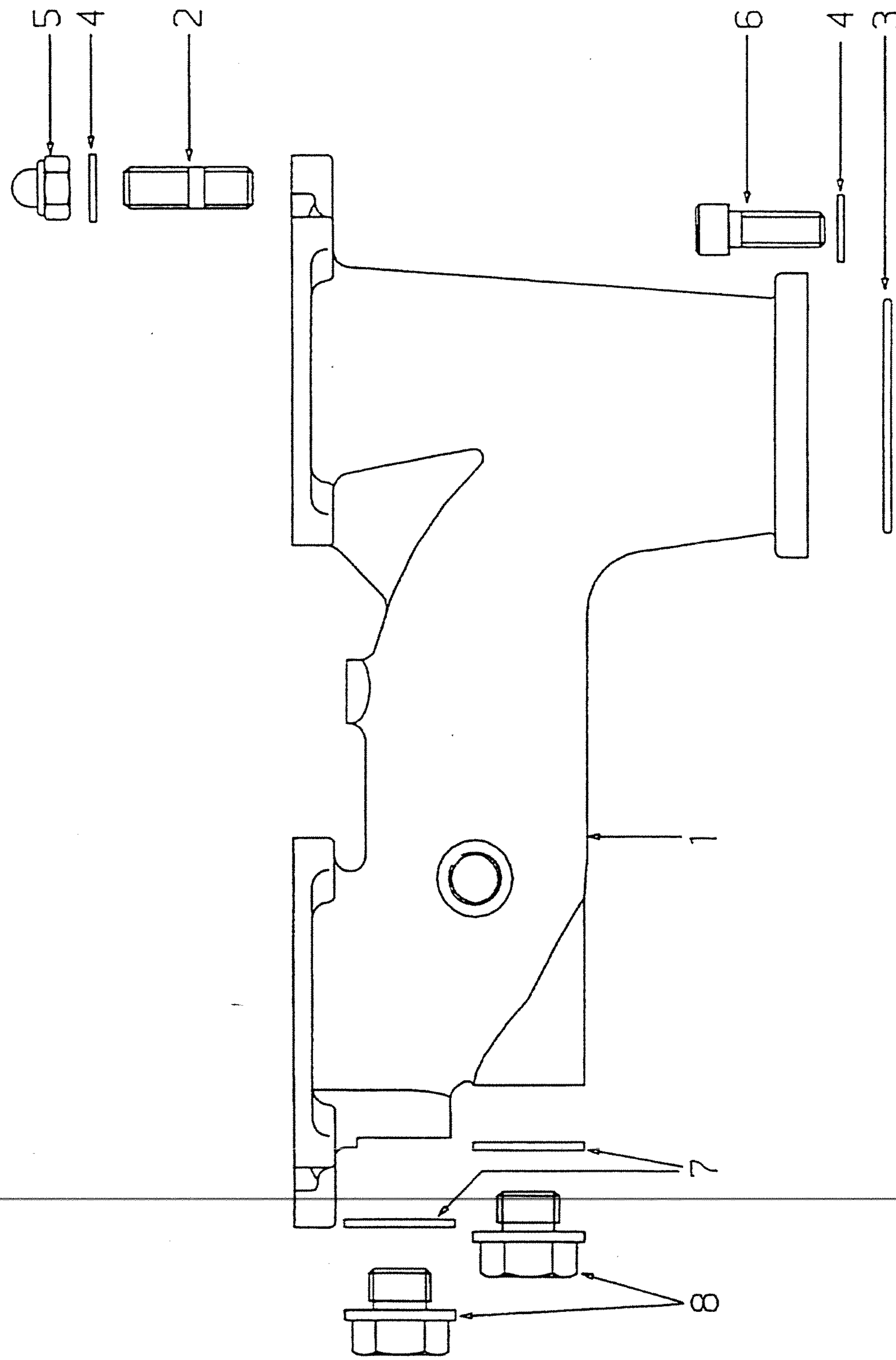
DISCHARGE VALVES

Item No.	Part No.	Description	Qty	Remarks
-	55662	Discharge valve assembly 2.5 I n. B S P		Comprises Items 1- 13 (1 per valve)
1	56469/01	Valve body		
2	56469/11	Hand wheel	1	
3	56469/12	Washer M 10	1	
4	56469/13	Nut, domed M 10	1	
5	56469/10*	Lock	1	For- hose-draining
6	56469/02	Spindle	1	
7	56469/03	Support ring	1	
8	56469/04*	Seal	1	
9	56469/09*	Spring	1	
10	56469/06	Safety lock	1	
11	56469/05	Stem assembly	1	
12	56469/08	Safety lock	1	
13	56469/07*	Plate	1	
14	54051*	'O'ring, valve-to-volute	2	
15	GPR11759/1	Anchor, blank-cap chain	1	
16	SATHM10722	Shim pack		
17	56559	Instantaneous connector 2 1/2"		

* These are available in discharge valve seal kit

56940/01	Seal kit - Continental discharge valve (Alum)
56940/02	Seal kit - Continental discharge valve (GM)
56940/03	Seal kit - Instantaneous connector (Cont'l & BV)

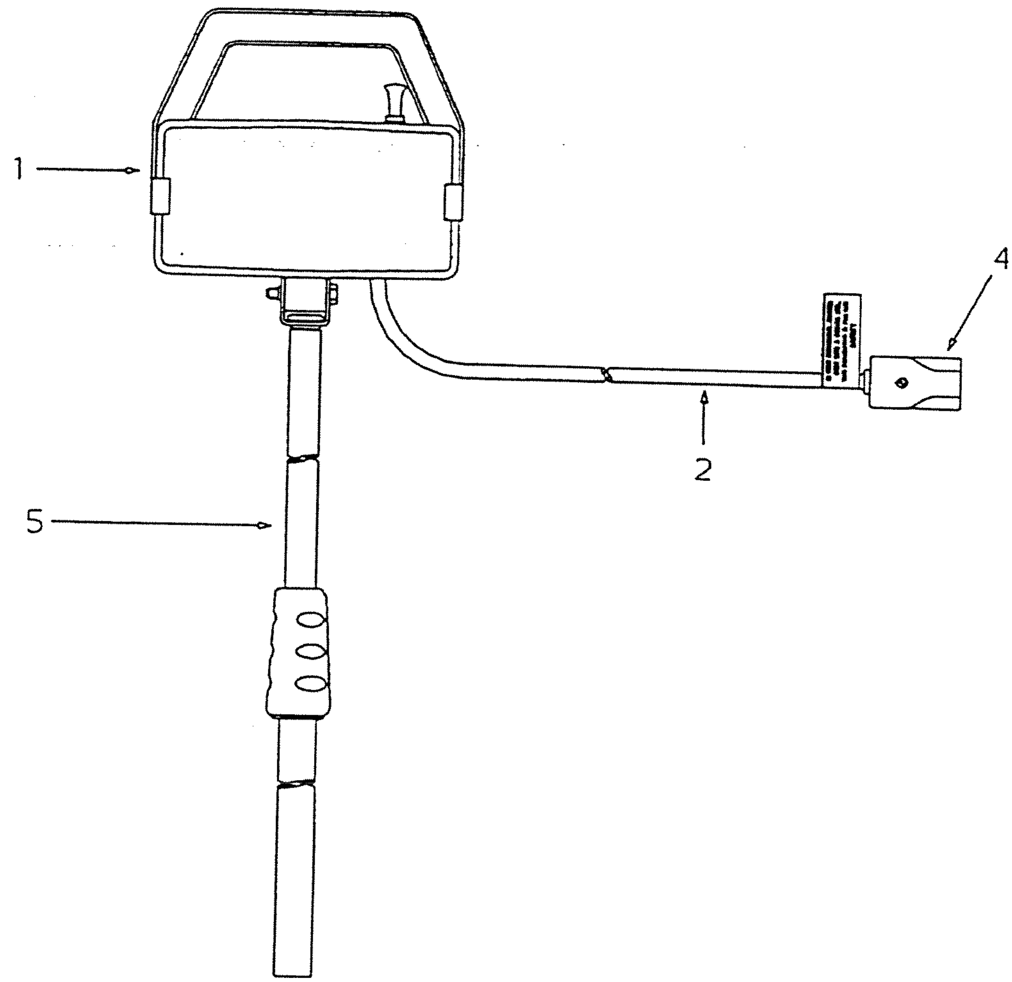
DISCHARGE MANIFOLD

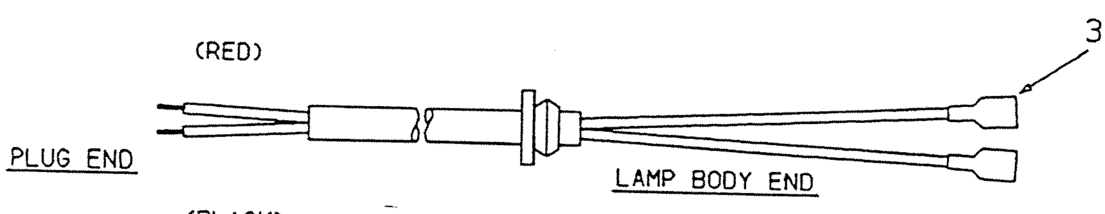


DISCHARGE MANIFOLD

Item No.	Part No.	Description	Qty	Remarks
1	55731	Discharge manifold	1	
2	MS49/25	Stud M 10	8	Discharge valves
3	55848	'O' ring	1	Manifold-to-volute
4	MS25/10	Washer M10	12	
5	MS42/5	Nut M10	8	Discharge-valve studs
6	MS165/30	Screw M10, socket-head	4	Manifold-to-volute
7	UFP2303/10	Sealing washer 3/4" BSP	1	
8	S64/6	Plug, shouldered 3/4" BSP	1	

FLOODLIGHT



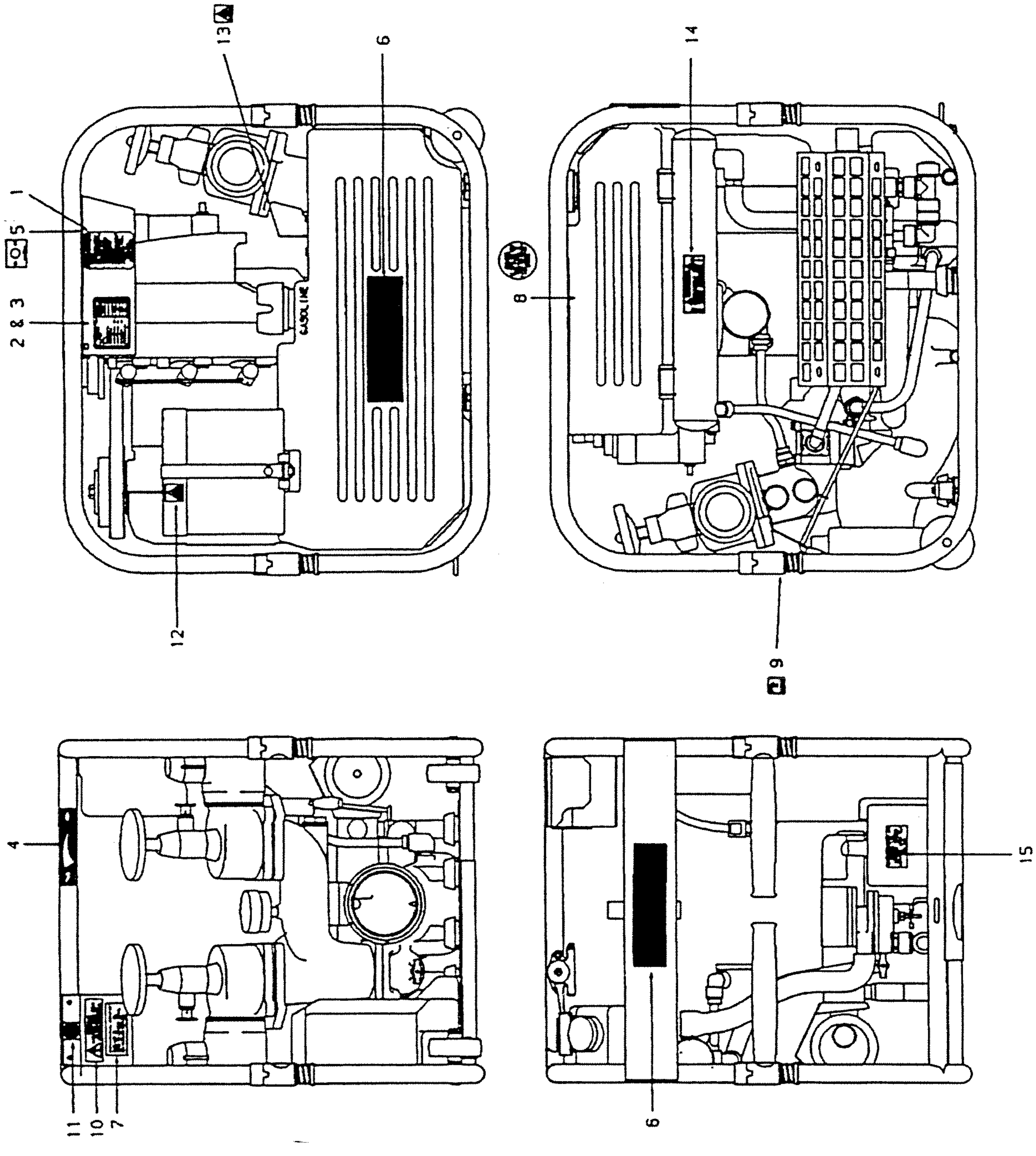


53644/02 CABLE DETAIL

FLOODLIGHT

Item No.	Part. No.	Description	Qty	Remarks
-	56504	Floodlight	1	(Optional)
1	536421	Floodlight	1	
2	53644/0-2	Cable, floodlight	1	
3	9535/2	Insulated terminal	3	
4	55682	Plug	1	
5	56505	Telescopic-stem assembly	1	

LABELS AND INSTRUCTION PLATES



LABELS AND INSTRUCTION PLATES

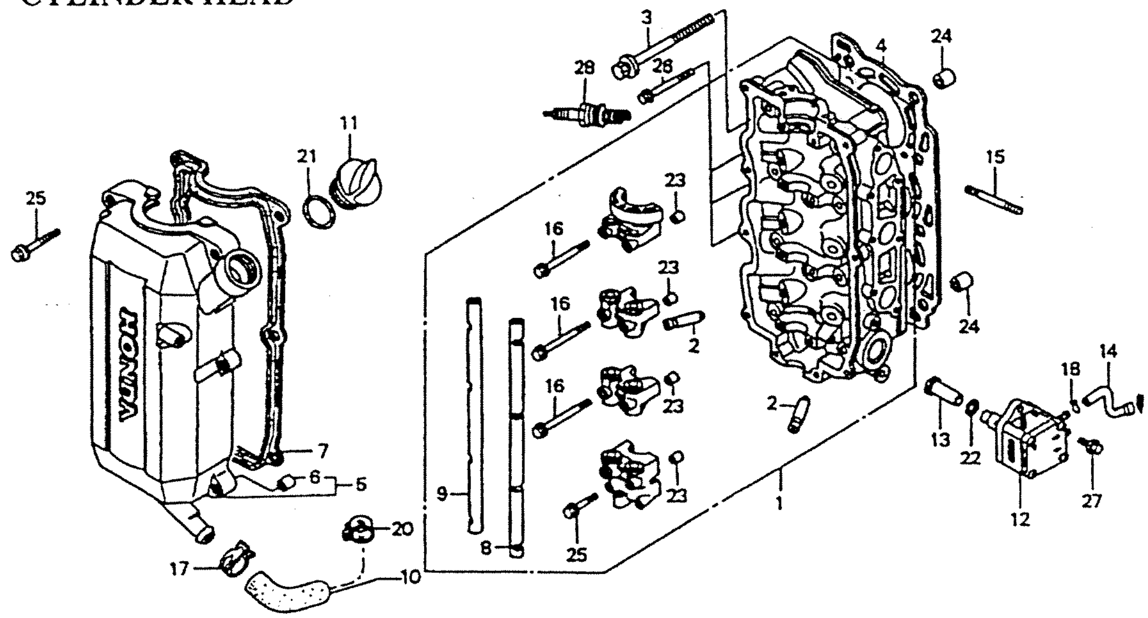
Item No.	Part No.	Description	Qty	Remarks
1	56267	Instruction Plate	1	
2	56268	Serial Number Plate	1	
3	DSM8135/1	Pop rivet	4	
4	56269	Instruction plate - Throttle	1	
5	56270	Instruction plate - Ignition	1	
6	53694	Nameplate, large	2	
7	56212	Weight decal	1	
8	56367/01	Warning plate, rope-start	1	
9	56483	Label - 'Pull To Prime'	1	
10	56587/04	Label - 'Trained Personnel'	1	
11	56587/03	Label - 'Earmuffs'	1	
12	56587/02	Label - 'Corrosive'	1	
13	56587/01	Label - 'Flammable'	1	
14	56587/05	Label - 'Hot Exhaust'	1	
15	51166	Label - 'Manufactured by'	1	
-	56871	Label - 'Differential Pressure'	1	Not Shown

RECOMMENDED SPARES - PUMP

Part No.	Description	Qty
55824/01	Carbon seal assembly	1
56183	Seal, seal housing-to-pump shaft	1
55825	Flange ring	1
55830	'O' ring, seal housing	1
55831	'O' ring, seal housing-to-adapter housing	1
55832	'O' ring, seal housing-	1
52814	'O' ring	1
MS41/8	Nut, self-locking, impeller-to-shaft	1
MS180/3	Key, impeller-to-shaft	1
UFP2303/5	Seating washer	2
MS133/6	Dowty seal, M8 screws	4
56070/01	Lower wear ring	1
56091	Upper wear ring	1
S41/10	Sealing washer (soft copper) coupling	2
56123	Diaphragm, priming valve	1
56128	'O' ring, priming valve	1
56124	Inlet gasket, priming valve	1
56127	Outlet gasket, priming valve	1
THA123/118	'O' ring, priming valve	1
THC2198	Spring, priming valve	1
55844	Gasket, exhaust-gas ejector	3
MS82/3	Hose clip	4
56307	Hose 15 mm (silicone-rubber)	1
56306	Hose 22 mm (silicone-rubber)	1
~~55755~~	~~'O' ring, heat exchanger-to-header tank~~	~~1~~
56088	Fuel filter	1
54051	'O' ring, discharge valve-to-volute	2

The company reserves the right to chance details of equipment and product specifications without prior notice as a part of its policy of continuous improvement.

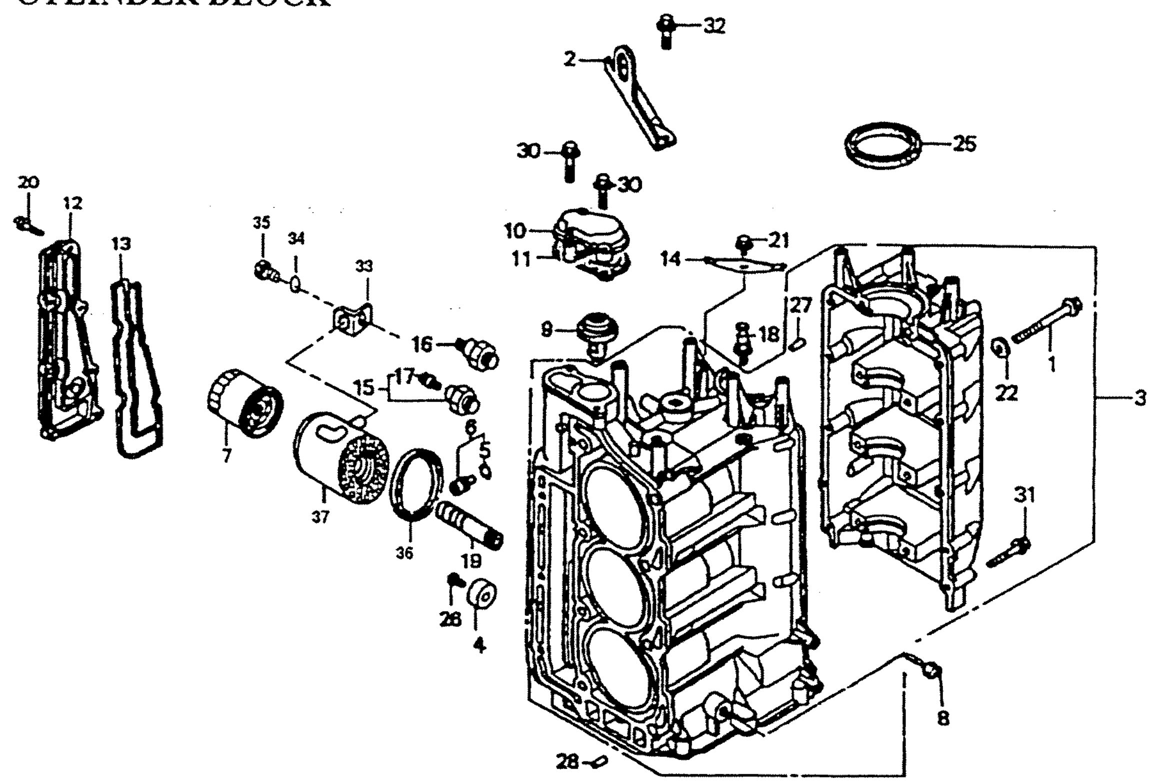
CYLINDER HEAD



CYLINDER HEAD

Item No.	Part No.	Description	Qty	Remarks
1	56589	Cylinder head assembly	1	
2	56590	Valve guide (0.52 oversize)	6	
3	56591	Bolt M 10 x 85	8	
4	56592	Gasket, cylinder head	1	
5	56593	Cover, cylinder head	1	
6	56594	Collar, cover	1	
7	56595	Gasket, cover	1	
8	56596	Inlet rocker shaft	1	
9	56597	Exhaust rocker shaft	1	
10	56111	Oil-return hose	1	
11	56598	Oil filler cap	1	
12	56599	Fuel pump assembly	1	
13	56600	Lifter, Oil pump	1	
14	56601	Fuel tube '13'	1	
15	56602	Stud 6 x 28	2	
16	56603	Bolt 6 x 70	8	
17	55800/34	Clamp, oil-return hose	1	
18	56604	Clip, tube B 10	1	
19	56605	Clip, tube B 12	1	
20	55800/35	Clamp, oil-return hose	1	
21	56606	'O' ring 26 x 2.7	1	
22	56607	'O' ring 20.8 x 2.4	1	
23	56608	Dowel pin 8 x 14	8	
24	55800/20	Dowel pin 6 x 10	2	
25	56609	Bolt 6 x 35	9	
26	56610	Bolt 8 x 40	3	
27	56611	Bolt 6 x20	2	
28	56612	Spark plug DR7 EA	3	Either
-	56613	Spark plug X22ESR-UND	3	type

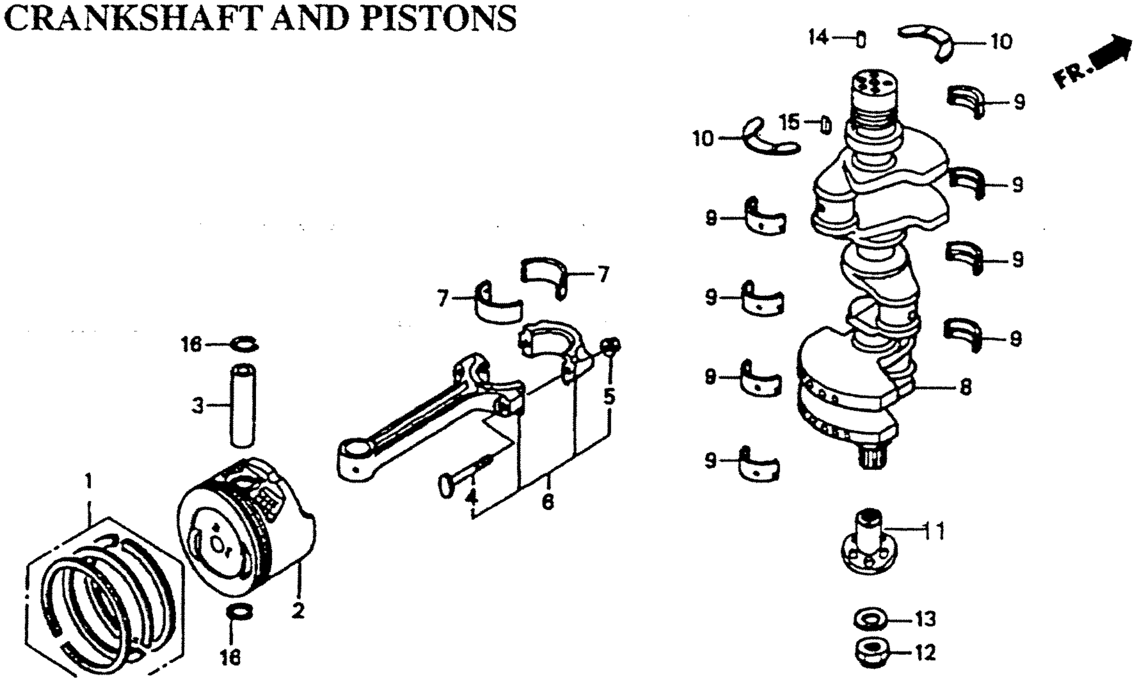
CYLINDER BLOCK



CYLINDER BLOCK

Item No.	Part No.	Description	Qty	Remarks
1	56614	Bolt 8 x 95	8	
2	56615	Engine hanger	1	
3	56616	Cylinder block	1	
4	56617	Sacrificial anode	1	
5	56618	'O' ring 4.8 x 1.9	1	
6	56619	Orifice assembly, oil	1	
7	55800/29	Oil filter cartridge	1	
8	S51/1	Plug, taper socket 1/8" BSP	1	
9	56620	Thermostat assy	1	
10	56621	Thermostat cover	1	
11	56622	Gasket, thermostat cover	1	
12	56623	Water jacket cover	1	
13	56624	Gasket, water jacket cover	1	
14	56625	Cord holder	1	
15	56626	Oil pressure switch	1	
16	56627	Switch assembly, thermostat	1	
17	56628	Screw, oil pressure switch 4 x 8	1	
18	56629	Anchor, turning-belt adjuster spring	1	
19	56169	Hollow stud, oil filter and cooler	1	
20	56630	Bolt, water jacket 6 x 22	7	
21	56631	Bolt, cord holder 6 x 12	1	
22	56612	Washer M8	8	
23	Not Used	-	-	
24	Not Used	-	-	
25	56633	Oil seal 56 x 70 x 8	1	
26	56634	Screw, pan-head 6 x 18	1	
27	56635	Dowel pin 10 x 12	8	
28	56636	Pin A, dowel 12 x 16	2	
29	Not Used	-	-	
30	56611	Bolt 6 x 20	2	
31	56638	Bolt 6 x 40	10	
32	56637	Bolt 8 x 18	2	
33	56171/01	Anti-turn bracket, oil cooler	1	
34	MS25/7	Washer M6	1	
35	MS04/12	Screw M6	1	
36	56170	'O' ring, oil cooler	1	
37	56168/01	Oil cooler	1	

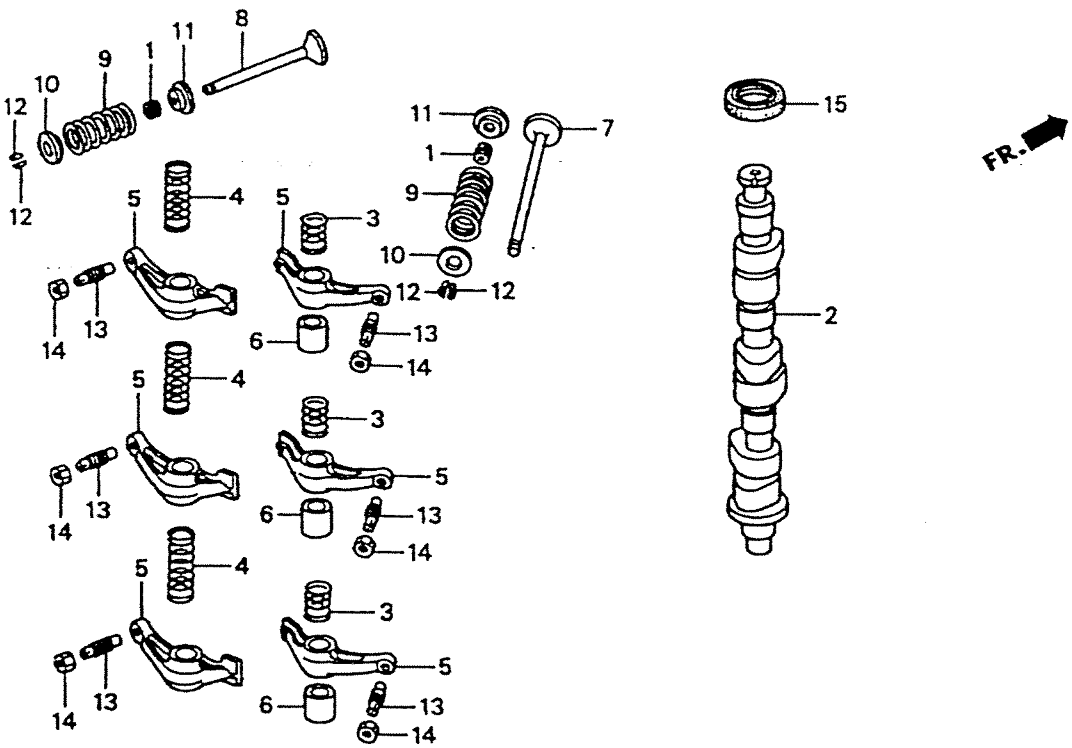
CRANKSHAFT AND PISTONS



CRANK SHAFT AND PISTONS

Item No.	Part No.	Description	Qty	Remarks
1	56639	Piston ring set (single piston)	3	
2	56640	Piston	3	
3	56641	Piston pin	3	
4	56642	Connection rod bolt	6	
5	56643	Connection rod nut	6	
6	56644	Connecting rod assembly	3	Includes Items 4 and 5
7	56645	Connecting rod bearing A (Blue)	6	See Reference Chart A
-	56646	Connecting rod bearing A (Blue)	6	See Reference Chart A
-	56647	Connecting rod bearing B (Black)	6	See Reference Chart A
-	56648	Connecting rod bearing B (Black)	6	See Reference Chart A
-	56649	Connecting rod bearing C (Brown)	6	See Reference Chart A
-	56650	Connecting rod bearing C (Brown)	6	See Reference Chart A
-	56651	Connecting rod bearing D (Green)	6	See Reference Chart A
-	56652	Connecting rod bearing D (Green)	6	See Reference Chart A
-	56653	Connecting rod bearing E (Yellow)	6	See Reference Chart A
-	56654	Connecting rod bearing E (Yellow)	6	See Reference Chart A
-	56655	Connecting rod bearing F (Pink)	6	See Reference Chart A
-	56656	Connecting rod bearing F (Pink)	6	See Reference Chart A
-	56657	Connecting rod bearing G (Red)	6	See Reference Chart A
-	56658	Connecting rod bearing G (Red)	6	See Reference Chart A
8	56659	Crankshaft	1	
9	56660	Main bearing A (Blue) (Daids)	8	See Reference Chart B
-	56661	Main bearing B (Black) (Daids)	8	See Reference Chart B
-	56662	Main bearing C (Brown) (Daids)	8	See Reference Chart B
-	56663	Main bearing D (Green) (Daids)	8	See Reference Chart B
-	56664	Main bearing E (Yellow) (Daids)	8	See Reference Chart B
-	56665	Main bearing F (Pink) (Daids)	8	See Reference Chart B
-	56666	Main bearing G (Red) (Daids)	8	See Reference Chart B
10	56667	Thrust washer	2	
11	55822	Pump-drive adapter	1	
12	55800/22	Nut M22	2	
13	55800/23	Washer M22	1	
14	56668	Dowel pin	1	
15	56669	Woodruff key 25 x 14	1	
16	56670	Clip, piston pin 18mm	6	

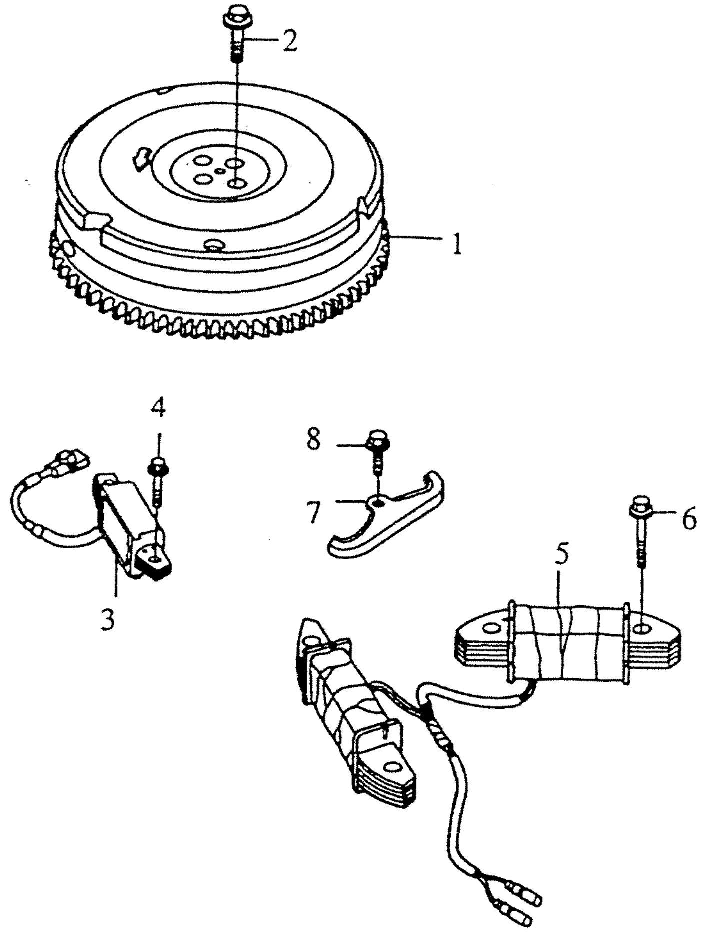
CAMSHAFT AND VALVE GEAR



CAMSHAFT AND VALVE GEAR

Item No.	Part No.	Description	Qty	Remarks
1	56671	Valve-stem seal	6	
2	56672	Camshaft	1	
3	56673	Spring, rocker arm (A)	3	
4	56674	Spring, rocker arm (B)	3	
5	56675	Rocker arm	6	
6	56676	Collar, rocker arm	6	
7	56677	Inlet valve	3	
8	56678	Exhaust valve	3	
9	56679	Valve spring	6	
-	56680	Valve spring	6	Not shown
10	56681	Retainer, valve spring	6	
11	56682	Seat, valve spring	6	
12	56683	Cotter, valve	12	
13	56684	Tappet-adjuster screw	6	
14	56685	Nut, adjuster screw	6	
15	56686	Oil seal, camshaft 30 x 42 x 8	1	

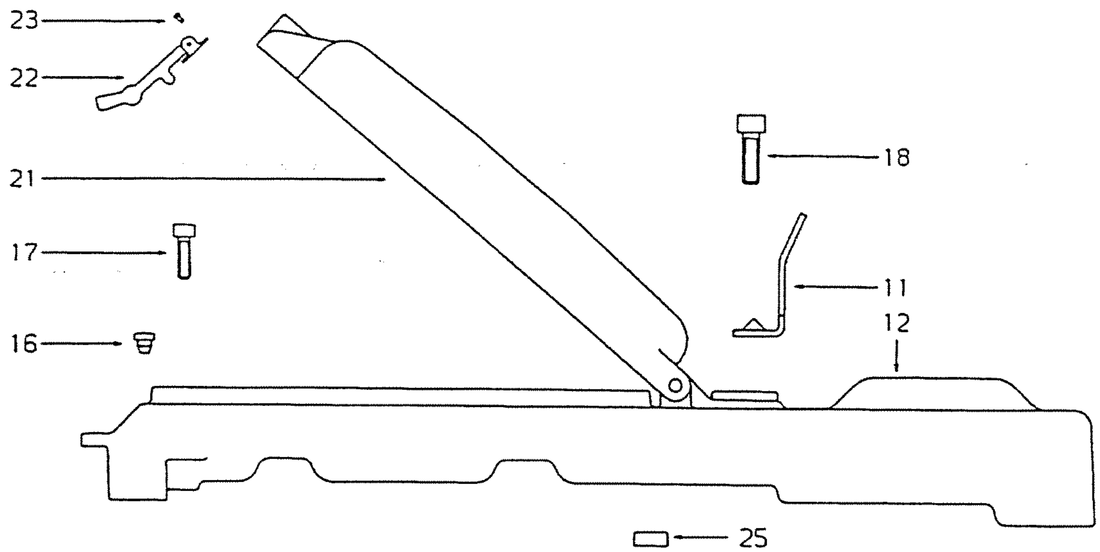
FLYWHEEL, EXCITER AND CHARGE COILS

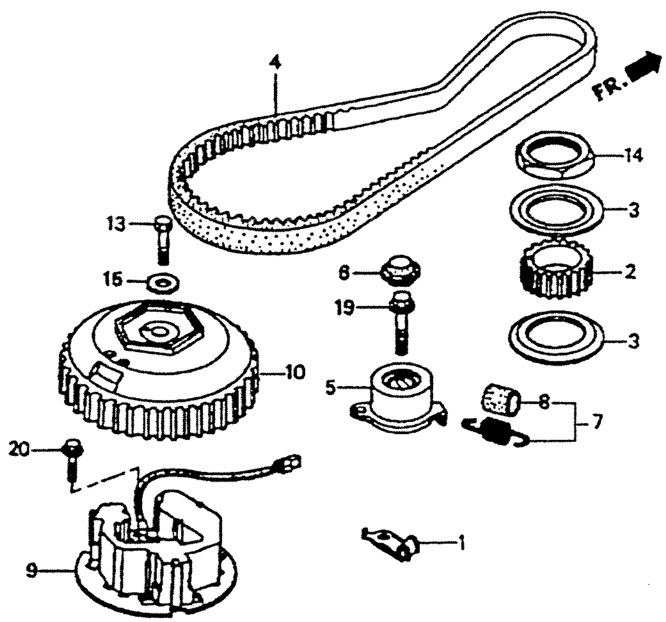


FLYWHEEL, EXCITER AND CHARGE COILS

Item No.	Part No.	Description	Qty	Remarks
1	56687	Flywheel	1	
2	56688	Flange bolt 10 x 25	4	
3	56689	Exciter coil assembly	1	
4	56690	Flange bolt 6 x 25	2	
-	56691	Charge coil kit (10A)	1	Comprises Items 5-8
5	56692	Charge coil assembly (12V, 10A)	1	
6	56693	Flange bolt 6 x 32	2	
7	56694	Cord holder	1	
8	56713	Flange bolt 6 x 12	1	

FLYWHEEL COVER AND TIMING BELT

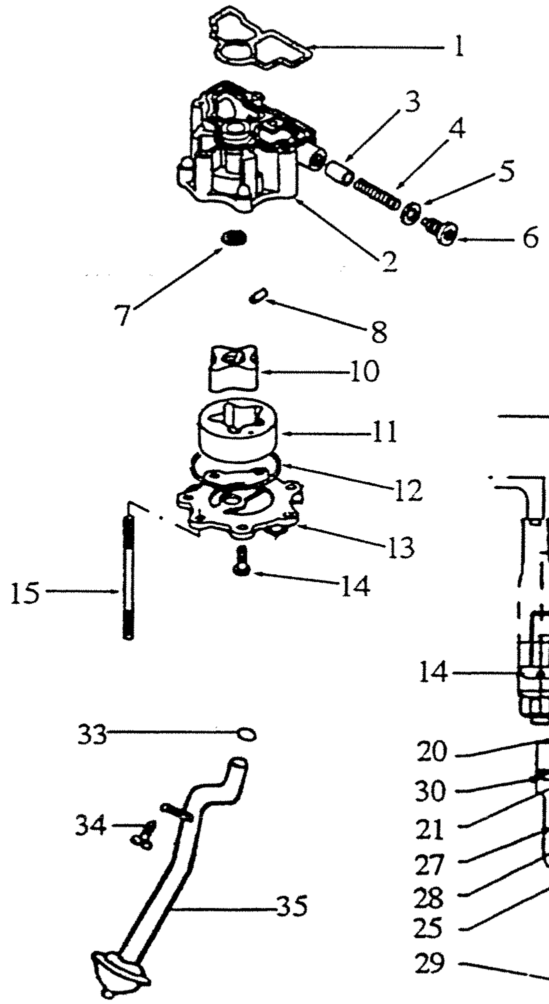


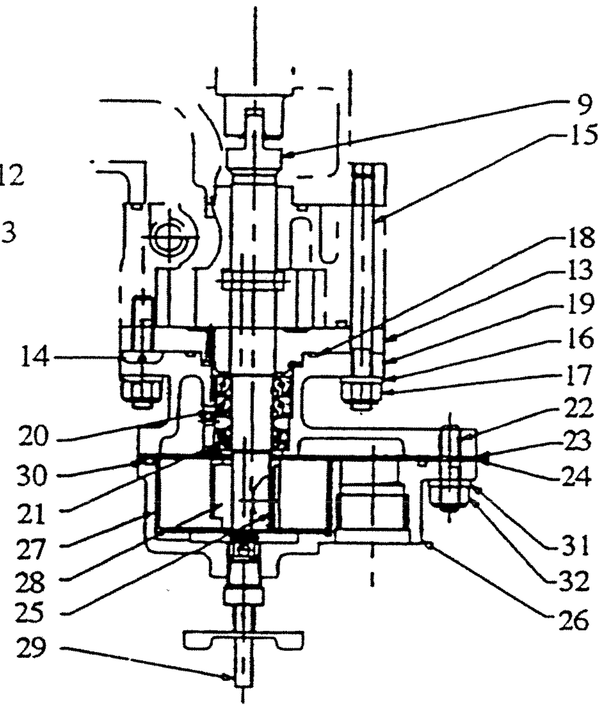


FLYWHEEL COVER AND TIMING, BELT

Item No.	Part No.	Description	Qty	Remarks
1	56695	Tube Clamp	1	
2	56696	Timing Pulley	1	
3	56697	Guide plate, timing belt	2	
4	56698	Timing-belt	1	
5	56699	Tensioner, timing belt	1	
6	56700	Cap, tensioner	1	
7	56701	Tensioner spring	1	
8	56702	Boot, tensioned spring	1	
9	56703	Pulser coil assembly	1	
10	56704	Pulser rotor	1	
11	56890	Lifting lug	1	
12	56560	Flywheel cover	4	
13	56706	Flange bolt 10x 32	1	
14	56707	Locknut M48	1	
15	56708	Washer 10 x 28 x 5	1	
16	56873	Plug	4	
17	MS163/20	Screw M6, socket head	2	
18	MS164/25	Screw M8, socket head	1	
19	56712	Flange bolt 10x 38	1	
20	56713	Flange bolt 6 x 12	2	
21	56561	Hinged cover	1	
22	56562	Flexible tab handle	1	
23	53854/01	Screw, hammer driven	2	
24	MS163/25	Screw M6 X 25, socket-head	4	Not shown
25	MS177/138	Spiral pin	2	

· OIL AND WATER PUMPS

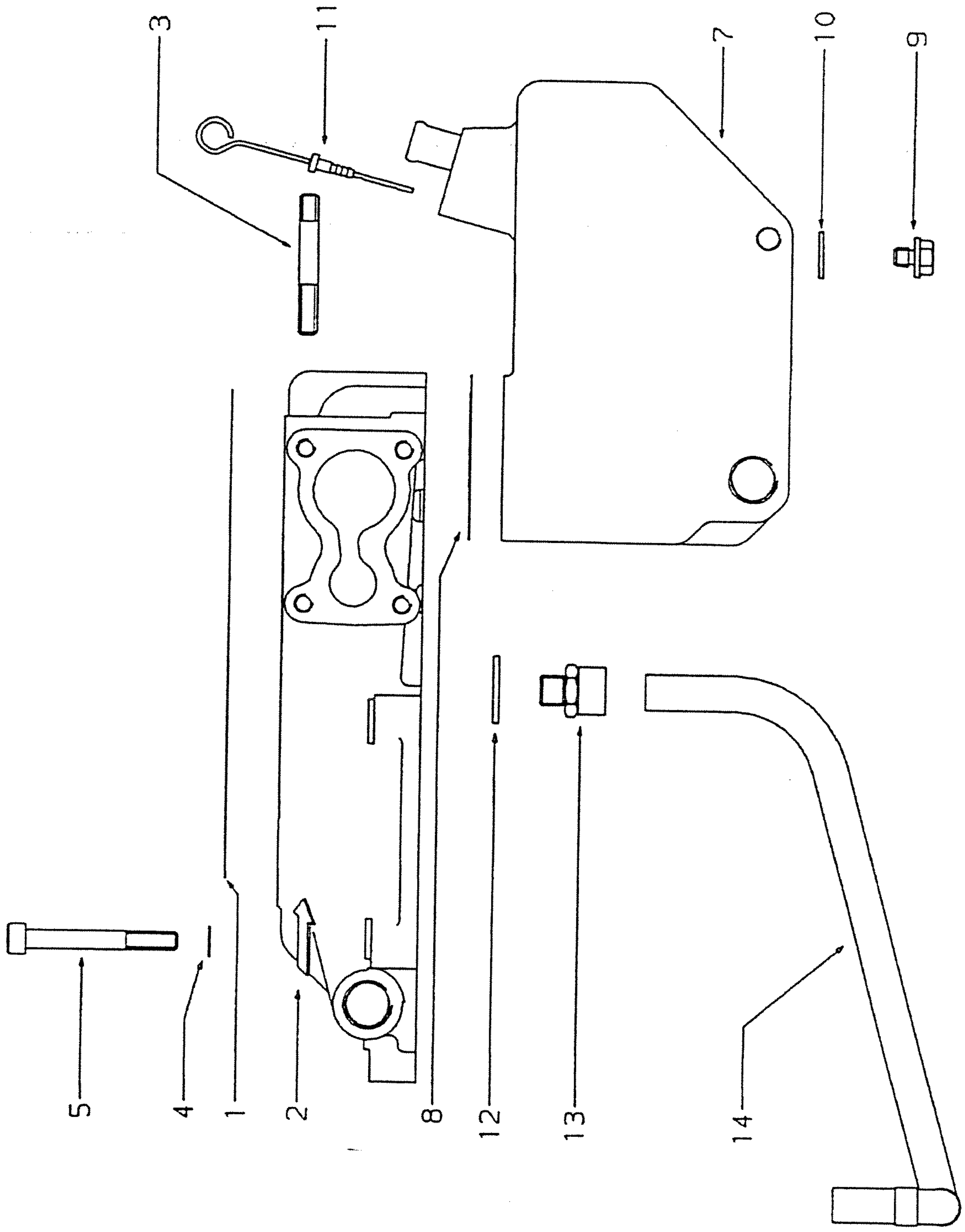




OIL AND WATER PUMPS

Item No.	Part No.	Description	Qty	Remarks
1	56714	Gasket	1	Housing-to-manifold
2	56715	Housing, oil PUMP	1	
3	56716	Relief let, valve	1	
4	56717	Spring, relief valve	1	
5	56718	Sealing washer 14mm	1	
6	56719	Bolt, scaling	1	
7	56720	Thrust washer 13mm	1	
8	56721	Roller 5 x 17,8	1	
9	55804	Oil/water pump-drive shaft	1	
10	56722	Inner rotor	1	
11	56723	Outer rotor A	1	
12	56724	'O' ring	1	
13	55805	Cover plate	1	
14	55800/07	Screw, pan-head 6 x 16	1	
15	MS47/60	Stud 6 x 60	4	
16	MS25/7	Washer M6	4	
17	MS41/4	Nut M6, self-lock	4	
18	55809	'O'ring	1	
19	55806	Seal housing	1	
20	55810	Oil seal		
21	55811	Oil seal	1	
22	MS47/16	Stud 6 x 16	4	
23	55800/03	Gasket, B-impeller	1	
24	55800/04	Impeller cover	1	
25	55812	Woodruff key	1	
26	55807	Impeller housing	1	
27	55800/02	Pump liner	1	
28	55935/01	Impeller sleeve, sub-assembly	1	
29	52119	Drain tap, coolant	1	
30	55800/05	'O'ring, water pump	1	
31	MS25/7	Washer M6	4	
32	MS41/4	Nut M6, self-lock	4	
33	55800/31	'O' ring 13.8 x 2.5	1	
34	55875/01	Oil suction strainer	1	
35	MS64/75	Screw M8, socket-head	1	
-	56065	Adapter 15mm pipe	1	
-	56059	Equal tee-piece	1	
-	56063	Plug	1	
-	56062	Pipe 15mm	1	
-	56487	Pipe support sleeve	2	
-	56060	Elbow 90 15mm	1	
-	56062/01	Pipe 15mm	1	
-	56487	Pipe support sleeve	2	
-	56061	Adapter 15mm pipe	1	

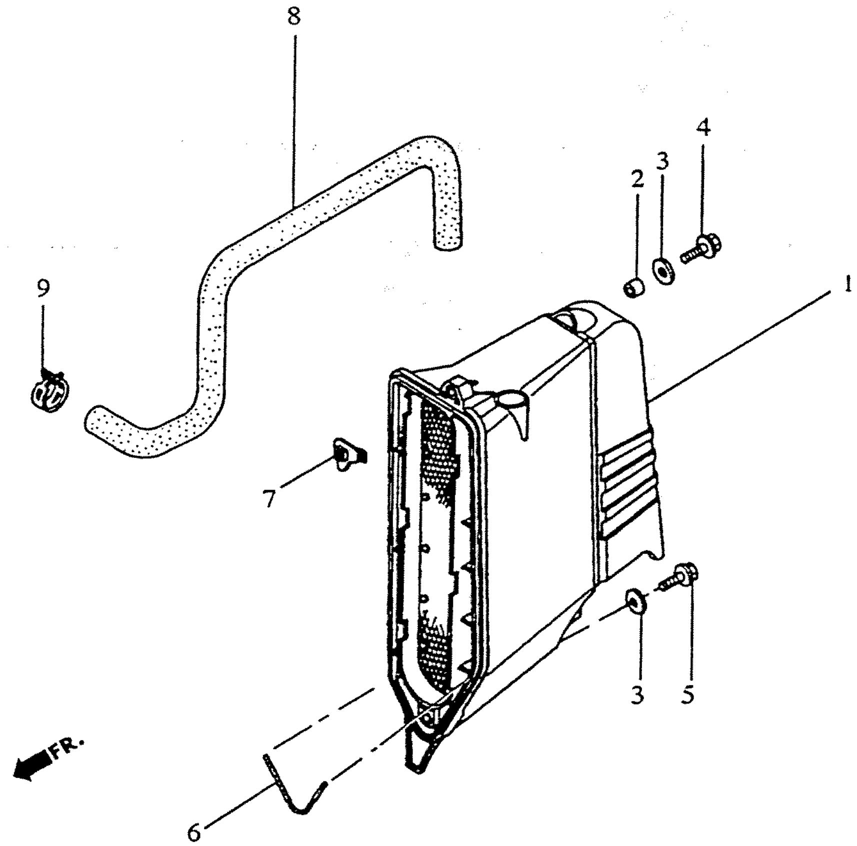
ADAPTOR HOUSING AND OIL SUMP



ADAPTER HOUSING AND OIL SUMP

license No.	Part No.	Description	Qty	Remarks
1	55880/21	Gasket, adapter	1	Housing-to-cylinder block
2	55695/01	Adapter housing	1	
3	MS48/50	Stud MS	4	Adapter-to-exhaust
4	MS33/8	Bonded seal MS	9	Adapter housing
5	MS164/65	Screw MS, socket-head	8	-to-
6	MS64/25	Screw MS, socket-head	1	cylinder head - Not shown
7	55886	Oil sump sub assembly	1	
8	55877	Gasket	1	Oil Sump-to-adapter housing
9	S64/2	Drain plug 1/4 In. BSP	1	
10	UFP2303/5	Sealing washer 1/4 In. BSP	1	
11	56039	Dip stick, engine oil	1	
12	UFP2303/8	Sealing washer 1/2 In. BSP	2	
13	55873	Straight coupler 15 x 0.5	2	
14	56184/01	Connecting-pipe assembly	1	

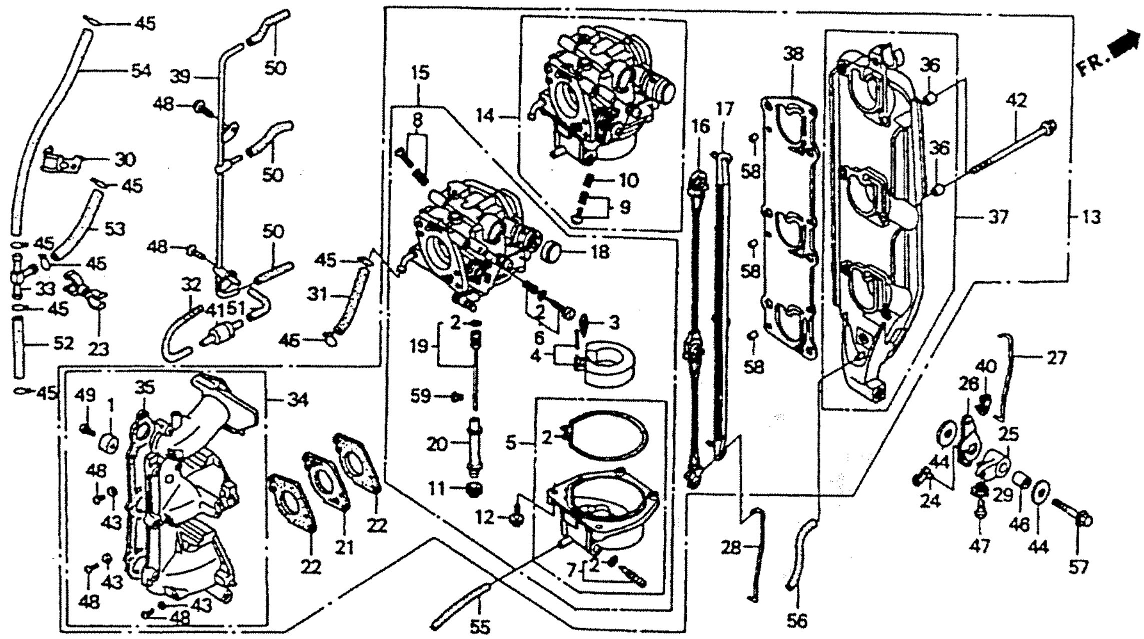
SILENCER COVER



SILENCER COVER

Item No.	Part No.	Description	Qty	Remarks
1	56725	Silencer cover (intake)	1	
2	56726	Distance collar	2	
3	56727	Washer 6.5 x 18	2	
4	56690	Flange bolt 6 x 25	1	
5	56638	Flange bolt 6 x 40	1	
6	56728	Packing	1	Silencer cover
7	56864	Nut	1	Silencer cover
8	56729	Breather tube	1	
9	56730	Clamp	1	

CARBURETORS AND INLET MANIFOLD

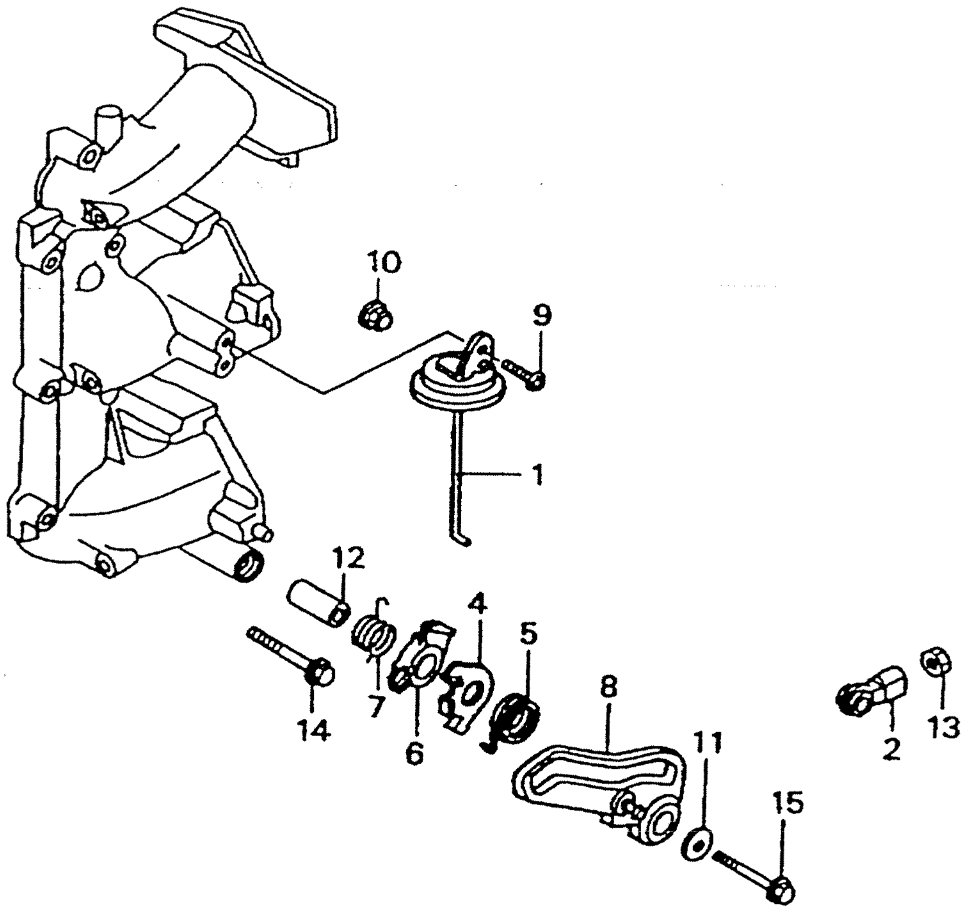


CARBURETORS AND INLET MANIFOLD

Item No	Part No.	Description	Qty	Remarks
1	56731	Anode, sacrificial	1	
5	56732	Gasket	3	
3	56733	Float-valve set	1	
4	56734	Float set	3	
5	56735	Float changer set	3	
6	56736	Screw (set)	3	
7	56737	Drain-screw set	3	
8	56738	Screw (set)	1	
9	56739	Screw (set)	2	
10	56740	Spring	3	
11	56741	Plug screw	3	
12	56742	Screw	12	
13	56743	Carburetor assy	1	
14	56744	Carburetor assy (Nos. 1 & 21)	2	
15	56745	Carburetor assy (No. 3)	1	
16	56746	Connecting link, throttles	1	
17	56747	Connecting link, chokes	1	
18	56748	Choke dust cap	3	
19	56749	Jet set	3	
20	56750	Main nozzle	3	
21	56151	Carburetor insulator	3	
22	56752	Carburetor packing	6	
23	56753	Clamp, fuel tube	1	
~~24~~	~~56754~~	~~Rod Joint~~	~~1~~	
25	56755	Choke arm (A)	1	
26	56756	Choke arm (B)	1	
27	56757	Choke rod	1	
28	56758	Choke rod knob	1	
29	MS35/5	Nut M4, choke arm	1	
30	56759	Clamp, fuel tube	1	

31	56760	Fuel tube (C)	1
32	56761	Fuel tube (D)	1
33	56762	Three-way joint	1
34	56763	Inlet manifold	1
35	56764	Packing, inlet manifold	1
36	56765	Distance collar	6
37	56766	Complete plate, silencer	1
38	56767	Packing, silencer plate	1
39	56768	Pipe	1
40	56769	Linkage bush	1
41	56770	Dashpot check valve	1
42	56771	Flange bolt 6 x 97	6
43	56772	Thrust washer M5	3
44	56773	Washer M6	2
45	56774	Clip, tube B 10	8
46	56775	Distance collar 6.5 x 10.5 x 16	1
47	MS70/25	Screw 4 x 25 pan-head, chock arm	1
48	56777	Screw 5 x 10 pan-head	5
49	56776	Screw 6 x 18 pan-head	1
50	56778	Fuel tube 3.5 x 45	3
51	56779	Fuel tube 3.5 x 60	1
52	56780	Fuel tube 5.3 x 65	1
53	56781	Fuel tube 5.3 x 110	1
54	56782	Fuel tube 5.3 x 170	1
55	56783	Tube 3.5 x 155	1
56	56784	Tube 3.5 x 190	1
57	56785	Flange bolt 6 x 28	1
58	56786	Roller 6 x 15	6
59	56787	Main jet	3

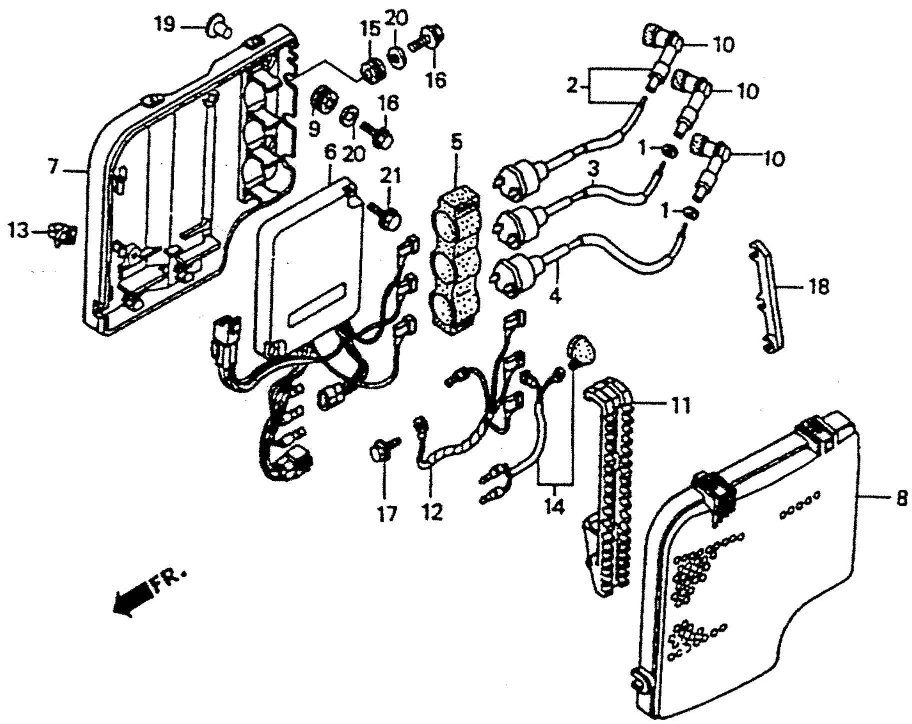
· THROTTLE MECHANISM AND DIAPHRAGM UNIT



THROTTLE MECHANISM AND DIAPHRAGM UNIT

Item No.	Part No.	Description	Qty	Remarks
1	56788	Diaphragm unit	1	
2	56789	Pivot linkage, double-cable	1	
3	Not Used			
4	56790	Assist plate	1	
5	56791	Assist spring	1	
6	56792	Throttle-opener cam	1	
7	56793	Throttle-opener cam return spring	1	
8	56794	Throttle cam	1	
9	56795	Torx bolt 6 x 14	1	
10	56796	Cap nut M6	2	
11	56773	Washer M6	1	
12	56797	Collar 6.7 x 12.5 x 24	1	
13	56798	Nut M5	1	Pivot link-to-throttle enable
14	56799	Flange bolt	5	

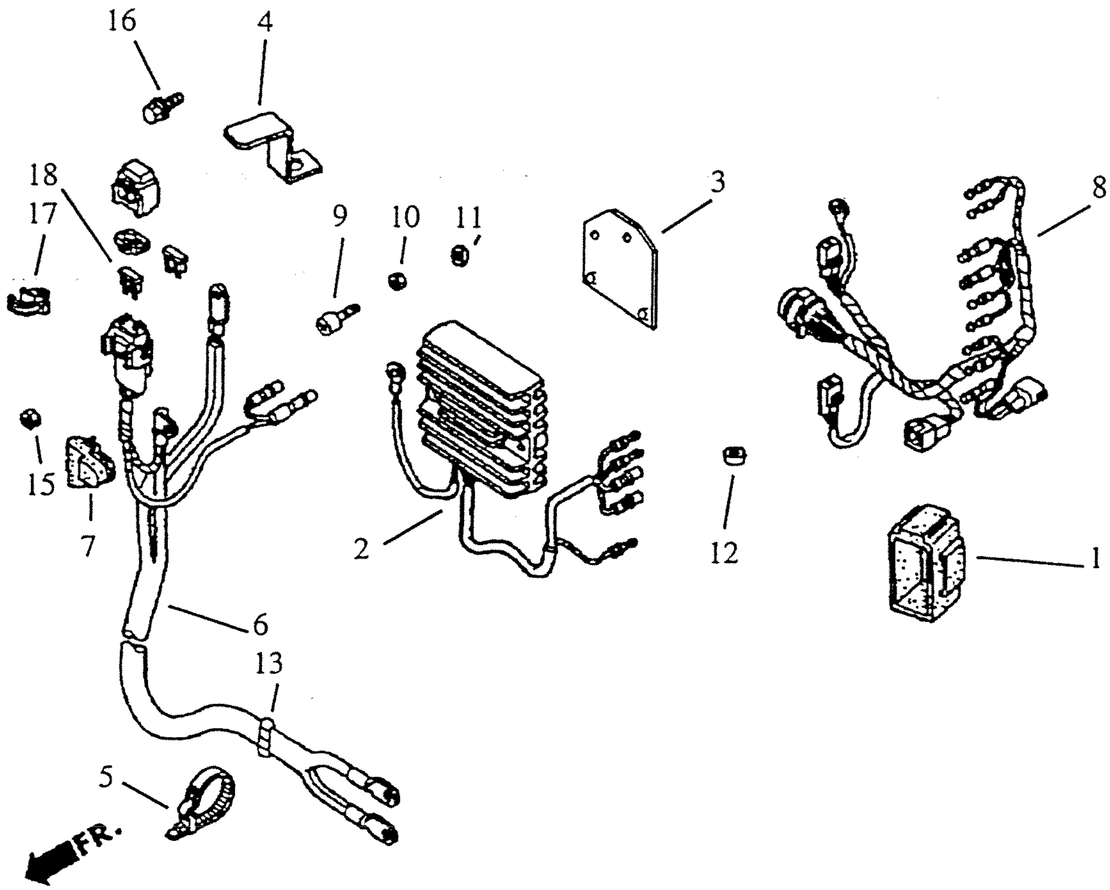
CAPACITOR DISCHARGE IGNITION (C.D.I.) SYSTEM



CAPACITOR DISCHARGE IGNITION (C.D.I.) SYSTEM

Item No.	Part No.	Description	Qty	Remarks
1	56800	Grommet, H.T. lead	2	
2	56801	Ignition coil assembly No. 1	1	
3	56802	Ignition coil assembly No. 2	1	
4	56803	Ignition coil assembly No. 3	1	
5	56804	Mounting, ignition coils	1	
6	56805	Capacitor discharge ignition (C.D.I.) unit	1	
7	56806	Case, C.D.I. unit	1	
8	56807	Cover, C.D.I. unit	1	
9	56808	Grommet, C.D.I. case (B)	2	
10	56809	Suppresser cap assembly	3	
11	56810	Connector bracket (A)	1	
12	56811	Ground cable assembly	1	
13	56812	Clip	1	
14	56813	Cord	1	
15	56814	Grommet, under case	2	
16	56690	Flange bolt 6 x 25	4	
17	56631	Flange bolt 6 x 12	1	
18	56815	Clip, H.T. lead	1	
19	56816	Collar, C.D.I. unit case	4	
20	56817	Washer M6	4	
21	56818	Flange bolt 6 x 20	2	

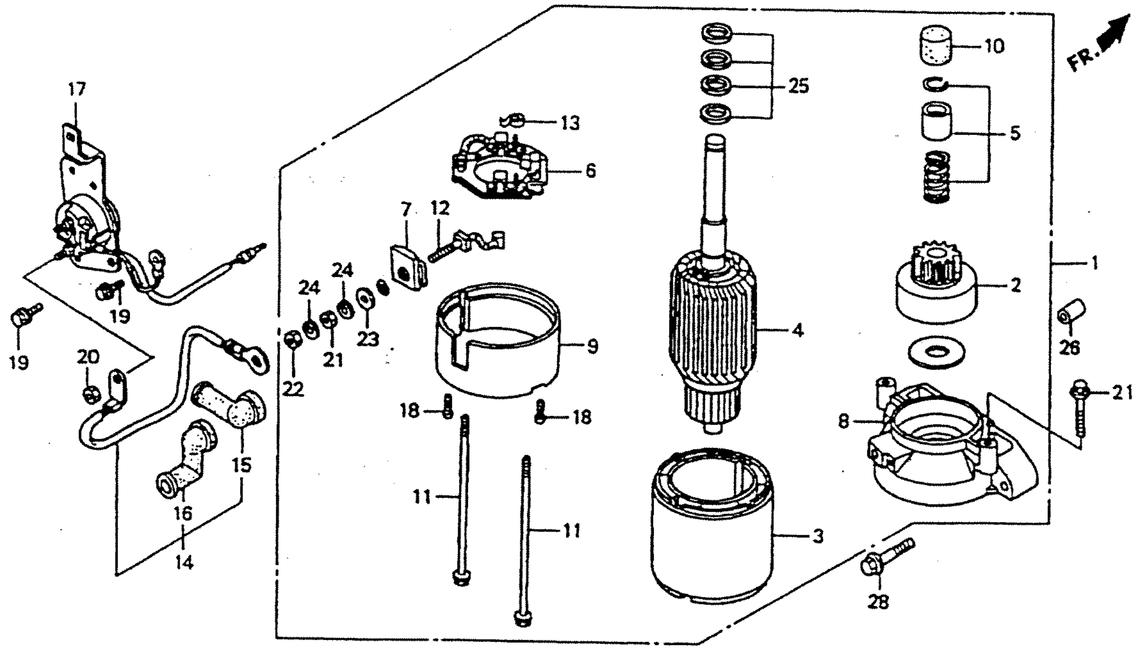
REGULATOR/RECTIFIER AND STARTER CABLES



REGULATOR/RECTIFIER AND STARTER CABLES

Item No.	Part No.	Description	Qty	Remarks
1	56819	Cushion, C.D.I. unit	1	
1	55800/61	Regulator/rectifier unit (12A)	1	
3	55893	Regulator mounting bracket	1	
4	56262	Bracket, multi-pin plug mounting	1	
5	56820	Cable tie	1	
6	56196	Starter cable assembly	1	
7	56821	Cover terminal	1	
8	56822	Cable assembly, remote control	1	
9	MS163/25	Screw M6, socket head x 25	2	Regulator/rectifier-
10	MS41/4	Nut M6, self-locking	2	to-mounting bracket
11	MS25/7	Washer M6	5	
12	56167/01	Spacer	1	Mounting bracket-to-engine
13	MS04/20	Screw M6 x 20	1	
14	56823	Clamper, battery cables	1	
15	56824	Nut M6	1	
16	56825	Flange bolt M8 x 12	2	
17	56826	Clamper, harness	1	
18	56827	Fuse blade (15A)	2	

STARTER MOTOR



STARTER MOTOR

Item No.	Part No.	Description	Qty	Remarks
1	56828	Starter motor assembly	1	
2	56829	Over-run clutch	1	
3	56830	Yoke	1	
4	56811	Armature	1	
5	56832	Pinion-stopper set	1	
6	56833	Brush holder	1	
7	56834	Bush	1	
8	56835	Bracket (FR)	1	
9	56836	Bracket (RR)	1	
10	56865	Cap stopper	1	
11	56837	Through-bolt	2	
12	56838	Brush	1	
13	56839	Brush spring	1	
14	56840	Magnetic-switch cable	1	120mm
15	56841	Terminal cover, starter motor	1	
16	56842	Terminal cover, magnetic switch	1	
17	56843	Magnetic-switch assembly	1	
18	56844	Screw M4	2	
19	56631	Flange bolt 6 x 12	3	
20	56824	Nut M6	1	
21	56845	Nut (1)	1	
22	56846	Nut (2)	1	
23	56847	Washer (1)	1	
24	56848	Washer (2)	1	
25	56849	Thrust-washer set	1	
26	56850	Dowel pin 10x 16	1	
27	56851	Flange bolt 6 x 28	1	
28	56852	Flange bolt 8 x 45	1	

GASKETS

Item No.	Part No.	Description	Qty	Remarks
-	56853	Gasket kit component parts	1	
-	56854	Packing, engine oil sump	1	
-	56855	Cylinder-head -gasket	1	
-	56856	Packing, head cover	1	
-	56857	'O' ring 4.8 x 1.9	1	
-	56858	Packing, carburetor	6	
-	56859	Packing, inlet manifold	1	
-	56860	Packing, silencer cover	1	
-	56861	Packing, silencer plate	1	
-	56862	Gasket A, exhaust pipe	1	
-	56863	Gasket, thermostat cover	1	

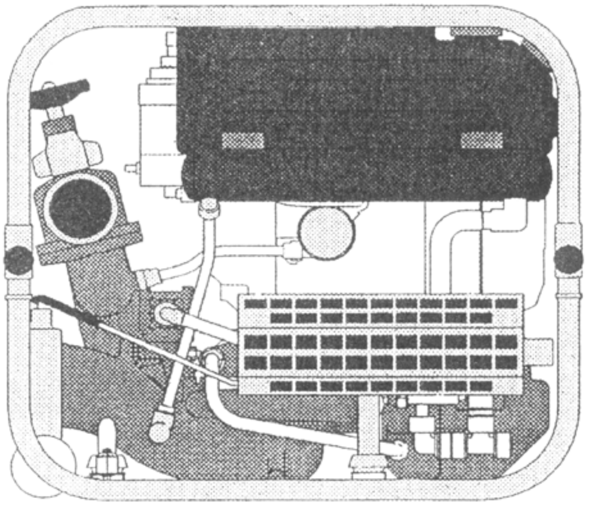
RECOMMENDED SPARES
ENGINE

Part No.	Description	Qty
56853	Gasket set	1
DR7 EA OR 56613	Spark plug	3
56618	'O' ring, oil orifice assembly	1
56170	'O' ring, oil cooler	1
56627	Thermostatic switch	1
56626	Oil pressure switch	1
56671	Valve stem seal	6
56686	Camshaft oil seal	1
56698	Timing belt, camshaft	1
55800/05	'O' ring, water pump	1
55800/03	Gasket, water pump	1
55810	Oil seal, oil and water pump shaft	2
55811	Oil seal, oil and water pump shaft	1
55877	Gasket, oil sump-to-adapter housing	1
56732	Carburetor gasket set	1

HALE

GODIVA

HP550
PORTABLE FIRE PUMP
WORKSHOP MANUAL



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700 Spring Mill Avenue, Conshohocken, PA 1942
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IDEX CORPORATION

GP/079/94
ISSUED 1995

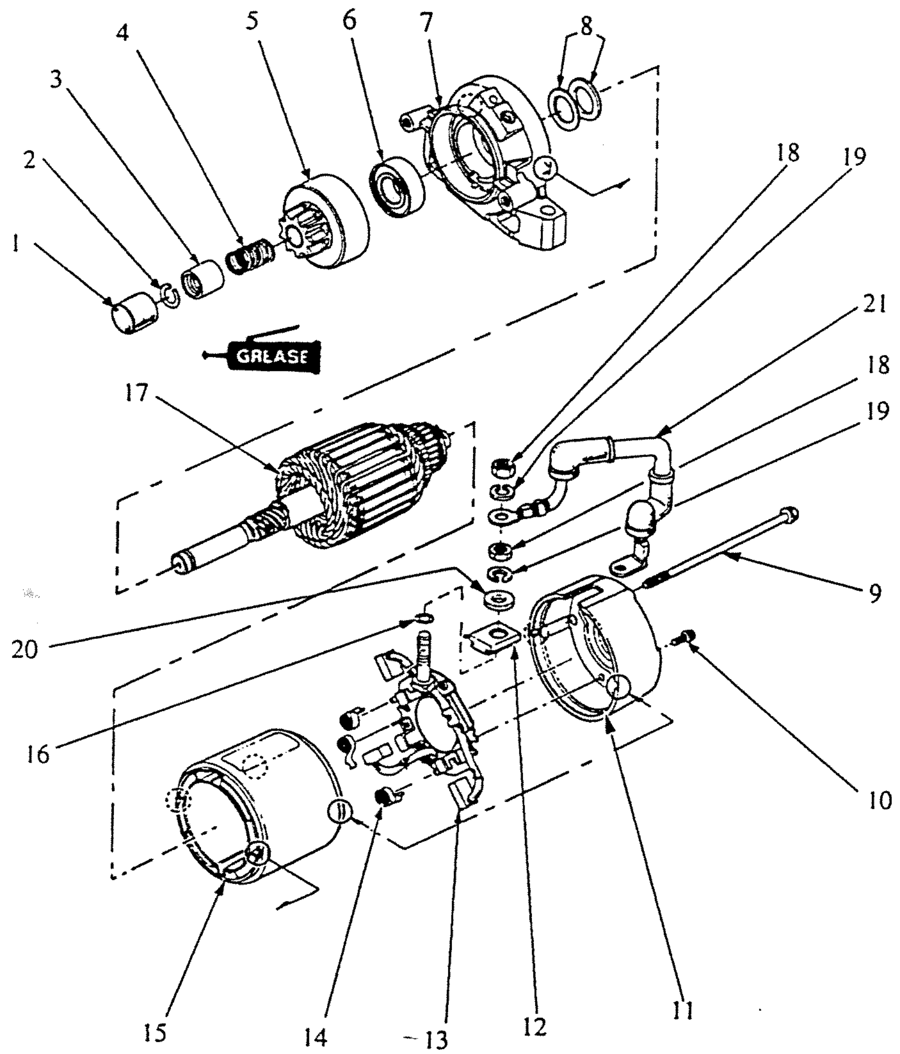
To Reinstall

Reinstallation is a reversal of the removal instructions.

Retighten the C.D.I. unit screws to a torque of 4 ft/lbs.

Starter Motor

The starter motor of the inertia-engagement type (1.2 HP rating) and also incorporates unidirectional (over-run) clutch-and-pinion assembly. The solenoid (magnetic switch) is mounted separately to the starter motor and connected to it by heavy-duty cable. Both units are mounted on the crankcase.



1. Cover
2. Snap ring
3. Stopper collar
4. Spring
5. Uni-directional clutch
6. Ball race
7. Front cover
8. Washers
9. Belt
10. Screw
11. Rear cover
12. Bushing
13. Bush holder
14. Bush spring
15. Yoke
16. 'O' ring
17. Armature
18. Flange nut
19. Spring washer
20. Washer
21. Cable assembly

Fig. 34-24. Starter Motor Components

To Remove

Disconnect and remove the battery.

Unscrew the 8 x 12mm flange bolt and detach the negative (-) cable from the starter motor body.

Peel back the protective cover of the positive (+) cable, unscrew the 8mm flange nut securing it to the starter-motor bushing and finally, recover the 8mm spring washer and cable (Fig. 34-25).

Remove the three flange bolts securing the starter motor to the crankcase and remove the starter motor.

. Place the starter in an upright position (starter-pinion uppermost).

Position an off-set wrench over the stopper collar and push the collar down. This will expose a snap ring which should then be removed (Fig. 34-26).

The collar and unidirectional clutch can then be withdrawn from the armature shaft.

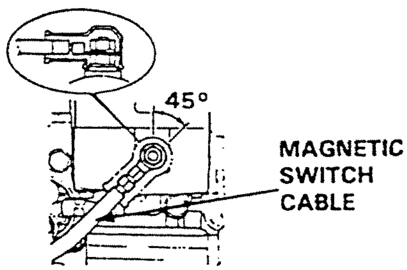


Fig. 34-25. Magnetic Switch Cable

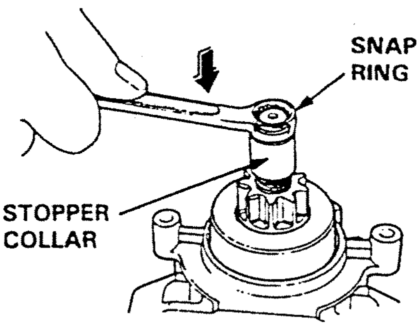


Fig. 34-26. Removing Snap Ring

Maintenance

To dismantle the starter motor refers to Fig. 37-24 and proceeds as follows:

Unscrew the two long bolts (9) clamping the rear cover (11) yoke (15) and front cover (7) together.

Remove the rear cover and brush-holder assembly and the yoke (15).

The armature (17) may then be withdrawn from the ball race (6) located in the front cover (7). Recover the washers (8).

Inspection and Testing

Brushes

Pull each brush spring away from the brush and withdraw the brush from its holder.

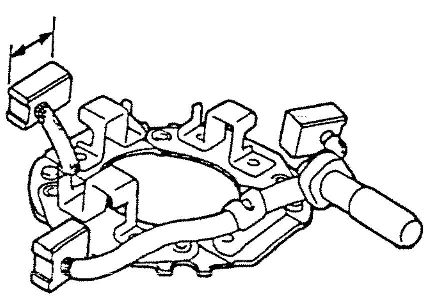


Fig. 34-27. Measuring Brush Length

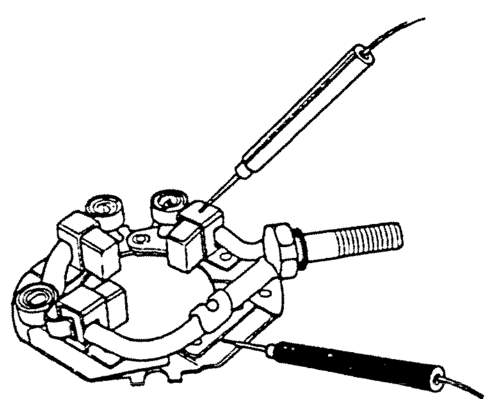


Fig. 34-28. Testing Brush Insulation

Measure the length of each brush (Fig. 34-27). The standard is 0.6" and the service limit is 2". If less than the service limit, install a new set of brushes.

With the brushes reinstalled to their holders, check for any continuity between the brushes (Fig. 37-28). Should continuity exist, install a new brush-holder assembly. To do this, unscrew the nut (18) and two screws (10) securing it to the end cover (11). See Fig. 34-24.

Mica Depth

Check the grooves between the commutator segments for depth, which should not be less than 0.0079" (Fig. 34-29). If less than this figure or if clogged, recut the grooves using a hacksaw blade or suitable small file.

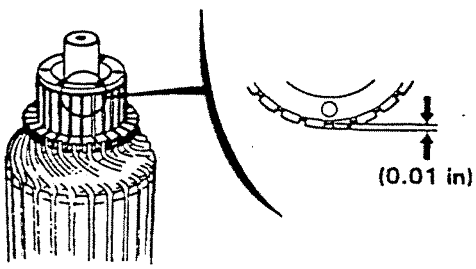


Fig. 34-29. Measuring Mica Depth

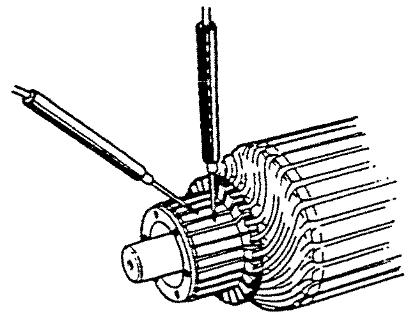


Fig. 34-30. Armatrure Continuity Check

Continuity Check

Check for continuity between the armature segments (Fig. 34-30). If no continuity exists (open-circuit) between the two segments, install a new armature.

Short-Circuit Test, Core-to-Commutator

Check for continuity between the commutator and armature-coil core (Fig. 34-31). If continuity exists, install a new armature.

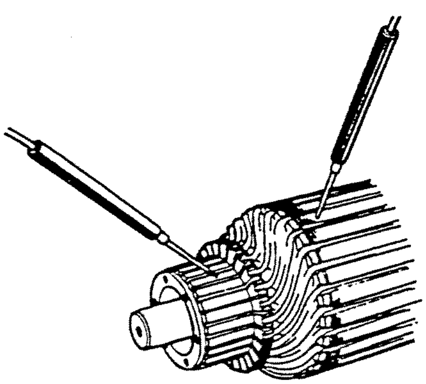


Fig. 34-31. Short-Circuit Test - Core to Commutator

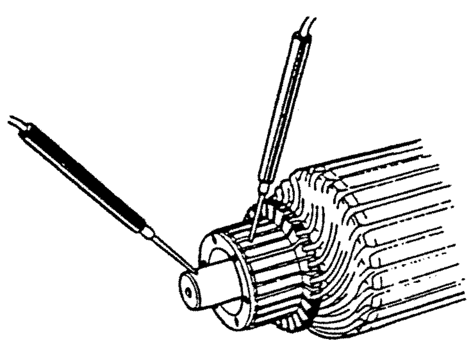


Fig. 34-32. Short-Circuit Test - Shaft to Commutator

Short-Circuit Test, Shaft-to-Commutator

Check for continuity between the commutator and armature shaft (Fig. 34-32). If continuity exists, install a new armature.

. **Short-Circuit Test, Armature**

Place the armature in an armature test unit, (this is commercially available). Hold a hacksaw blade or similar metal strip, close to (but not touching) the armature (Fig. 34-33).

If the blade vibrates, or is attracted to the core when the test unit is turned on, there is a short circuit in the armature. Install a new armature if short-circuited.

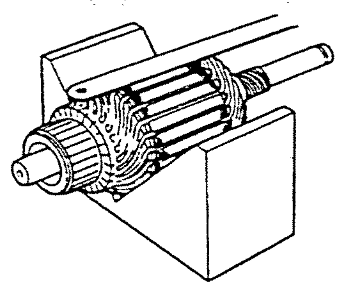


Fig. 34-33. Armature Short-Circuited

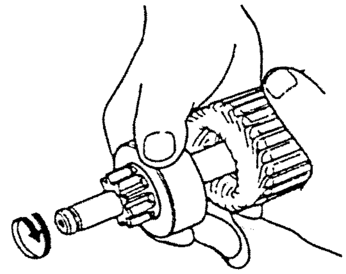


Fig. 34-34. Checking Uni-Directional Clutch

Uni-directional Clutch

The clutch should first be checked for smooth axial movement. Oil should be applied but if still unsatisfactory, install a new clutch unit (Fig. 34-34).

Check the operation of the clutch by holding the unit stationary and turning the armature (Fig. 34-35). The clutch should turn freely in the counterclockwise direction, but should NOT turn clockwise.

Check the pinion teeth for wear or damage and if unsatisfactory, install a new one. If this is necessary, check the flywheel teeth for excessive wear or damage. Replace if necessary.

Inspect the armature for dust, rust or any other damage. Wipe clean with a clean lint-free, cloth. If rusted or damaged, dress with a fine emery cloth. Make sure that no metallic material is attached to the armature before replacing.

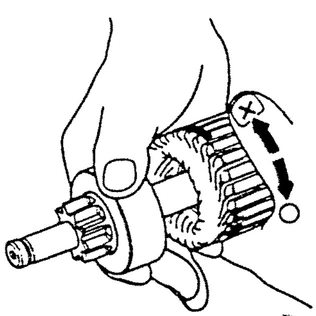


Fig. 34-35. Checking Clutch Operation

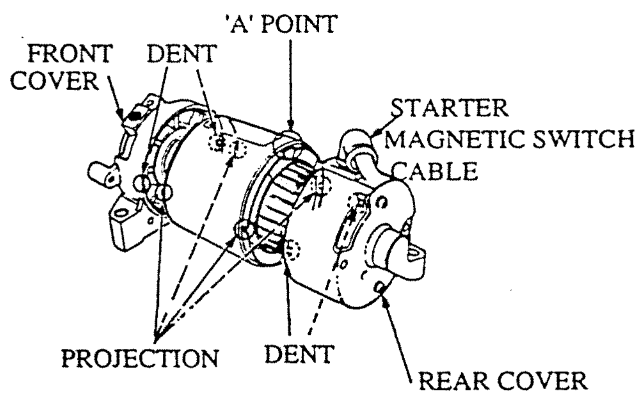


Fig. 34-36. Yoke and Covers Relationship

Check the front and rear bearings for excessive movement and replace if necessary.

When reassembling, align the projections on the yoke with the recesses in the rear cover ensuring that the 'A' Point on the yoke faces the starter magnetic switch cable (Fig. 34-36). The front cover recesses should be aligned with the projections on the yoke, in a similar manner.

Apply an adhesive compound (e.g. Cemedain 575 or equivalent) to the bushing to rear cover joint.

Magnetic Switch (Solenoid)

Testing

Ensure that the battery is in good condition and fully-charged before performing this test.

Connect the black/white wire of the switch to the positive (+) terminal of the battery and the black wire to the negative (-) terminal (Fig. 34-37).

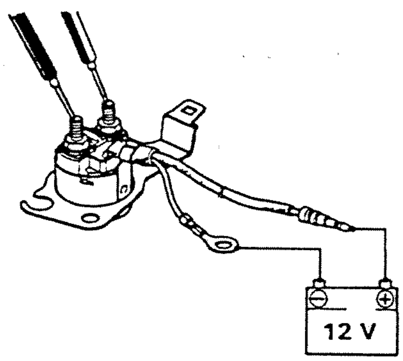


Fig. 34-37. Continuity Test - Solenoid

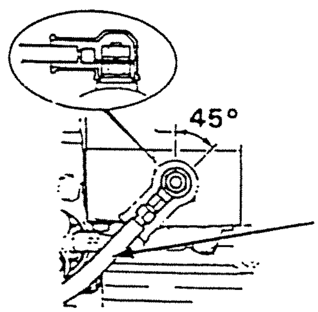


Fig. 34-38. Starter Cable Installation

Connect the probes of the test apparatus, one to each solenoid terminal and check for continuity (Fig. 34-37). There should be continuity with the battery connected, but no continuity with the battery disconnected. If faulty, install a new solenoid.

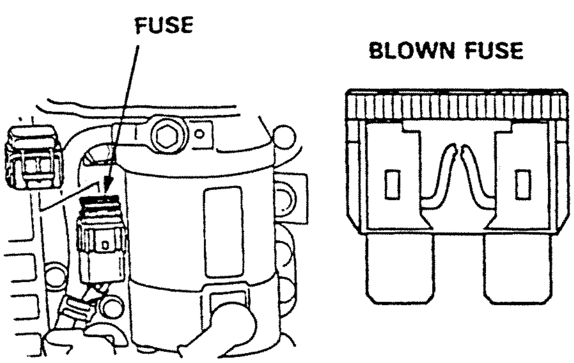


Fig. 34-39. Fuse Location and Condition

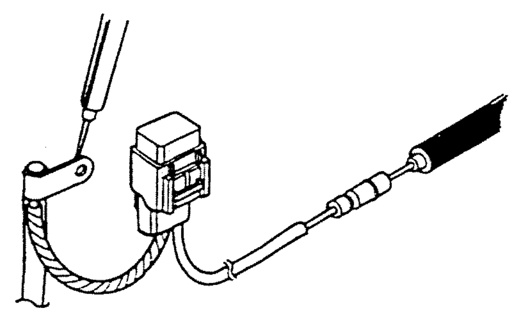


Fig. 34-40. Checking Fuse Continuity

Fuse and Fuse Case

The fuse case is located adjacent to the starter motor (Fig. 34-39).
The fuse plugs into the top of the case and should be checked either visually or electrically to determine its condition (Fig. 37-39).

If 'blown', install a new fuse.

Testing

Using a 'known' good fuse plugged into the fuse case, connect the probes of the test apparatus as shown (Fig. 34-40) and check the fuse case for continuity.

If no continuity, replace the fuse case.

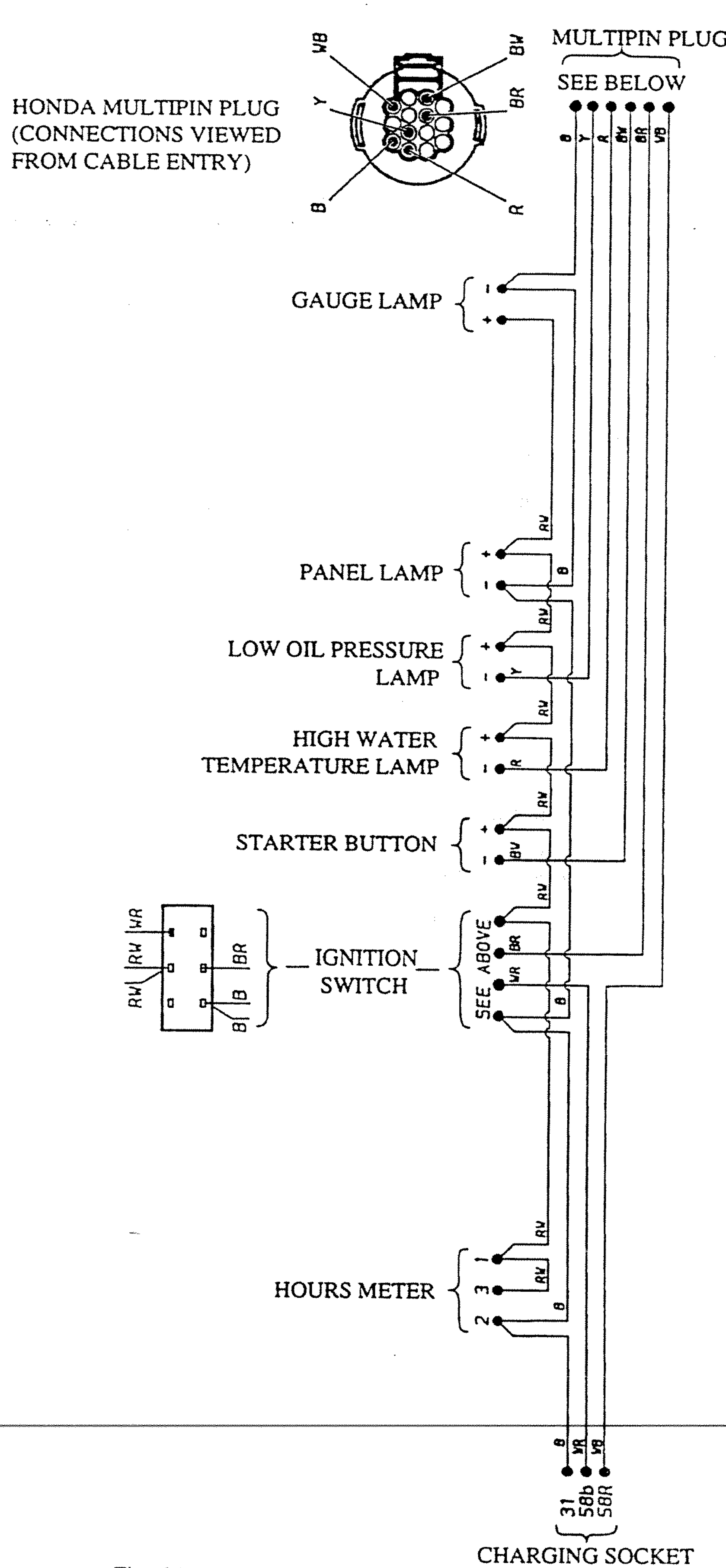


Fig. 34-41. Schematic Wiring Diagram - Hale Part

SECTION 35

MAINTENANCE SCHEDULE

REGULAR SERVICE ITEM	PERFORM AT EVERY INDICATED MONTH OR HOUR INTERVAL WHICHEVER COMES FIRST	EACH USE	FIRST MONTH OR 20 HRS	EVERY 6 MONTHS OR 100 HRS	EVERY YEAR OR 200 HRS	EVERY 2 YEARS OR 400 HRS	REFER TO SECTION
ENGINE OIL	CHECK LEVEL	X					10
	CHANGE		X		X		10
ENGINE OIL FILTER	CHANGE					X	10
TIMING BELT	CHECK-READJUST				X		2
CARBURETOR LINKAGE	CHECK		X	X			14
IDLING	READJUST		X	X			14
VALVE CLEARANCE	CHECK-READJUST		X		X		4
SPARK PLUGS	CHECK-CLEAN		X		X		16
FUEL FILTER	CHECK			X			12
	CHANGE					X	12
THERMOSTAT	CHECK				X		11
FUEL	CHECK	X					
	(REPLACE IF NECESSARY)					X	
BATTERY FLUID	CHECK-REFILLING	X					16
CABLE CONNECTION	CHECK-TIGHTNESS		X	X			16
BOLTS AND NUTS	CHECK-TIGHTNESS		X	X			

TECHNICAL DATA

UNITS: INCHES

PART	ITEM		STANDARD	SERVICE LIMIT
ENGINE	IDLE SPEED		950 +/- 50 MIN (RPM)	
	CYLINDER COMPRESSION		212 +/- 14 PSI AT 500 MIN (RPM)	
CARBURETOR	MAIN JET		#125	
	PILOT SCREW OPENING		2-1/8 TURNS OUT	
	FLOAT HEIGHT		0.6	
SPARK PLUG	GAP		0.024-0.028	
VALVES	VALVE CLEARANCE	IN	0.005-0.007	
		EX	0.008-0.010	
	STEM O.D.	IN	0.2157-0.2161	0.215
		EX	0.2150-0.2154	0.213
	GUIDE O.D.	IN/EX	0.2165-0.2170	0.218
	SEAT WIDTH	IN	0.049-0.061	0.08
		EX	0.049-0.061	0.08
	SPRING FREE LENGTH	IN/EX	1.45	1.39
	STEM-TO-GUIDE-CLEARANCE	IN	0.0004-0.0013	0.0024
		EX	0.0012-0.0020	0.004
ROCKER ARM	ROCKER ARM I.D.		0.5516-0.5523	0.553
	ROCKER ARM SHAFT O.D.		0.5502-0.5509	0.549
	ROCKER ARM SHAFT-TO-ROCKER ARM CLEARANCE		0.0006-0.0020	0.003
PISTON	SKIRT O.D.		2.7547-2.7555	2.7524
	PISTON-TO-CYLINDER CLEARANCE		0.0004-0.0018	0.0035
	PIN HOLE I.D.		0.7087-0.7090	0.709
	PIN O.D.		0.7084-0.7086	0.7068
	PIN-TO-HOLE CLEARANCE		0.0001-0.0005	0.0016
PISTON RING	RING SIDE CLEARANCE	TOP	0.0016-0.0026	0.004
		SECOND	0.00059-0.0018	0.004
		OIL	0.0022-0.0055	0.006
	RING AND GAP	TOP	0.006-0.012	0.03
		SECOND	0.012-0.018	0.037
		OIL	0.0079-0.028	0.04
	RING WIDTH	TOP	0.0390-0.0404	0.038
		SECOND	0.0469-0.0482	0.0457
CYLINDER/ CYLINDER HEAD	CYLINDER SLEEVE I.D.		2.7559-2.7565	2.758
	DISTORTION OF CYLINDER HEAD		0.0019	0.004
	I.D. OF CAMSHAFT		0.9055-0.9063	0.908

UNITS: INCHES

PART	ITEM		STANDARD	SERVICE LIMIT
CONNECTING ROD	SMALL END I.D.		0.7093-0.7100	0.711
	BIG END OIL CLEARANCE		0.0006-0.0016	0.0019
	BIG END AXIAL CLEARANCE		0.0019-0.0079	0.012
	CONNECTING ROD BEARING OIL CLEARANCE		0.0008-0.0015	0.003
CRANKSHAFT	JOURNAL O.D.	MAIN	1.5741-1.5750	1.572
		PIN	1.4951-1.4961	1.494
	CRANKSHAFT MAIN BEARING OIL CLEARANCE		0.0008-0.0015	0.0019
	CRANKSHAFT SIDE CLEARANCE		0.0019-0.012	0.018
CAMSHAFT	SHAFT AXIAL CLEARANCE		0.0012-0.0043	0.012
	SHAFT RUNOUT		0.0012 MAX	0.0019
	JOURNAL O.D.		0.9039-0.9047	0.903
	CAM HEIGHT	IN	1.3751-1.3877	1.3665
		EX	1.3769-1.3895	1.3682
	SHAFT OIL CLEARANCE		0.0008-0.0026	0.003
OIL PUMP	BODY I.D.		1.974-1.975	1.976
	INNER ROTOR-TO-OUTER ROTOR CLEARANCE		0.006 MAX	0.0079
	OUTER ROTOR-TO-BODY CLEARANCE		0.006-0.009	0.0102
	OUTER ROTOR HEIGHT		0.6685-0.6693	0.667
	PUMP BODY DEPTH		0.670-0.671	0.673
	PUMP AND CLEARANCE		0.0008-0.0028	0.004
IGNITION COIL	RESISTANCE	PRIMARY	0.19-0.23 ♠	
		SECONDARY	2.8-3.4 k♠	
CHARGING COIL	RESISTANCE		0.20-0.26 ♠	
EXCITER COIL	RESISTANCE		168-227 ♠	
PULSER COIL	RESISTANCE		288-352 ♠	

TIGHTENING TORQUES

Item	Thread Dia. (mm) and pitch (length)	Nm	Torque Values kgm	ft. lb.
ENGINE				
Crank case bolt *	M8x1.25	28	2.8	20.2
	M6x1.0	11	1.1	8.0
Oil filter cartridge	M20x1.5	8	0.8	5.6
Water jacket cover bolt	M6x1.0	12	1.2	8.7
Thermostat cover bolt	M6x1.0	12	1.2	8.7
Cylinder head bolt *	M10x1.25	38	3.8	27.5
	M8x1.25	27	2.7	19.5
Cylinder head cover bolt	M6x1.0	12	1.2	8.7
Fuel pump bolt	M6x1.0	10	1.0	7.2
Camshaft holder bolt	M6x1.0	14	1.4	10.1
	M6x1.0	12	1.2	8.7
Throttle cam	M6x1.0	12	1.2	8.7
Choke arm bolt	M6x1.0	12	1.2	8.7
Intake manifold bolt, nut	M6x1.0	12	1.2	8.7
carburetor bolt	M6x1.0	10	1.0	7.2
Connecting rod nut	M6x0.75	28	2.8	20.2
Pump drive adapter nut	M22x1.2	92	9.2	66.5
Valve adjusting nut	M7x0.75	23	2.3	16.6
Oil drain bolt	M12x1.5	23	2.3	16.6
Exhaust pipe bolt	M6x1.0	10	1.0	7.2
	M8x1.25	21	2.1	15.2
Oil pan bolt	M6x1.0	10	1.0	7.2
Oil pump bolt	M6x1.0	13	1.3	9.4
Timing pulley bolt	M48x1.51	130	13.0	94.0
Timing belt tensioner bolt	M10x1.25	45	4.5	32.5
Timing belt adjusting spring bolt	M6x1.0	12	1.2	8.7
Flywheel bolt	M10x1.0	66	6.6	47.7
Pulser rotor bolt	M10x1.25	57	5.7	41.2
Oil pressure switch	PT 1/8	9	0.9	6.5
Thermo switch	M16x1.5	12	1.2	8.7
Starter solenoid (Switchside)	M6x1.0	5	0.5	3.6
(Starter motor side)	M8x1.25	7	0.7	5.1
CDI unit bolt	M6x1.0	5	0.5	3.6

*Tighten the crankcase bolts to 20.2 ft/lbs and the cylinder head bolts to 27.5 ft /lbs then tighten them 90^{o+30} further.

STANDARD TORQUE VALUES

Item	Thread Dia	Nm	Torque values kgm	ft /lbs
Blot and nut	5mm	5	0.5	3.6
	6mm	10	1.0	7.2
	8mm	21	2.1	15.2
	10mm	35	3.5	25.3
	12mm	55	5.5	40.0
Flange bolt and nut	6mm (RH Flange bolt)	9	0.9	6.5
	6mm	12	1.2	8.7
	8mm	27	2.7	19.5
	10mm	35	3.5	25.3
	12mm	60	6.0	43.4
Screw	5mm	4	0.4	2.9
	6mm	9	0.9	6.5

SECTION 38

SPECIAL TOOLS

Item No.	Tool Name	Tool Number	Application
1	Float-level gauge	07401 - 0010000	Inspection for carburetor float level.
2	Vacuum 4ch tester set	07404 - 0030001	Carburetor vacuum pressure inspection.
3	Oil pressure gauge	007506 - 300000	Inspection for oil pressure
3-1	Attachment for Item 3	07406 - 0030000	
4	Torx bit handle	07703 - 0010300	For Torx bits
4-1	Screw T20H	07703 - 0010400	Fuel pump disassembly /reassembly
4-2	Screw T30H	07703 - 0000100	Diaphragm adjustment
5	Valve guide driver 5.5 mm	07742 - 0010100	Valve-guide removal/installation
6	Valve-spring compressor	07757 - 0010000	Valve cotter removal
7	Valve-seat cutter 45°29 dia.	07780 - 0010300	Valve-seat reconditioning EX
8	Valve-seat cutter 45°33 dia.	07780 - 0010800	Valve-seat reconditioning IN
9	Valve-seat cutter 32°30 dia.	07780 - 0012200	Valve-scat reconditioning EX
10	Valve-seat cutter 32°33 dia.	07780 - 0012900	Valve-seat reconditioning IN
11	Valve-seat cutter 60°30 dia.	07780 - 0014000	Valve-seat reconditioning EX
12	Valve-seat cutter 60°37.5 dia.	07780 - 0014100	Valve-seat reconditioning IN
13	Cutter holder 5.5mm	07781 - 0010101	Valve-seat reconditioning EX 14
14	Valve-guide rearner	07894 0 2000001	Valve-guide reaming
15	Oil-filter wrench	07HAA - PJ0100	Oil-filter replacement
16	56mm lock-nut wrench	07LPA - ZV30200	Pulser rotor 45mm locknut removal/installation
17	Ring-gear holder	07LBP - ZV30 1 00	Flywheel 22mm locknut removal/installation
18	Stakiro tool	53563	Stakina 22mm locknut Securing pump
19	Pump adapter puller	56566	Removing pump adapter from crankshaft
20	Seal and seating tool	56571	Fitting silicon-carbide seal and seating to impeller

Special Tools (Continued)

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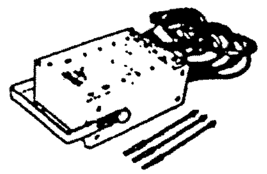

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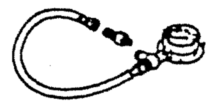

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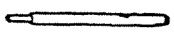

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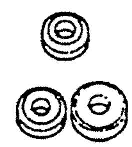

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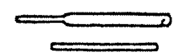

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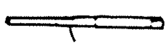

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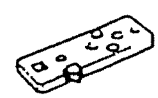

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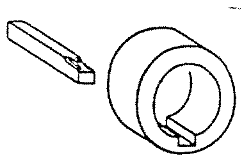

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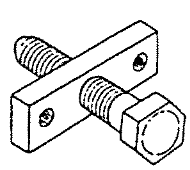

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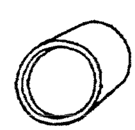

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ENGINE FAULT-TRACING CHART

ENGINE WILL NOT START

POSSIBLE FAULT	REMEDY
1. Fuel tank empty	Refill tank.
2. Fuel pump not functioning	Install new pump.
3. In-line filter clogged	Install new filter.
4. Water or impurities in fuel system	Clean out fuel pump, carburetors, fuel tank and fuel pipelines. Refill tank with fresh fuel.
5. Blockage in fuel pipeline	Disconnect and clear.
6. Carburetor setting fault	Adjust carburetor.
7. Carburetor flooding	
a) Over-choked	Release choke, turn engine over with the throttle wide open.
b) Needle-valve sticking	Remove and clean needle-valve.
8. Carburetor air vent blocked	Clean vent hole.
9. Insufficient choke	Check and correct.
10. Throttle open too wide	Check and close.
11. Faulty speak plugs	Install new plugs.
12. Plug leads loose, broken or poorly-fitted.	Examine leads, if necessary, replace leads.
13. Fuel pipe incorrectly-fitted	Check and rectify.
14. Fuel pipe twisted or trapped	Check and reposition.
15. Position of plug leads incorrect	Refit leads correctly.
16. Ignition not switched ON	Switch ignition ON.
17. Quick-release fuel connector disconnected.	Reconnect connector

ENGINE MISSES AT LOW SPEEDS ONLY

POSSIBLE FAULT	REMEDY
1 Air leaks in system.	Check Joints between: a) Cylinder head-and-intake manifold. b) Carburetor-and-intake manifold.
2. Carburetor setting faulty.	Adjust carburetor.
3. Valve not seating properly due to:	
a) Incorrect valve clearance	Check and adjust.
b) Burnt or bent valve(s)	Remove cylinder head and replace parts.

ENGINE MISSES AT ALL SPEEDS

POSSIBLE FAULT	REMEDY
1. Carburetor flooding	a) Remove and clean needle valve. b) Check float is not punctured or damaged.
2. Faulty spark plugs	Remove, clean and set plug points and, if needed install new plugs.
3. Plug lead(s) loose or damaged	Examine and, if necessary, install new plugs.
4. Plug lead(s) insulation Faulty	Replace leads.
5. Faulty valve operation due to:	
a) Broken votive spring	Examine and replace detective parts.
b) Valve sticking in guide	Check and clean valve
c) Incorrect valve dentifrice	Check and adjust.
d) Bent valve(s)	Remove cylinder head and install new valve(s).
6. Weak mixture due to: Fuel filter being partially-blocked.	Replace filter.

. ENGINE MISSES AT HIGH SPEEDS ONLY

POSSIBLE FAULT	REMEDY
1 Faulty spark plugs, or incorrect electrodes gap.	Remove, clean and set plug-electrodes gap and, if necessary, install new plugs.
2. Faulty valve operation due to:	
a) Incorrect valve clearance.	Check and adjust.
b) Valve sticking in guide.	Examine and replace detective parts.
c) Bent or badly-fitting valve*.	

*Defective valve(s) indicated by:

Popping or spitting in the carburetor - inlet; 'banging' in the exhaust silencer, examine and replace defective parts.

ENGINE LACKS POWER

POSSIBLE FAULT	REMEDY
1. Water supply low in engine cooling system.	Refill and check all coolant hoses and clips for safety.
2. Air leaks in induction system.	Check the Joints between: a) The cylinder head-and-intake manifold. b) The carburetor-and-intake manifold. If necessary, install new, joints/tighten nuts.
3. Carburetor(s) setting faulty.	Adjust carburetor(s).
4. Choke in "rich" position.	Return choke-control to correct position.
5. Defective heat exchanger.	a) Clear blockage (back-flush). b) Install new heat exchanger.
6. Oil diluted or of incorrect grade.	Drain the oil system and refill with the correct grade of oil.
7. Faulty thermostat	Test thermostat - replace if necessary.

DIFFICULT STARTING

POSSIBLE FAULT	REMEDY
1 . Weak spark due to:	
a) Faulty spark plugs.	Install new spark plugs.
b) Wet or fouled spark plugs.	Clean or replace.
2. Low compression	Check for: a) Correct valve clearance. b) Loose cylinder head. c) Blown cylinder-head gasket. d) Loose spark plug(s). e) Damaged or burnt valves. f) Worn piston rings. g) Worn cylinder heads.

ENGINE RUNS HOT

POSSIBLE FAULT	REMEDY
1. Water level low in cooling system	Refill and check all coolant hoses and clips for safety.
2. Air leaks in induction system.	Check the joints between: a) The cylinder head-and-intake manifold b) The carburetor-and-Intake manifold. If necessary, install new joints/tighten nuts.
3. Carburetor(s) setting faulty.	Adjust carburetor(s).
4. Choke in rich position	Return choke-control to correct position.
5. Defective heat exchanger or oil cooler.	a) Clear blockage (back -flush). b) Install new heat exchanger or oil cooler.
6. Oil diluted or of incorrect grade.	Drain oil system and refill with correct grade of oil.
7. Faulty thermostat.	Test thermostat - replace if necessary.
8. Insufficient differential pressure in system.	Increase pump pressure to minimum raw water 43.5 PSI differential.
9. Blocked strainer in raw water feed	Remove strainer and clean. from manifold.

PUMP FAULT-TRACING CHART

DEFECT	REMEDY
HIGH VACUUM GAUGE READING RELATIVE TO SUCTION LIFT	
Suction strainer choked.	Remove and clean.
FAILURE TO LIFT OR HOLD WATER	
1. Suction-hose joints leaking.	Check and tighten.
2. Suction strainer not completely immersed.	Check and submerge.
3. Defective exhaust primer.	Check and rectify.
4. Leaking priming valve.	Check and rectify.
5. Discharge valve leaking.	Check and rectify.
BROKEN JETS WITH 'AIR CRACKLE'	
1. Suction strainer: a) Not completely immersed. b) Too near the surface of the water supply.	Check and submerge.
2. Slight leaks on suction side of pump.	Check joints and tighten nuts.
THERMAL RELIEF VALVE ACTUATES	
1. Pump water overheating.	Avoid prolonged pumping with closed nozzles.

If the remedies presented here do not clear the fault, then proceed with the MONTHLY PUMP TEST as previously described.

HP550
PORTABLE FIRE PUMP
SPARE PARTS MANUAL

Please Note:

RECOMMENDED SPARES

Thank you for choosing a HALE Fire Pump - designed and built to provide many years of trouble-free service.

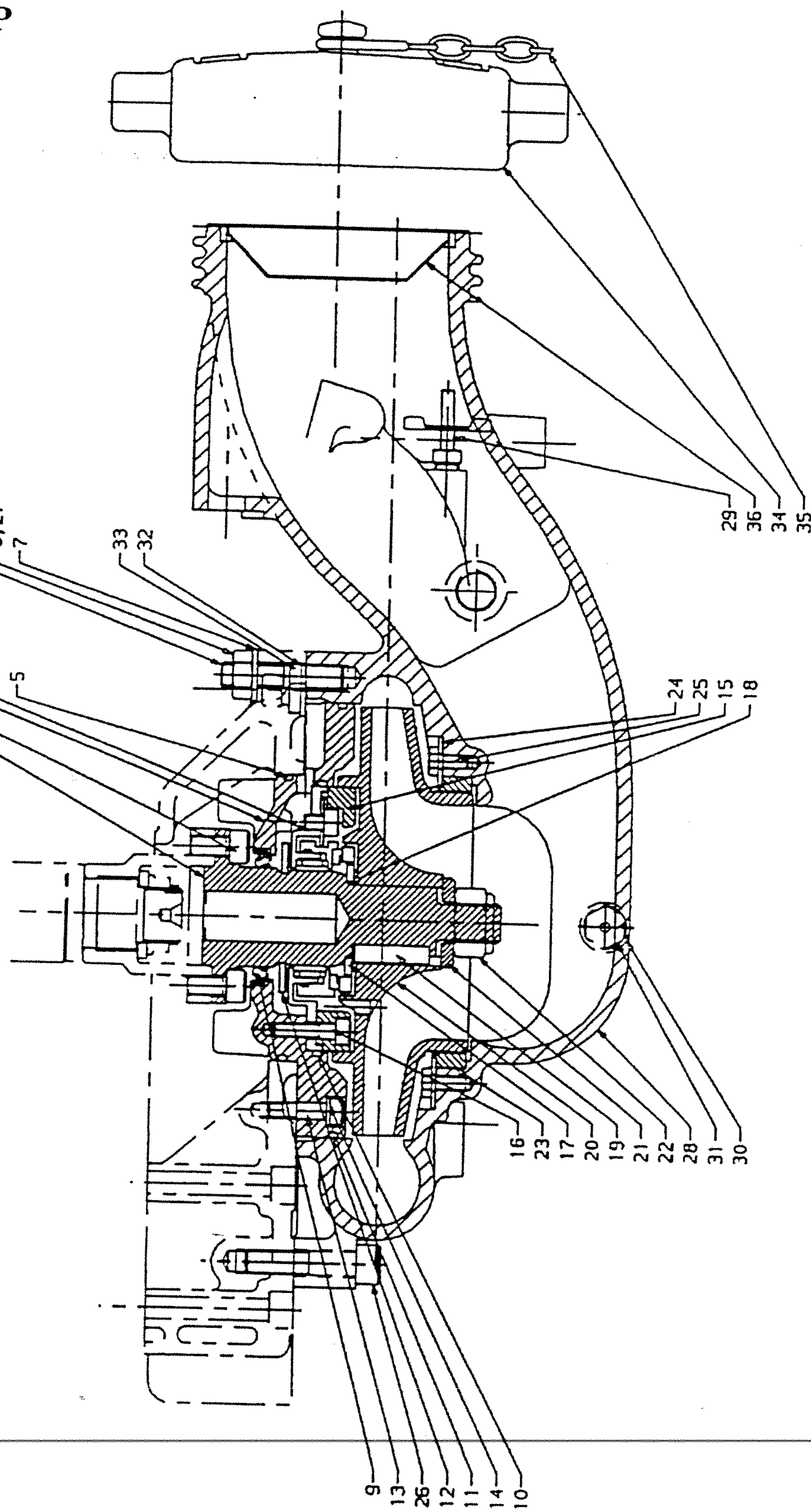
While we consider it to be the very best fire pump available today, we also recognize that any 'rotating' machinery is subject to wear and therefore we feel it necessary to bring to your attention our 2-years' Recommended Spares Listing - at the back of Part A for the PUMP and at the back of Part B for the ENGINE - in this book.

This stock-holding will enable you to maintain your pump in cases where minor defects occur and will also minimize any possibility of the pump being 'out of service' for extended periods of time.

HOW TO USE THE SPARE PARTS LIST

Select the appropriate group for the part required e.g. 'EXHAUST GAS EJECTOR'. Refer to the illustration to identify the particular part and note the 'Item No.' - this can be found in the parts list opposite - along with the appropriate 'Part No.', 'Description' and Quantity ('Qty') to enable an order to be correctly-placed.

PUMP



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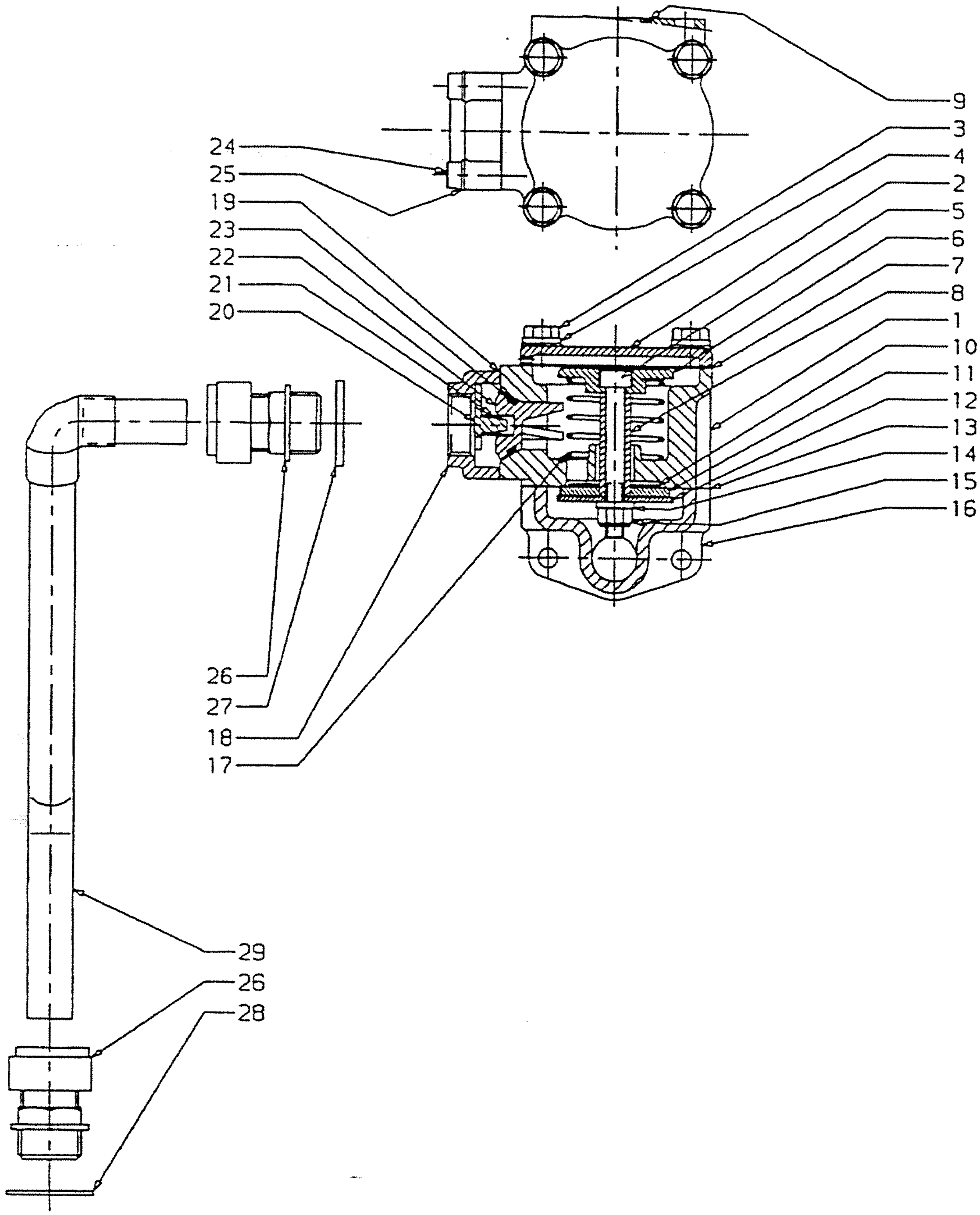
PUMP

Item No.	Part No.	Description	Qty	Remarks
1	55823/01	Pump drive shaft	1	
2	MS64/16	Screw M8, socket-head	6	
3	55697	Seal housing	1	
4	55824/01	Carbon seal assembly	1	
5	55831	'O' Ring	1	
6	MS149/35	Stud M10	5	Volute
7	MS25/10	Washer M10	5	-to-
8	MS35/9	Nut M10	4	adapter housing
9	56183	Seal, double lip	1	
10	55830	'O' Ring	1	
11	55832	'O' Ring	1	
12	55825	Flinger ring	1	
13	MS163/25	Screw M6, socket -head	4	
14	MS133/6	Dowty seal	4	
15	56091	Upper wear ring	1	
16	MS163/25	Screw M6, socket-head	4	
17	55826	Spacer ring	1	
18	52814	'O' ring	1	
19	MS180/3	Key	1	Impeller-to-shaft
20	55735/01	Impeller	1	
21	56187	Washer, impeller	1	
22	MS41/8	Nut MI 6, self-locking	1	
23	56070/01	Lower wear ring	1	
24	56182	Washer	2	Wear ring -
25	MS104/12	Screw M6	2	retaining.
26	MS65/45	Screw M10, socket-head	1	Volute-to-
27	56499	Extended nut M10	1	adapter housing
28	55696	Volute 4" R.T.	1	
-	55696/02	Volute 4 1/2" B.S.P.	1	
29	52119	Drain tap, volute 1		
30	UFP2303/5	Sealing washer 1/4m. BSP.	1	Plug
31	S64/2	Plug 1/4" BSP	1	
32	UFP2303/5	Sealing washer 1/4" BSP	1	Union
33	56403	Union 1/4" BSP	1	
34	FWP2004	Blank cap (4" R.T.)	1	
35	FWP 1062	Chain, blank cap	1	
36	52125/01	Suction strainer 4"	1	

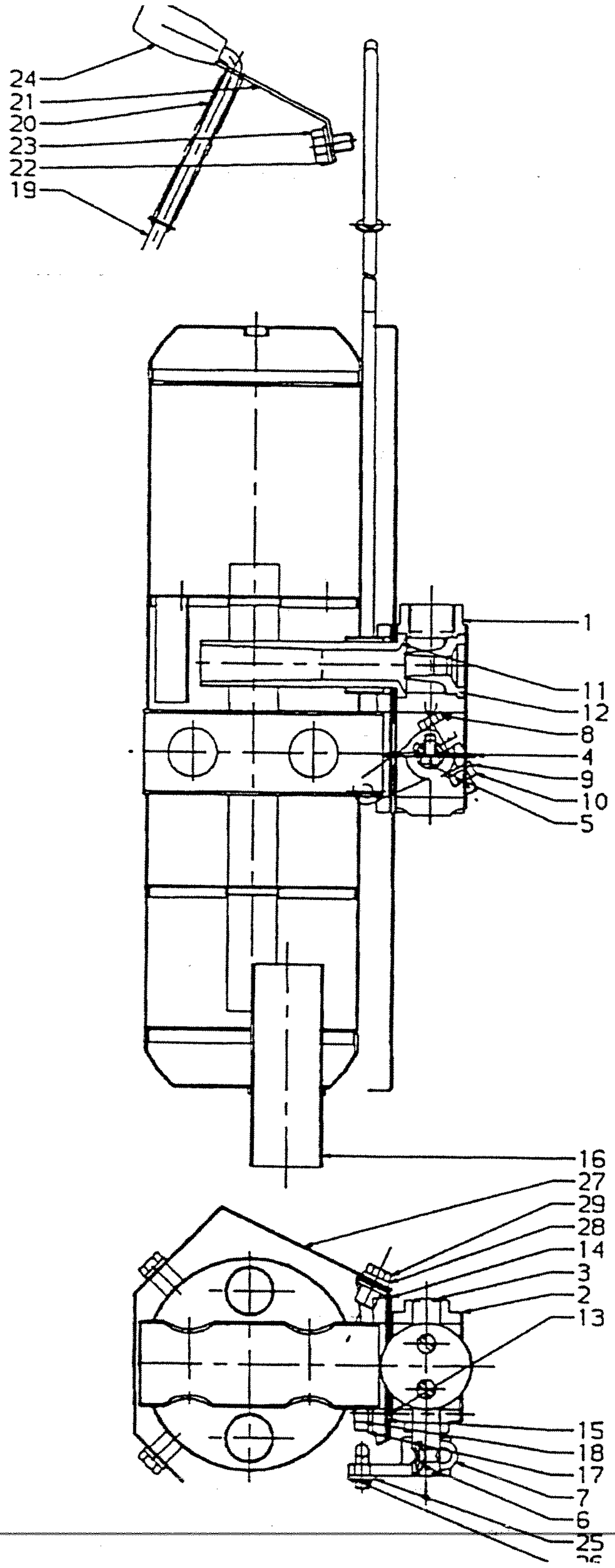
PRIMING VALVE



PRIMING VALVE

Item No	Part No.	Description	Qty	Remarks
-	56125	Priming valve assembly	1	
1	56119	Body	1	
2	56120	Diaphragm cover	1	
3	MS16/60	Bolt M6	4	Diaphragm cover-to-
4	MS25/7	Washer M6	4	priming valve assembly
5	MS163/50	Screw,socket head	1	
6	55666	Thrust rod	1	
7	56123	Diaphragm	1	
8	55665	Spacer	1	Between thrust pad and seal-support washer
9	56128	'O' ring	1	Between outlet valve & priming-valve body
10	55668	Seal retaining washer	1	
11	55669	Seal washer	1	
12	55670	Seal-support washer	1	
13	56124	Inlet gasket	1	Inlet housing-to-priming valve body
14	MS125/7	Washer M6	1	For
15	MS141/4	Nut M6,self-locking	1	seal support
16	56121	Inlethousing	1	
17	UMP9811	Spring	1	Between thrust pad and priming-valve body
18	56122	Outlet housing	1	
19	56127	Outlet gasket	1	Outlet housing-to-priming valve body
20	56378	Spring locator	1	
21	THC2198	Spring	1	Over Item 20
22	THC2194	Valve	1	
23	THA123/118	'O'ring	1	
24	MS62/20	Screw M5, sockethead	4	Outlet housing-to-
25	MS25/6	Washer M5	41	priming valve body
26	55873	Straight coupler assembly	2	
27	UFP2303/8	Sealing washer 1/2" BSP	1	
28	S41/10	Sealing washer (copper)	1	
29	55829	Priming pipe	1	
-	MS04/20	Screw M6	21	Priming valve-to-
-	MS25/7	Washer M6	2	suction tube

EXHAUST GAS EJECTOR



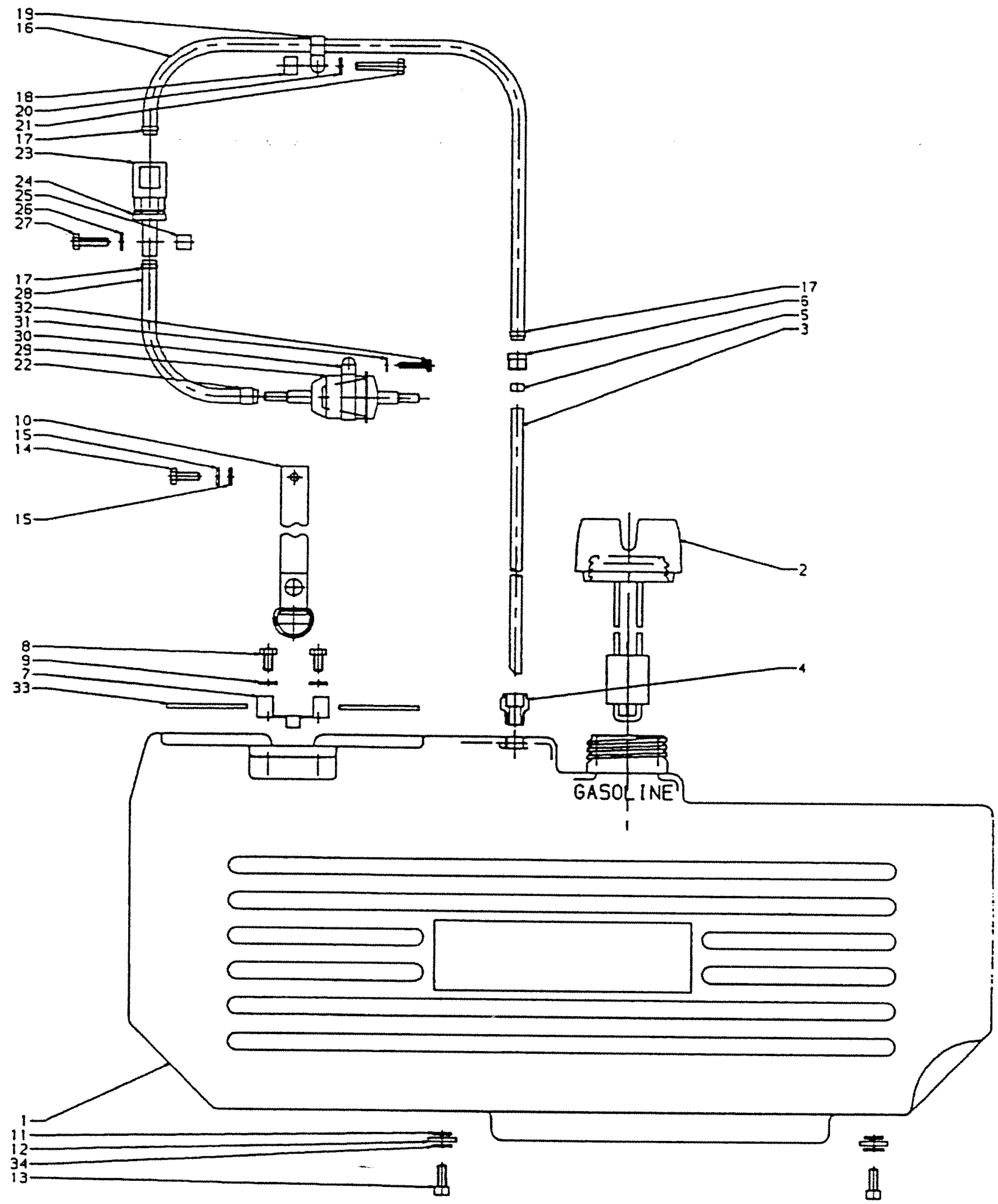
EXHAUST GAS EJECTOR

Item No.	Part No.	Description	Qty	Remarks
1	55737/01	Primer ejector housing	1	
2	55844	Gasket	1	Exhaust flange
3	GPR11743/1	Shaft, butterfly	1	
4	GPR11742	Butterfly valve	1	
5	MS171/48	Screw M5, cheese head	2	Volute-to-shaft
6	S25/3	Woodruff key	1	
7	FWMB 1160/3	Operating lever	1	Butterfly shaft
8	MS16/35	Bolt M6	1	Operating lever-
9	MS25/7	Washer M6	1	to-
10	MS35/7	Nut M6	1	shaft
11	55738	Primer ejector diffuser	1	
12	FWP1098/3	Ejector nozzle	1	
13	55844	Gasket	1	Ejector-to-heat shield
14	56174	Inner heat shield	1	
15	55844	Gasket	1	Heat shield-to-silencer
16	55739/01	Silencer	1	
17	MS25/9	Washer M8	4	Silencer -
18	MS35/8	Nut M8	4	to-ejector
19	55846	Primer operating rod	1	
20	GPR 11745	Compression spring	1	Primer rod return
21	56207	Guide brackets	1	Primer rod
22	MS25/9	Washer M8	1	Bracket-to-
23	MS05/12	Screw M8	1	discharge-manifold
24	52855	Handle	1	
25	MS27/3	Washer M6	1	
26	S31/C5	Split pin	1	
27	56173	outer heat shield	1	
28	MS127/3	Washer M6	8	Heat shields-
29	MS104/10	Screw M6	8	to-silencer
30	55177/01	Taper Plug	1	

COOLING SYSTEM

Item No.	Part No.	Description	Qty	Remarks
1	55752	Header tank	1	
2	56341/01	Clamp washer	3	
3	MS/127/3	Washer M6	3	
4	MS116/40	Screw M6	3	
5	56191	Filler cap, coolant	1	
6	55800/70	Starter rope	1	
7	MS82/5	Hose clip, 25-40mm range	1	Not shown
8	56096	Threaded cap, rope compartment	1	
9	55755/02	'O' ring	1	Header tank-to-heat exchanger
10	55753/05	Heat exchanger	1	
11	56168/01	Oil cooler	1	
12	56170	'O' ring, oil cooler	1	
13	MS63/16	Screw M6, socket head	1	
14	MS25/7	Washer M6	1	
15	UFP2303/7	Sealing washer 3/8" BSP	1	
16	55739/01	Restrictor Assembly	1	
17	51171	Tubing nut	4	
18	51170	Sleeve	4	
19	56221/03	Nylon tubing 12mm dia x .33mm	1	
20	56491	Formed tube .230mm	1	
21	56491/01	Formed tube .235mm	6	
22	56284	Elbow adapter	6	12mm to 3/8" BSP
23	56000	Elbow 15 mm to 3/8" BSP	1	
24	56309	Tee-piece assembly	1	
25	52119	Drain tap, volute	1	
26	56307	Hose, silicone rubber 15mm	1	
27	56306	Hose, silicone rubber 22mm	1	
28	MS82/3	Hose clip 20-32mm range	2	
29	56308	Pipe, swaged 15mm dia.	1	
30	55535	Tube nut 15mm dia.	1	
31	55536	Tubing sleeve 15mm dia.	1	

FUEL TANK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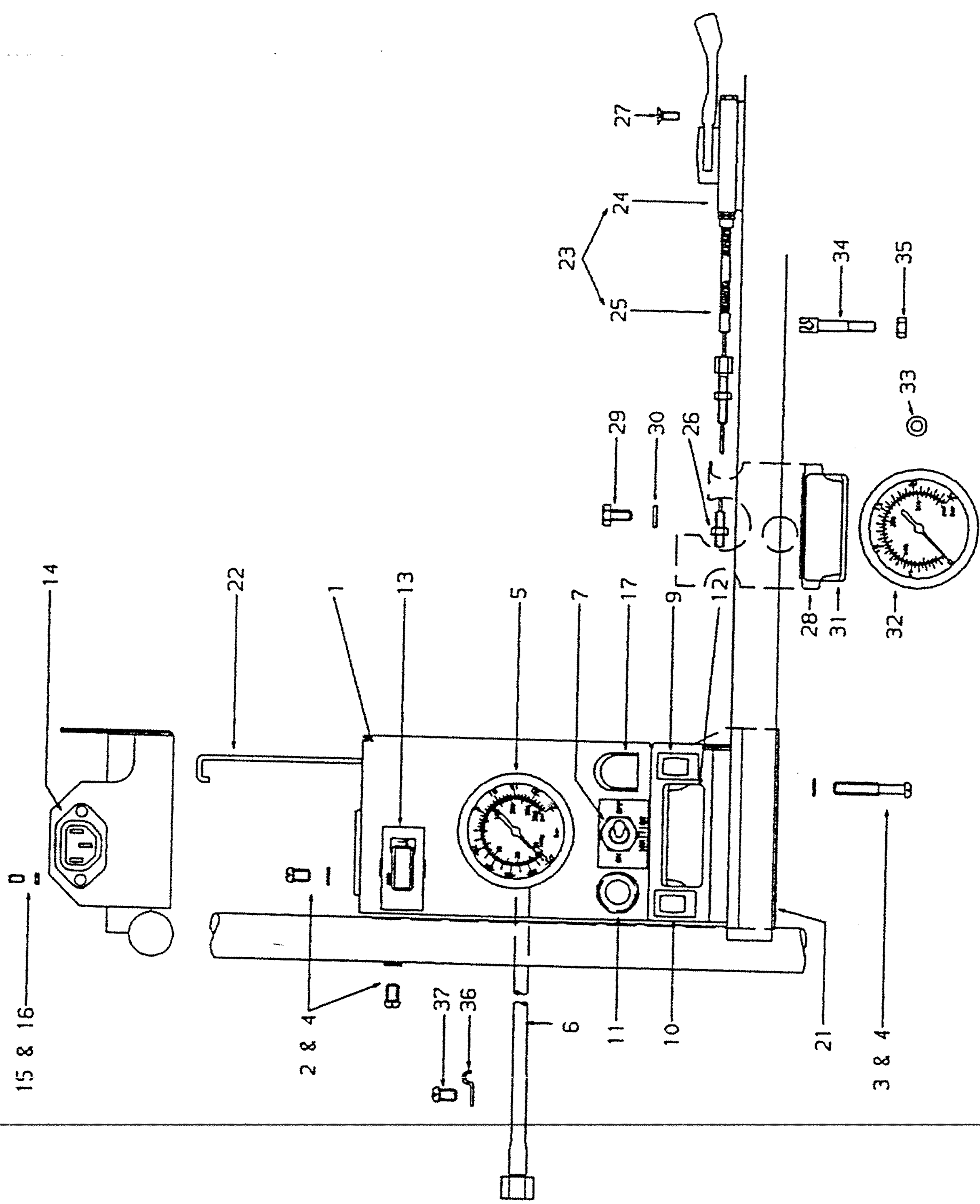
GASOLINE

FUEL TANK

Item No.	Part No.	Description	Qty	Remarks
1	55757	Fuel tank	1	
2	55881	Fuel gauge	1	
3	56531	Fuel suction pipe	1	
4	56532	Male adapter	1	
5	52799	Tubing sleeve 8mm	1	
6	GPNI2353	Tubing nut 8mm	1	
7	56142	Retaining bracket, battery	1	
8	MS04/12	Screw M6	2	Bracket-to-
9	MS25/7	Washer M6	2	tank
10	11796/03	Retaining strap, battery	1	
11	MS127/3	Washer M6	4	
12	56224/01	Rubber washer	4	
13	MS163/16	Screw M6, socket-head	4	
14	MS04/16	Screw M6	11	Battery strap-to-
15	MS27/3	Washer M6	2	fuel tank
16	56518	Fuel pipe	1	
17	9993	Tie, nylon insulated	3	
18	56167/01	Spacer	1	
19	53708/04	Clip, conduit	1	
20	MS25/7	Washer M6	1	
21	MS16/30	Bolt	1	
22	MS81/1	Hose clip	2	
23	55800/51	Connector A, fuel hose	1	
24	55800/50	Connector B, fuel hose	1	
25	55800/52	Collar 6mm	1	In Connector B
26	MS25/7	Washer M6	1	
27	MS04/20	Screw M6	1	
28	56518/01	Fuel pipe	1	
29	56088	Fuel filter, in-line	1	
30	56089	Clip, fuel filter	1	
31	MS25/4	Washer M4	11	Fuel-filter clip,
32	MS02/20	Screw M4	1	fuel pump
33	56539	Self-adhesive foam	2	
34	MS127/3	Washer M6 - large, heavy	4	

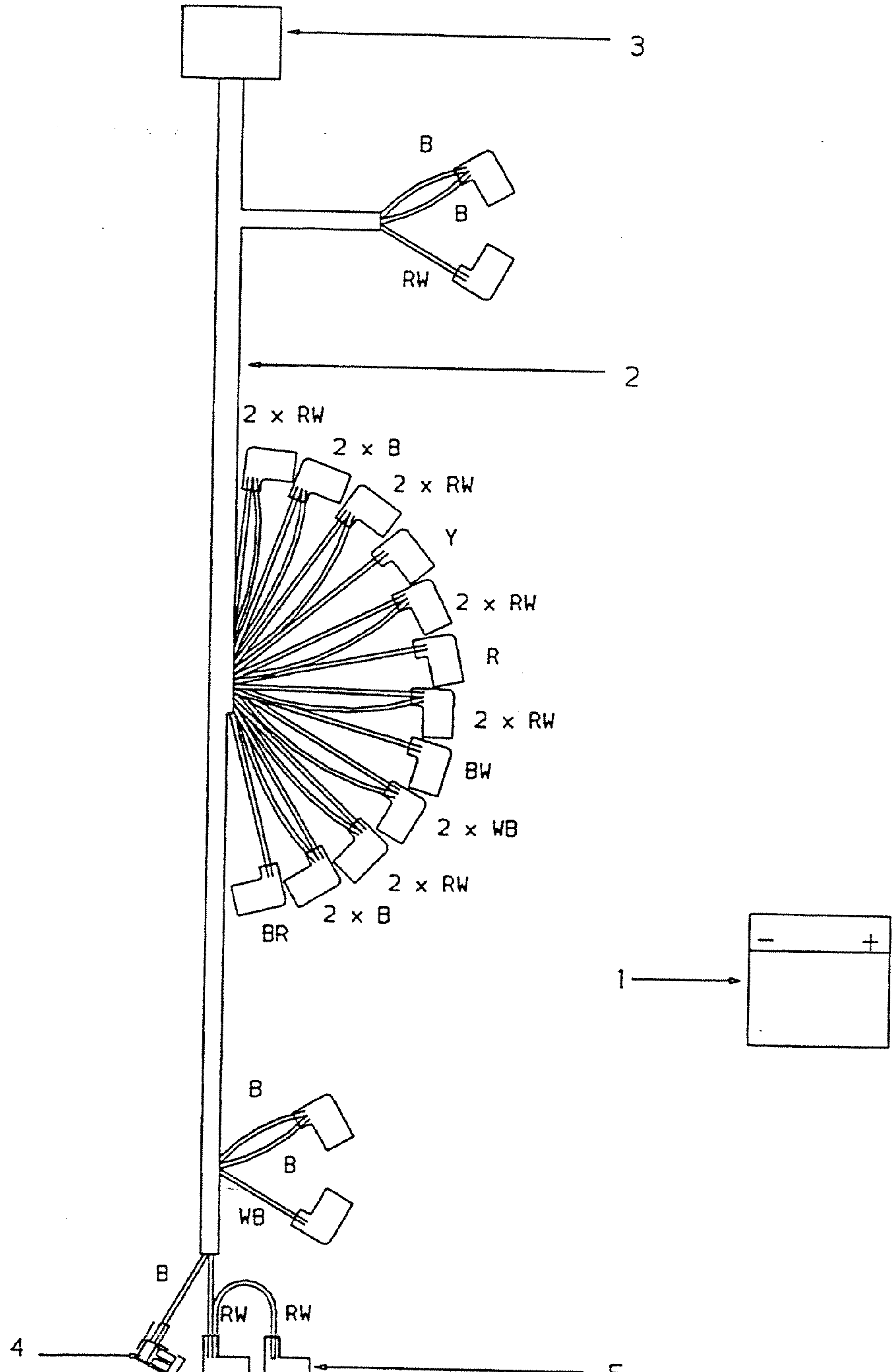
INSTRUMENTS AND CONTROLS



INSTRUMENTS AND CONTROLS

Item No.	Part No.	Description	Qty	Remarks
1	55911105	Instrument panel	1	
2	MS171/48	Screw M5, cheese-head	3	Instrument panel-
3	MS171/55	Screw M5, cheese-head	2	to-
4	MS125/6	Washer M5	5	cradle
5	56556	Compound gauge	1	
6	55891	Gauge-pipe assembly	1	
7	56342	Ignition switch	1	
8	FWMP7522	Seal, ignition switch	1	Not shown
9	56361	Warning lamp, oil pressure	1	
10	56361/01	Warning lamp, coolant temperature	1	
11	56362/01	Starter switch, push-button	1	
12	51599	Panel lamp, gauge illumination	1	
13	55871/01	Hours meter	1	
14	51594	Socket floodlight/battery-charging	1	
15	MS72/30	Screw M3, countersunk	2	
16	MS35/4	Nut M3	2	
17	55800/40	Choke knob	1	
18	55800/41	Guide, choke knob	1	Not shown
19	56040	Open grommet	1	Not shown
20	56041	'O' ring	1	Not shown
21	56245	Guard	1	
22	56112	Choke-operating rod	1	
23	56118	Throttle-cable assembly	1	Comprises Items
24	53670/03	Throttle control	1	
25	56117	Throttle-cable sub-assembly	1	
26	MS135/6	Nut M5	1	
27	MS172/49	Screw M5, countersunk	2	
28	55892/01	Illuminating-lamp bracket	1	
29	MS25/7	Washer M6	1	Bracket-to-
30	MS04/12	Screw M6	1	engine
31	51599	Illuminating-lamp, pressure gauge	1	
32	56557	Pressure gauge 0-25 bar	1	
33	50470	Washer	1	
34	56115	Cable anchor	1	Throttle cable
35	MS35/7	Nut M6	1	
36	56572	Tubing Clip	1	
37	MS171/48	Screw M5, cheese head	1	

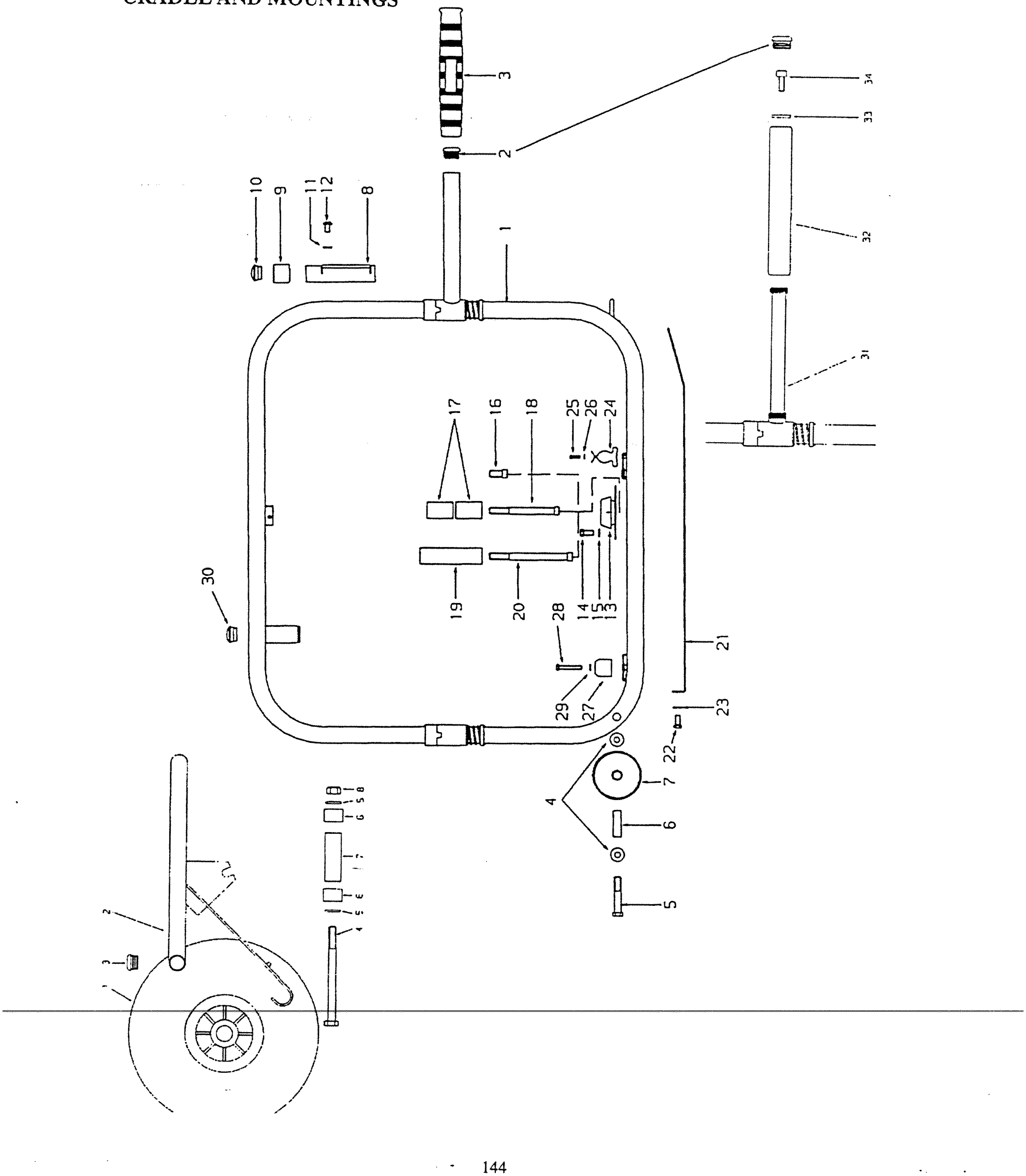
ELECTRICS - PUMP



ELECTRICS - PUMP

Item No.	Part No.	Description	Qty	Remarks
1	53627	Battery 18 Amp/hr	1	
2	55890/01	Wiring harness	1	
3	55800/62	Multi-pin plug	1	
-	56461	Loose pins	14	
-	56485	Terminal seal	6	Multi-pin plug
-	56486	Blanking plug	8	
4	56903	Flag Terminal	3	
5	56904	Terminal sleeve	3	

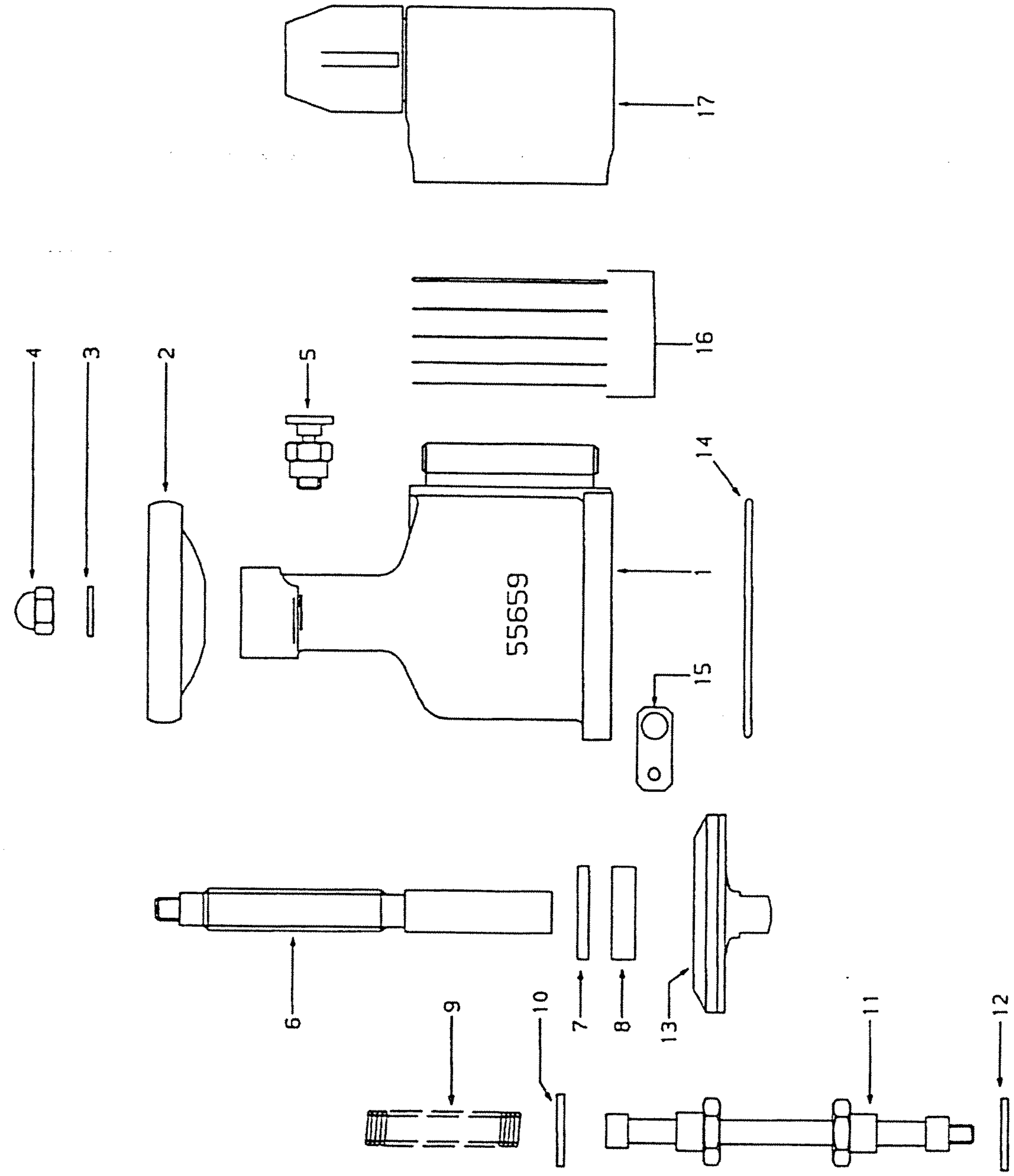
CRADLE AND MOUNTINGS



CRADLE AND MOUNTINGS

Item No.	Part No.	Description	Qty	Remarks
1	55689/02	Cradle	1	
2	50471/01	Blanking plug, handle	4	
3	50096	Grip, handle	4	
4	MS127/4	Washer M8	4	
5	MS117/55	Bolt M8	2	
6	55368/01	Wheel axle	1	
7	55370	Wheel, nylon	2	
8	56029	Cross member	1	
9	56030	Conduit bush, P.V.C.	1	Flood lamp support
10	56031/01	End plug	1	
11	MS125/7	Washer M6	4	Flood lamp-support
12	MS170/40	Screw M6, pan-head	4	cross member
13	56490	Anti-vibration mount	4	Mountings
14	MS104/16	Screw M6, hex-head	8	Mountings
15	MS125/7	Washer M6	8	Mountings
16	MS64/20	Screw M8, socket-head	2	Mountings
17	55854/01	Insulator	2	Mountings
18	MS64/100	Screw M8, socket-head	1	Mountings
19	56492	Spacer	1	Mountings
20	MS64/120	Screw M8, socket-head	1	Mountings
21	56422	Skid plate	1	
22	MS104/16	Screw M6, hex-head	4	
23	MS125/7	Washer M6	4	
24	56190	Clip	2	Secures
25	MS160/12	Screw M3, socket-head	2	suction
26	MS125/2	Washer M3	2	blank
27	56220	Wrench locator	2	cap
28	MS103/35	Screw M5	2	wrenches
29	MS125/6	Washer M5	2	to cradle
30	50471/02	Blanking Plug	1	
(Optional Extending Handles Unit)				
31	55689/03	Cradle	1	
32	56967	Handle - outer	4	
33	56969	Handle retainer	4	
34	MS64/20	Screw M8, socket-head	4	
Wheelbarrow Assembly - 56582				
1	56586	Wheel	1	
2	56583	Wheel frame	1	
3	50471/01	Blanking plug	2	
4	MS19/150	Bolt M 12, hex-head	1	
5	MS25/11	Washer Ml 2	2	
6	56585	Spacer	2	
7	56584	Axle	1	
8	MS41/7	Nut M12, Nylon	1	

DISCHARGE VALVES



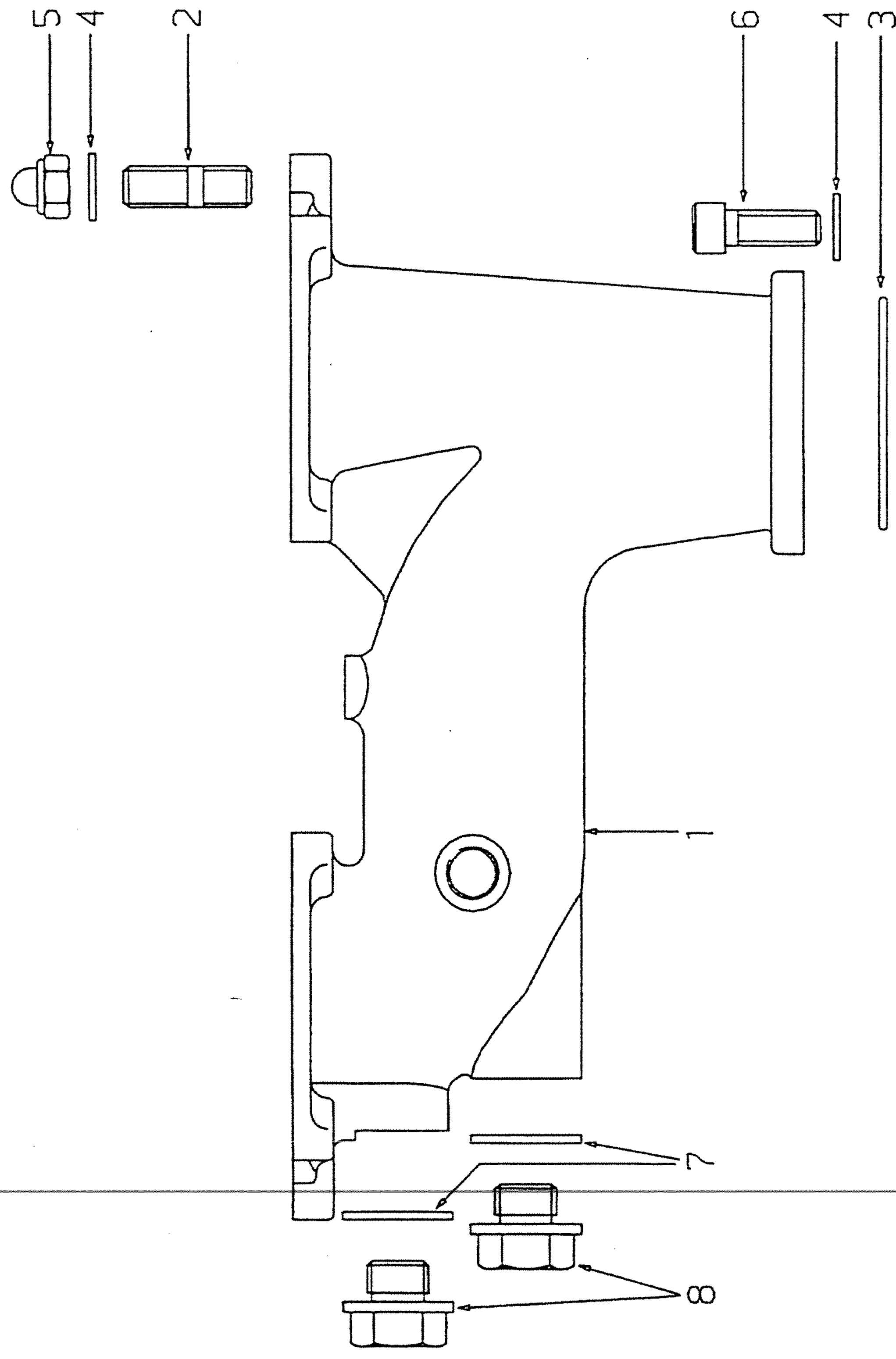
DISCHARGE VALVES

Item No.	Part No.	Description	Qty	Remarks
-	55662	Discharge valve assembly 2.5 I n. B S P		Comprises Items 1- 13 (1 per valve)
1	56469/01	Valve body		
2	56469/11	Hand wheel	1	
3	56469/12	Washer M 10	1	
4	56469/13	Nut, domed M 10	1	
5	56469/10*	Lock	1	For- hose-draining
6	56469/02	Spindle	1	
7	56469/03	Support ring	1	
8	56469/04*	Seal	1	
9	56469/09*	Spring	1	
10	56469/06	Safety lock	1	
11	56469/05	Stem assembly	1	
12	56469/08	Safety lock	1	
13	56469/07*	Plate	1	
14	54051*	'O'ring, valve-to-volute	2	
15	GPR11759/1	Anchor, blank-cap chain	1	
16	SATHM10722	Shim pack		
17	56559	Instantaneous connector 2 1/2"		

* These are available in discharge valve seal kit

56940/01	Seal kit - Continental discharge valve (Alum)
56940/02	Seal kit - Continental discharge valve (GM)
56940/03	Seal kit - Instantaneous connector (Cont'l & BV)

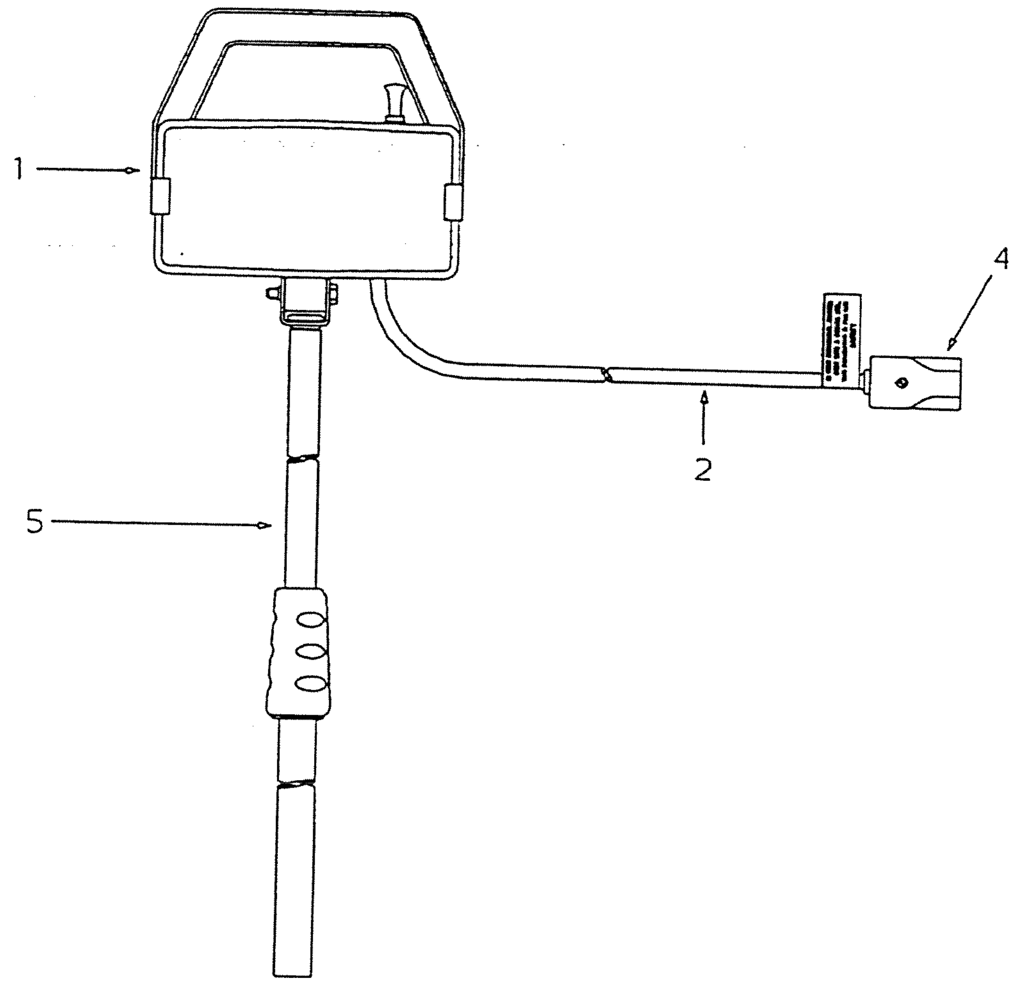
DISCHARGE MANIFOLD

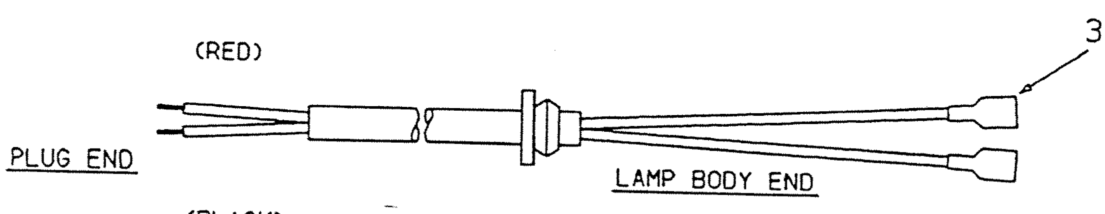


DISCHARGE MANIFOLD

Item No.	Part No.	Description	Qty	Remarks
1	55731	Discharge manifold	1	
2	MS49/25	Stud M 10	8	Discharge valves
3	55848	'O' ring	1	Manifold-to-volute
4	MS25/10	Washer M10	12	
5	MS42/5	Nut M10	8	Discharge-valve studs
6	MS165/30	Screw M10, socket-head	4	Manifold-to-volute
7	UFP2303/10	Sealing washer 3/4" BSP	1	
8	S64/6	Plug, shouldered 3/4" BSP	1	

FLOODLIGHT



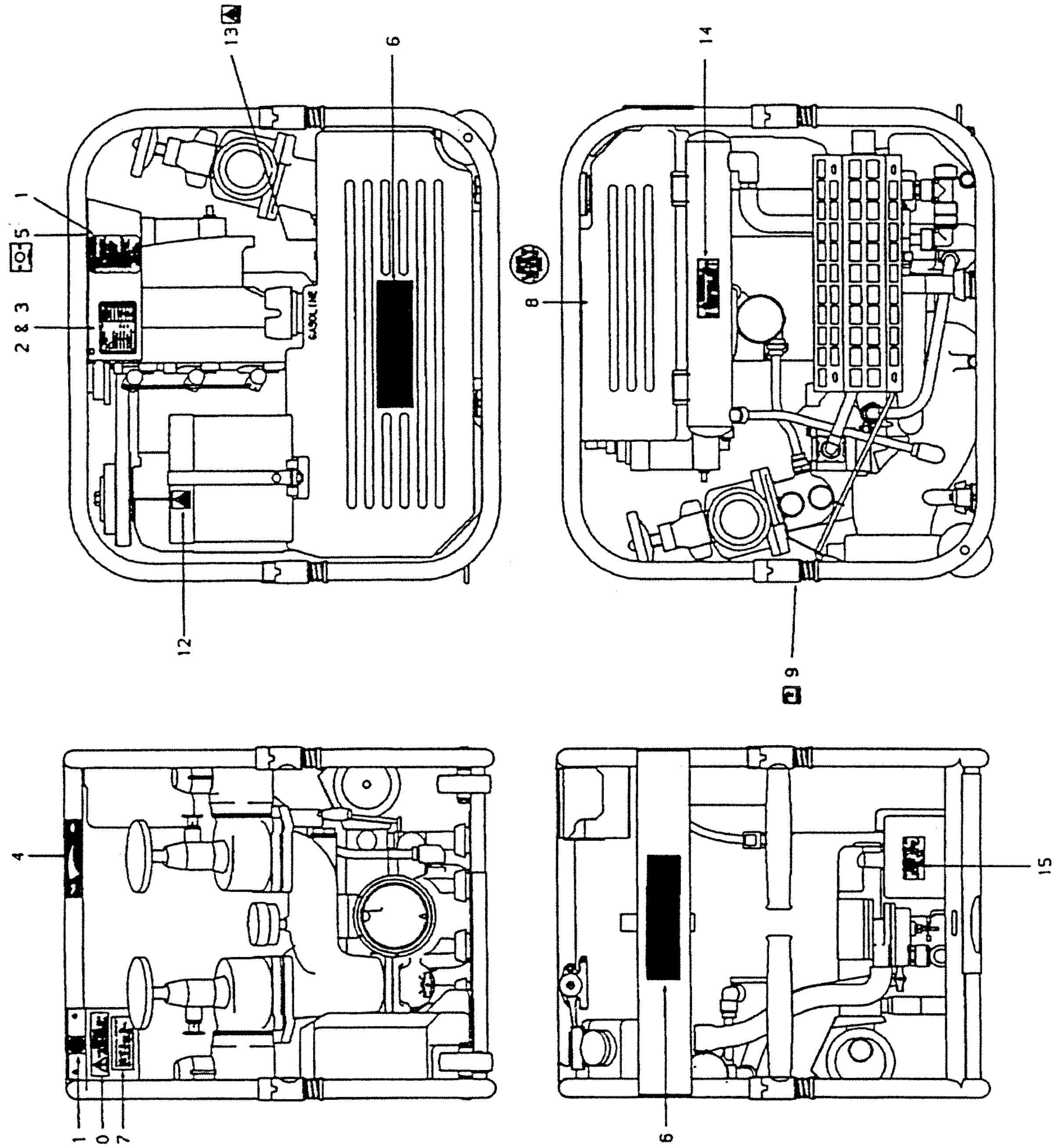


53644/02 CABLE DETAIL

FLOODLIGHT

Item No.	Part. No.	Description	Qty	Remarks
-	56504	Floodlight	1	(Optional)
1	536421	Floodlight	1	
2	53644/0-2	Cable, floodlight	1	
3	9535/2	Insulated terminal	3	
4	55682	Plug	1	
5	56505	Telescopic-stem assembly	1	

LABELS AND INSTRUCTION PLATES



LABELS AND INSTRUCTION PLATES

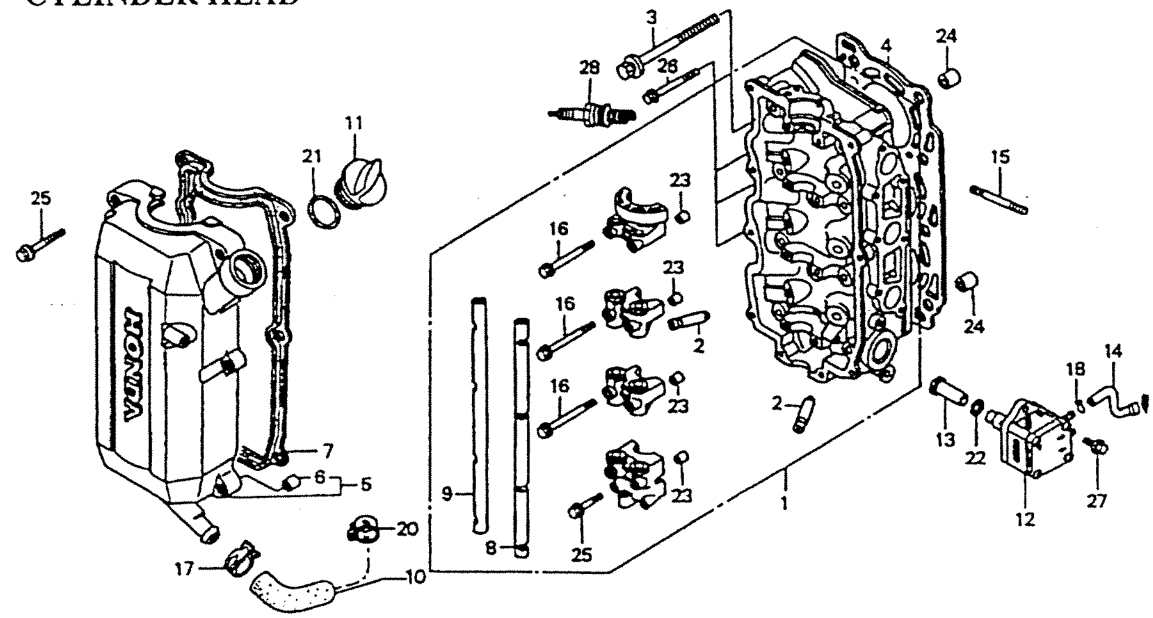
Item No.	Part No.	Description	Qty	Remarks
1	56267	Instruction Plate	1	
2	56268	Serial Number Plate	1	
3	DSM8135/1	Pop rivet	4	
4	56269	Instruction plate - Throttle	1	
5	56270	Instruction plate - Ignition	1	
6	53694	Nameplate, large	2	
7	56212	Weight decal	1	
8	56367/01	Warning plate, rope-start	1	
9	56483	Label - 'Pull To Prime'	1	
10	56587/04	Label - 'Trained Personnel'	1	
11	56587/03	Label - 'Earmuffs'	1	
12	56587/02	Label - 'Corrosive'	1	
13	56587/01	Label - 'Flammable'	1	
14	56587/05	Label - 'Hot Exhaust'	1	
15	51166	Label - 'Manufactured by'	1	
-	56871	Label - 'Differential Pressure'	1	Not Shown

RECOMMENDED SPARES - PUMP

Part No.	Description	Qty
55824/01	Carbon seal assembly	1
56183	Seal, seal housing-to-pump shaft	1
55825	Flange ring	1
55830	'O' ring, seal housing	1
55831	'O' ring, seal housing-to-adapter housing	1
55832	'O' ring, seal housing-	1
52814	'O' ring	1
MS41/8	Nut, self-locking, impeller-to-shaft	1
MS180/3	Key, impeller-to-shaft	1
UFP2303/5	Seating washer	2
MS133/6	Dowty seal, M8 screws	4
56070/01	Lower wear ring	1
56091	Upper wear ring	1
S41/10	Sealing washer (soft copper) coupling	2
56123	Diaphragm, priming valve	1
56128	'O' ring, priming valve	1
56124	Inlet gasket, priming valve	1
56127	Outlet gasket, priming valve	1
THA123/118	'O' ring, priming valve	1
THC2198	Spring, priming valve	1
55844	Gasket, exhaust-gas ejector	3
MS82/3	Hose clip	4
56307	Hose 15 mm (silicone-rubber)	1
56306	Hose 22 mm (silicone-rubber)	1
~~55755~~	~~'O' ring, heat exchanger-to-header tank~~	~~1~~
56088	Fuel filter	1
54051	'O' ring, discharge valve-to-volute	2

The company reserves the right to chance details of equipment and product specifications without prior notice as a part of its policy of continuous improvement.

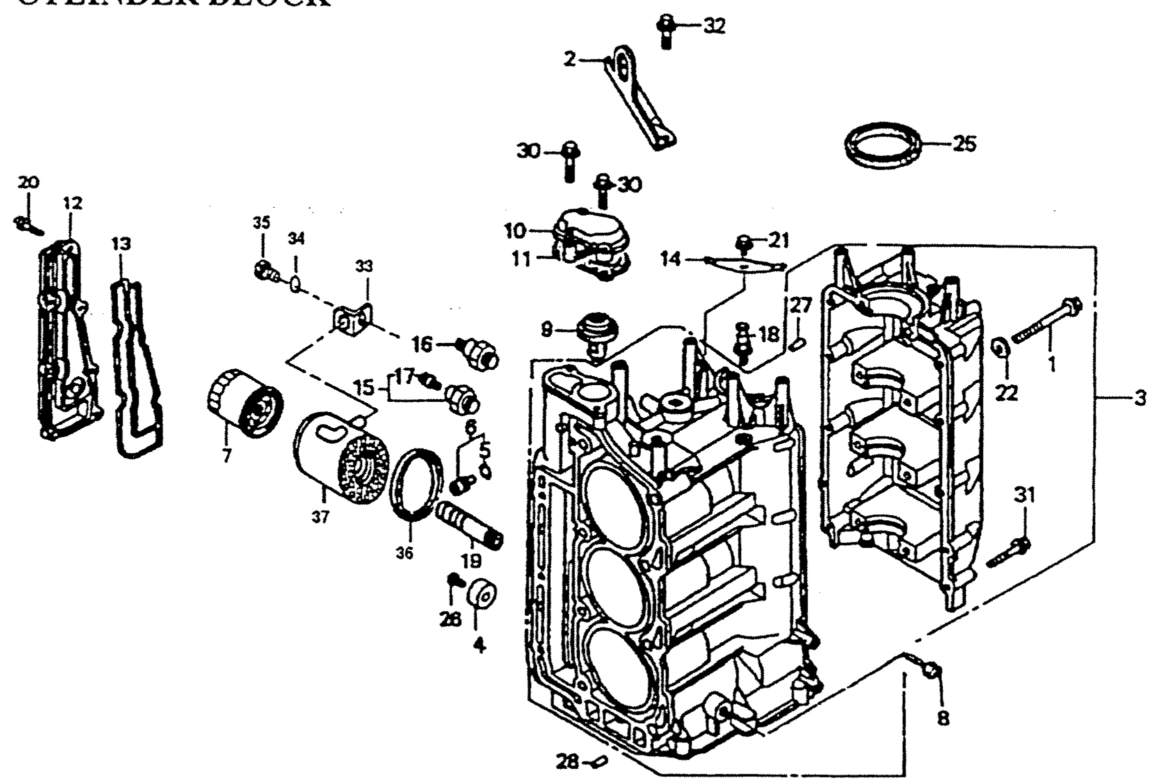
CYLINDER HEAD



CYLINDER HEAD

Item No.	Part No.	Description	Qty	Remarks
1	56589	Cylinder head assembly	1	
2	56590	Valve guide (0.52 oversize)	6	
3	56591	Bolt M 10 x 85	8	
4	56592	Gasket, cylinder head	1	
5	56593	Cover, cylinder head	1	
6	56594	Collar, cover	1	
7	56595	Gasket, cover	1	
8	56596	Inlet rocker shaft	1	
9	56597	Exhaust rocker shaft	1	
10	56111	Oil-return hose	1	
11	56598	Oil filler cap	1	
12	56599	Fuel pump assembly	1	
13	56600	Lifter, Oil pump	1	
14	56601	Fuel tube '13'	1	
15	56602	Stud 6 x 28	2	
16	56603	Bolt 6 x 70	8	
17	55800/34	Clamp, oil-return hose	1	
18	56604	Clip, tube B 10	1	
19	56605	Clip, tube B 12	1	
20	55800/35	Clamp, oil-return hose	1	
21	56606	'O' ring 26 x 2.7	1	
22	56607	'O' ring 20.8 x 2.4	1	
23	56608	Dowel pin 8 x 14	8	
24	55800/20	Dowel pin 6 x 10	2	
25	56609	Bolt 6 x 35	9	
26	56610	Bolt 8 x 40	3	
27	56611	Bolt 6 x20	2	
28	56612	Spark plug DR7 EA	3	Either
-	56613	Spark plug X22ESR-UND	3	type

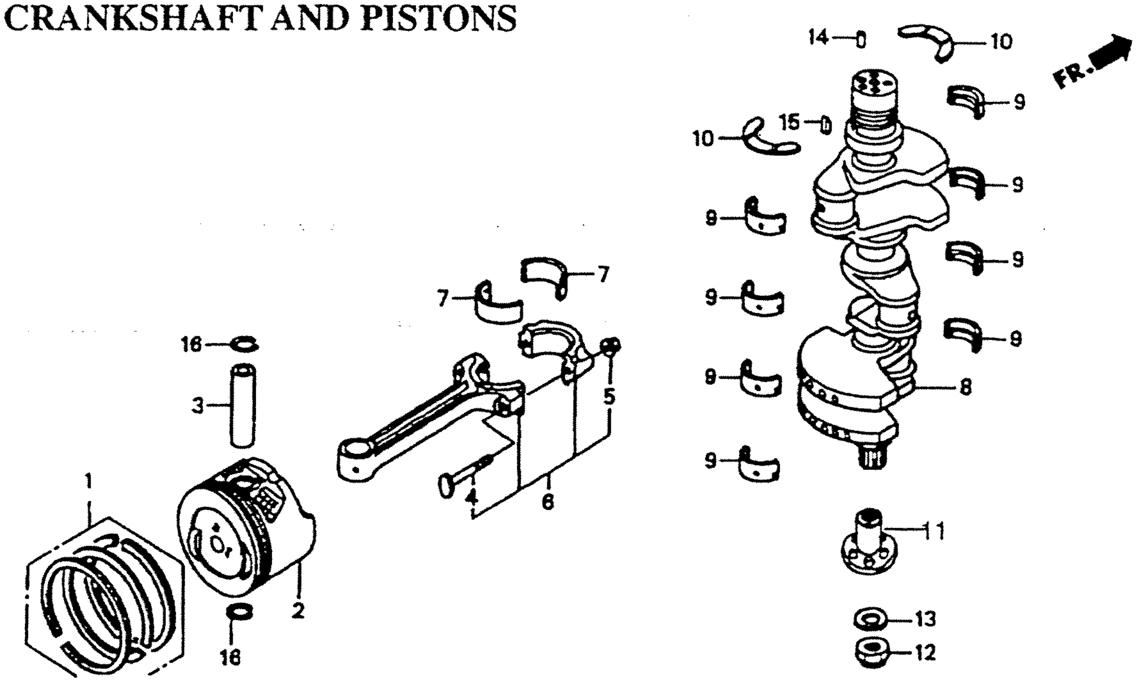
CYLINDER BLOCK



CYLINDER BLOCK

Item No.	Part No.	Description	Qty	Remarks
1	56614	Bolt 8 x 95	8	
2	56615	Engine hanger	1	
3	56616	Cylinder block	1	
4	56617	Sacrificial anode	1	
5	56618	'O' ring 4.8 x 1.9	1	
6	56619	Orifice assembly, oil	1	
7	55800/29	Oil filter cartridge	1	
8	S51/1	Plug, taper socket 1/8" BSP	1	
9	56620	Thermostat assy	1	
10	56621	Thermostat cover	1	
11	56622	Gasket, thermostat cover	1	
12	56623	Water jacket cover	1	
13	56624	Gasket, water jacket cover	1	
14	56625	Cord holder	1	
15	56626	Oil pressure switch	1	
16	56627	Switch assembly, thermostat	1	
17	56628	Screw, oil pressure switch 4 x 8	1	
18	56629	Anchor, turning-belt adjuster spring	1	
19	56169	Hollow stud, oil filter and cooler	1	
20	56630	Bolt, water jacket 6 x 22	7	
21	56631	Bolt, cord holder 6 x 12	1	
22	56612	Washer M8	8	
23	Not Used	-	-	
24	Not Used	-	-	
25	56633	Oil seal 56 x 70 x 8	1	
26	56634	Screw, pan-head 6 x 18	1	
27	56635	Dowel pin 10 x 12	8	
28	56636	Pin A, dowel 12 x 16	2	
29	Not Used	-	-	
30	56611	Bolt 6 x 20	2	
31	56638	Bolt 6 x 40	10	
32	56637	Bolt 8 x 18	2	
33	56171/01	Anti-turn bracket, oil cooler	1	
34	MS25/7	Washer M6	1	
35	MS04/12	Screw M6	1	
36	56170	'O' ring, oil cooler	1	
37	56168/01	Oil cooler	1	

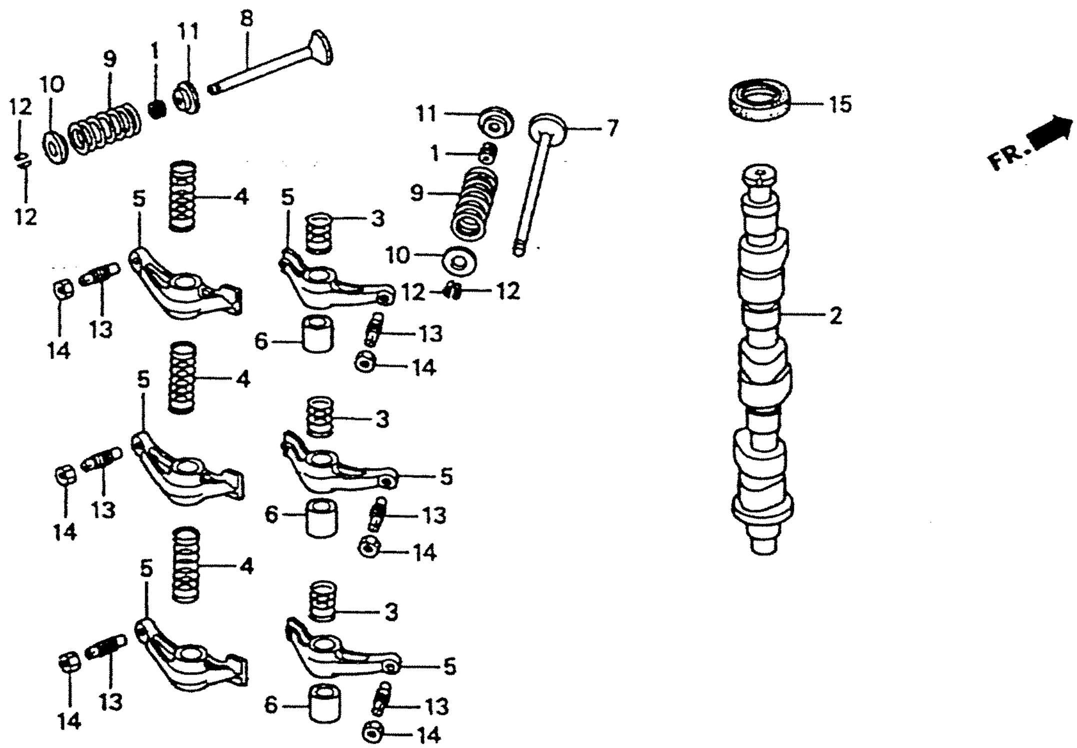
CRANKSHAFT AND PISTONS



CRANK SHAFT AND PISTONS

Item No.	Part No.	Description	Qty	Remarks
1	56639	Piston ring set (single piston)	3	
2	56640	Piston	3	
3	56641	Piston pin	3	
4	56642	Connection rod bolt	6	
5	56643	Connection rod nut	6	
6	56644	Connecting rod assembly	3	Includes Items 4 and 5
7	56645	Connecting rod bearing A (Blue)	6	See Reference Chart A
-	56646	Connecting rod bearing A (Blue)	6	See Reference Chart A
-	56647	Connecting rod bearing B (Black)	6	See Reference Chart A
-	56648	Connecting rod bearing B (Black)	6	See Reference Chart A
-	56649	Connecting rod bearing C (Brown)	6	See Reference Chart A
-	56650	Connecting rod bearing C (Brown)	6	See Reference Chart A
-	56651	Connecting rod bearing D (Green)	6	See Reference Chart A
-	56652	Connecting rod bearing D (Green)	6	See Reference Chart A
-	56653	Connecting rod bearing E (Yellow)	6	See Reference Chart A
-	56654	Connecting rod bearing E (Yellow)	6	See Reference Chart A
-	56655	Connecting rod bearing F (Pink)	6	See Reference Chart A
-	56656	Connecting rod bearing F (Pink)	6	See Reference Chart A
-	56657	Connecting rod bearing G (Red)	6	See Reference Chart A
-	56658	Connecting rod bearing G (Red)	6	See Reference Chart A
8	56659	Crankshaft	1	
9	56660	Main bearing A (Blue) (Daids)	8	See Reference Chart B
-	56661	Main bearing B (Black) (Daids)	8	See Reference Chart B
-	56662	Main bearing C (Brown) (Daids)	8	See Reference Chart B
-	56663	Main bearing D (Green) (Daids)	8	See Reference Chart B
-	56664	Main bearing E (Yellow) (Daids)	8	See Reference Chart B
-	56665	Main bearing F (Pink) (Daids)	8	See Reference Chart B
-	56666	Main bearing G (Red) (Daids)	8	See Reference Chart B
10	56667	Thrust washer	2	
11	55822	Pump-drive adapter	1	
12	55800/22	Nut M22	2	
13	55800/23	Washer M22	1	
14	56668	Dowel pin	1	
15	56669	Woodruff key 25 x 14	1	
16	56670	Clip, piston pin 18mm	6	

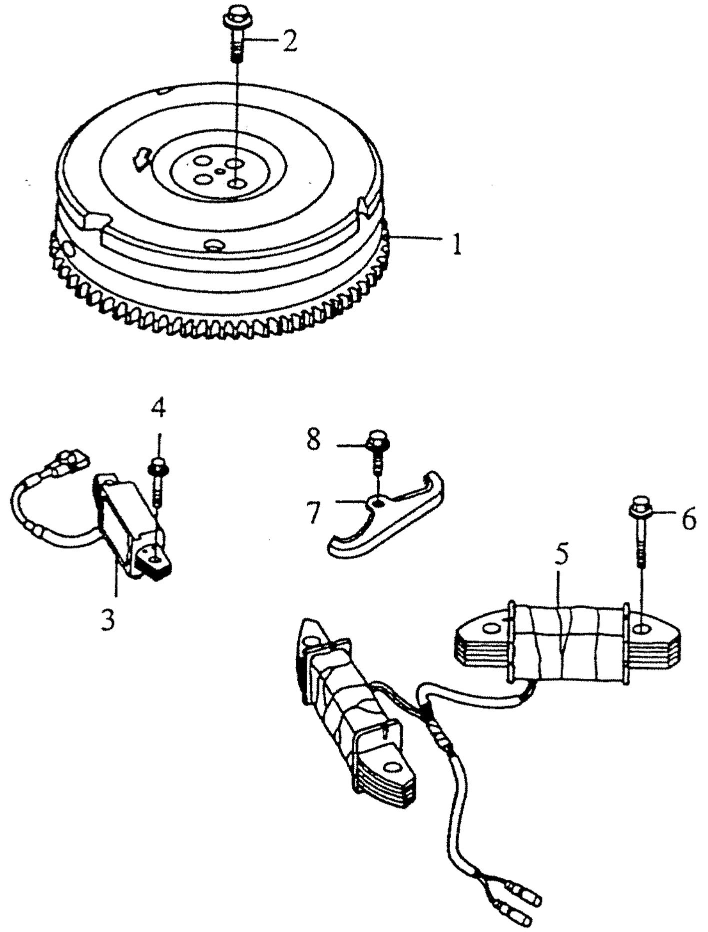
CAMSHAFT AND VALVE GEAR



CAMSHAFT AND VALVE GEAR

Item No.	Part No.	Description	Qty	Remarks
1	56671	Valve-stem seal	6	
2	56672	Camshaft	1	
3	56673	Spring, rocker arm (A)	3	
4	56674	Spring, rocker arm (B)	3	
5	56675	Rocker arm	6	
6	56676	Collar, rocker arm	6	
7	56677	Inlet valve	3	
8	56678	Exhaust valve	3	
9	56679	Valve spring	6	
-	56680	Valve spring	6	Not shown
10	56681	Retainer, valve spring	6	
11	56682	Seat, valve spring	6	
12	56683	Cotter, valve	12	
13	56684	Tappet-adjuster screw	6	
14	56685	Nut, adjuster screw	6	
15	56686	Oil seal, camshaft 30 x 42 x 8	1	

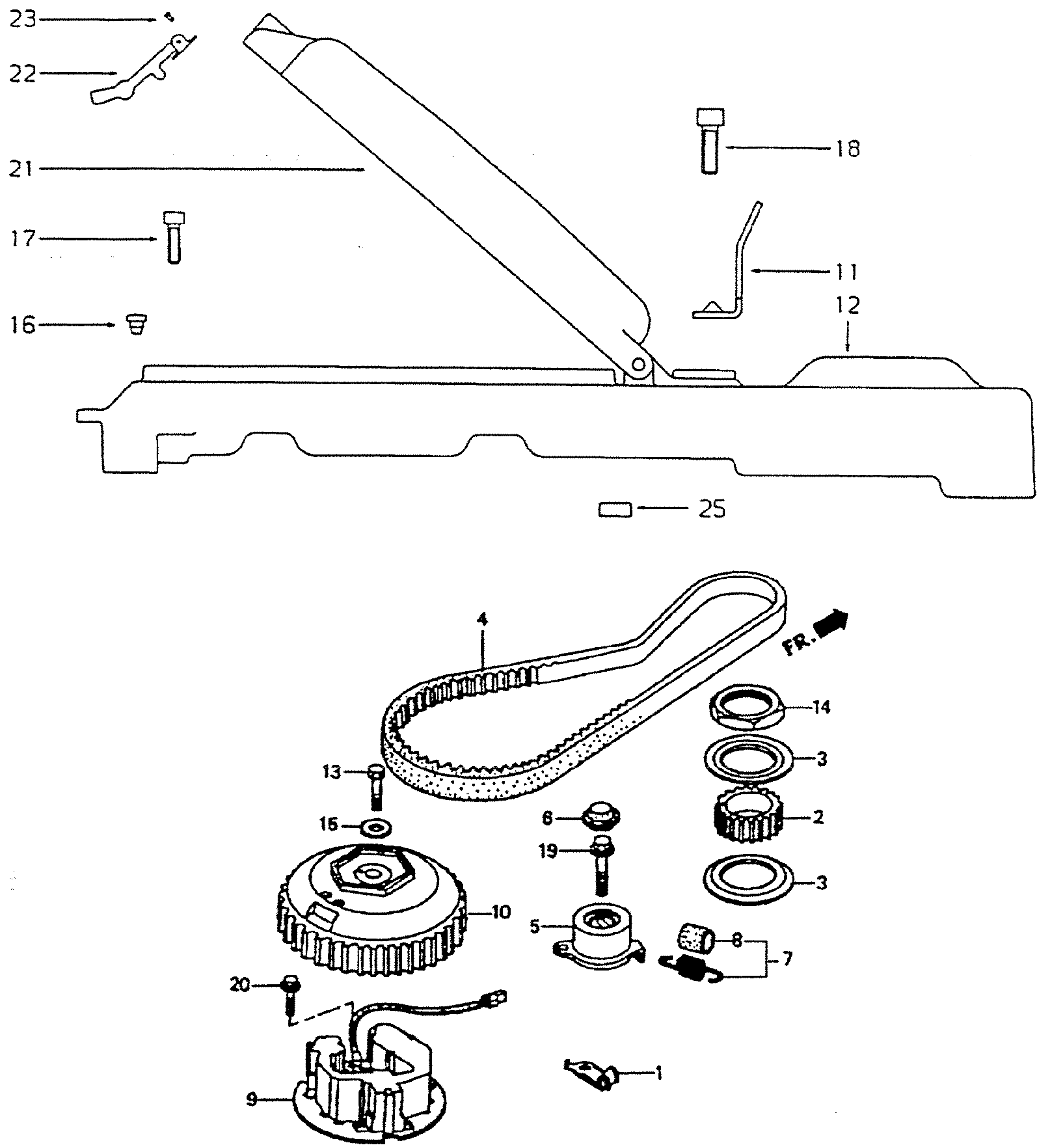
FLYWHEEL, EXCITER AND CHARGE COILS



FLYWHEEL, EXCITER AND CHARGE COILS

Item No.	Part No.	Description	Qty	Remarks
1	56687	Flywheel	1	
2	56688	Flange bolt 10 x 25	4	
3	56689	Exciter coil assembly	1	
4	56690	Flange bolt 6 x 25	2	
-	56691	Charge coil kit (10A)	1	Comprises Items 5-8
5	56692	Charge coil assembly (12V, 10A)	1	
6	56693	Flange bolt 6 x 32	2	
7	56694	Cord holder	1	
8	56713	Flange bolt 6 x 12	1	

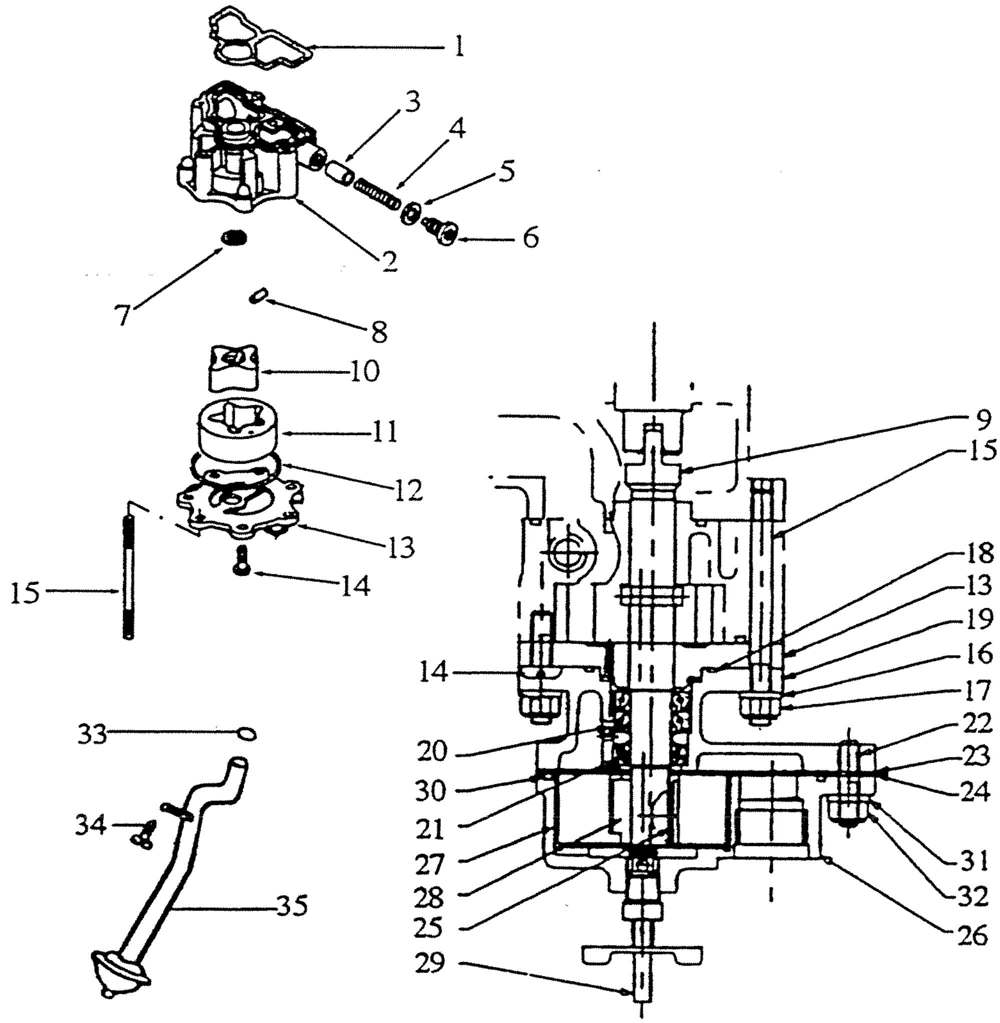
FLYWHEEL COVER AND TIMING BELT



FLYWHEEL COVER AND TIMING, BELT

Item No.	Part No.	Description	Qty	Remarks
1	56695	Tube Clamp	1	
2	56696	Timing Pulley	1	
3	56697	Guide plate, timing belt	2	
4	56698	Timing-belt	1	
5	56699	Tensioner, timing belt	1	
6	56700	Cap, tensioner	1	
7	56701	Tensioner spring	1	
8	56702	Boot, tensioned spring	1	
9	56703	Pulser coil assembly	1	
10	56704	Pulser rotor	1	
11	56890	Lifting lug	1	
12	56560	Flywheel cover	4	
13	56706	Flange bolt 10x 32	1	
14	56707	Locknut M48	1	
15	56708	Washer 10 x 28 x 5	1	
16	56873	Plug	4	
17	MS163/20	Screw M6, socket head	2	
18	MS164/25	Screw M8, socket head	1	
19	56712	Flange bolt 10x 38	1	
20	56713	Flange bolt 6 x 12	2	
21	56561	Hinged cover	1	
22	56562	Flexible tab handle	1	
23	53854/01	Screw, hammer driven	2	
24	MS163/25	Screw M6 X 25, socket-head	4	Not shown
25	MS177/138	Spiral pin	2	

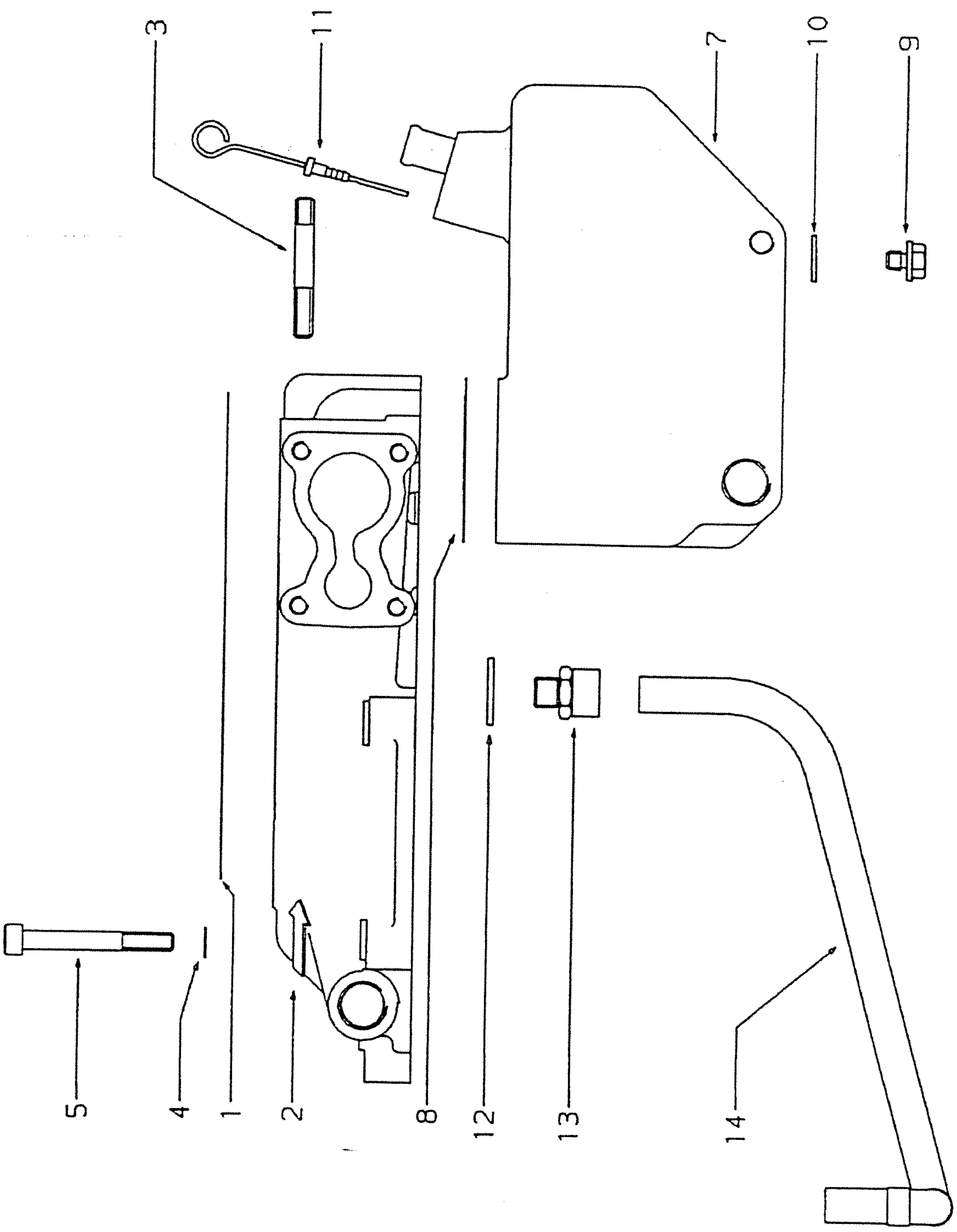
· OIL AND WATER PUMPS



OIL AND WATER PUMPS

Item No.	Part No.	Description	Qty	Remarks
1	56714	Gasket	1	Housing-to-manifold
2	56715	Housing, oil PUMP	1	
3	56716	Relief let, valve	1	
4	56717	Spring, relief valve	1	
5	56718	Sealing washer 14mm	1	
6	56719	Bolt, scaling	1	
7	56720	Thrust washer 13mm	1	
8	56721	Roller 5 x 17,8	1	
9	55804	Oil/water pump-drive shaft	1	
10	56722	Inner rotor	1	
11	56723	Outer rotor A	1	
12	56724	'O' ring	1	
13	55805	Cover plate	1	
14	55800/07	Screw, pan-head 6 x 16	1	
15	MS47/60	Stud 6 x 60	4	
16	MS25/7	Washer M6	4	
17	MS41/4	Nut M6, self-lock	4	
18	55809	'O'ring	1	
19	55806	Seal housing	1	
20	55810	Oil seal		
21	55811	Oil seal	1	
22	MS47/16	Stud 6 x 16	4	
23	55800/03	Gasket, B-impeller	1	
24	55800/04	Impeller cover	1	
25	55812	Woodruff key	1	
26	55807	Impeller housing	1	
27	55800/02	Pump liner	1	
28	55935/01	Impeller sleeve, sub-assembly	1	
29	52119	Drain tap, coolant	1	
30	55800/05	'O'ring, water pump	1	
31	MS25/7	Washer M6	4	
32	MS41/4	Nut M6, self-lock	4	
33	55800/31	'O' ring 13.8 x 2.5	1	
34	55875/01	Oil suction strainer	1	
35	MS64/75	Screw M8, socket-head	1	
-	56065	Adapter 15mm pipe	1	
-	56059	Equal tee-piece	1	
-	56063	Plug	1	
-	56062	Pipe 15mm	1	
-	56487	Pipe support sleeve	2	
-	56060	Elbow 90 15mm	1	
-	56062/01	Pipe 15mm	1	
-	56487	Pipe support sleeve	2	
-	56061	Adapter 15mm pipe	1	

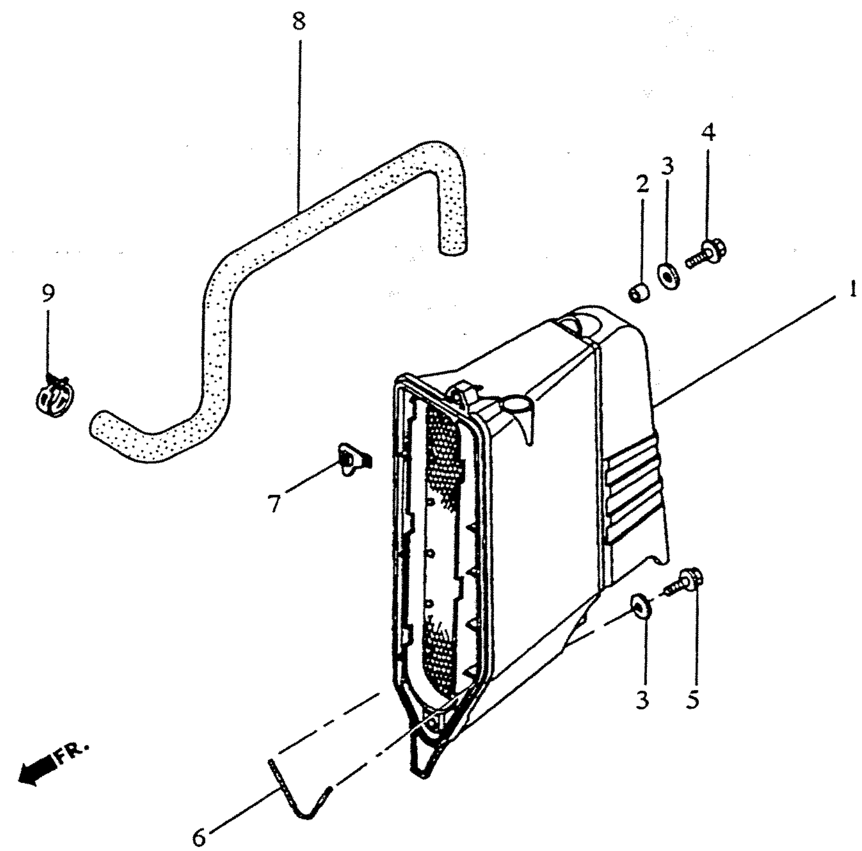
ADAPTOR HOUSING AND OIL SUMP



ADAPTER HOUSING AND OIL SUMP

license No.	Part No.	Description	Qty	Remarks
1	55880/21	Gasket, adapter	1	Housing-to-cylinder block
2	55695/01	Adapter housing	1	
3	MS48/50	Stud MS	4	Adapter-to-exhaust
4	MS33/8	Bonded seal MS	9	Adapter housing
5	MS164/65	Screw MS, socket-head	8	-to-
6	MS64/25	Screw MS, socket-head	1	cylinder head - Not shown
7	55886	Oil sump sub assembly	1	
8	55877	Gasket	1	Oil Sump-to-adapter housing
9	S64/2	Drain plug 1/4 In. BSP	1	
10	UFP2303/5	Sealing washer 1/4 In. BSP	1	
11	56039	Dip stick, engine oil	1	
12	UFP2303/8	Sealing washer 1/2 In. BSP	2	
13	55873	Straight coupler 15 x 0.5	2	
14	56184/01	Connecting-pipe assembly	1	

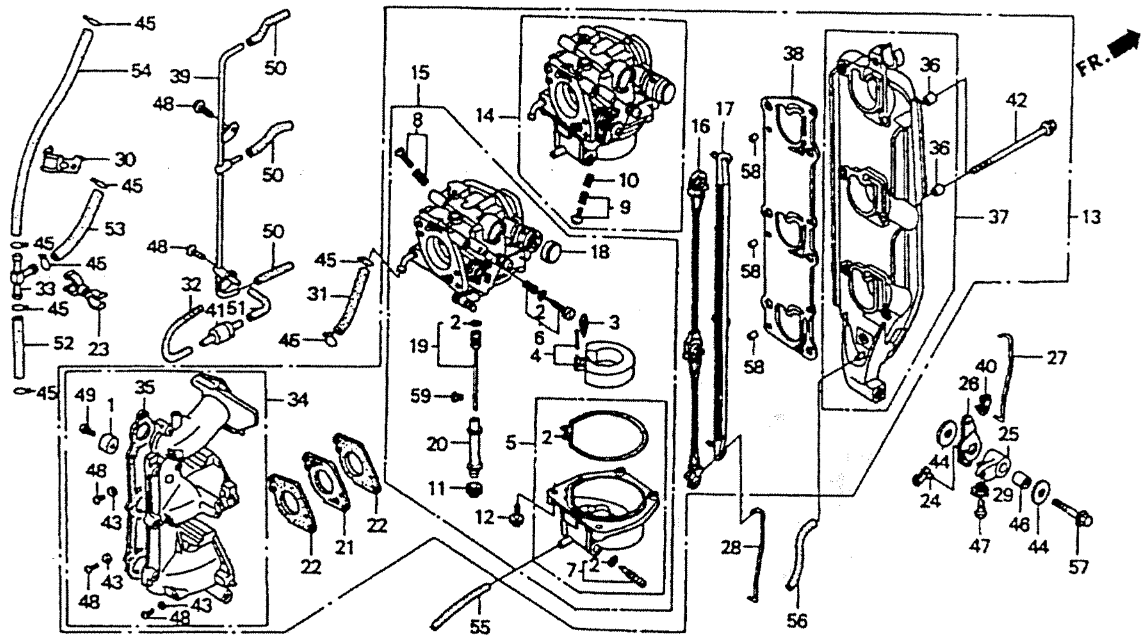
SILENCER COVER



SILENCER COVER

Item No.	Part No.	Description	Qty	Remarks
1	56725	Silencer cover (intake)	1	
2	56726	Distance collar	2	
3	56727	Washer 6.5 x 18	2	
4	56690	Flange bolt 6 x 25	1	
5	56638	Flange bolt 6 x 40	1	
6	56728	Packing	1	Silencer cover
7	56864	Nut	1	Silencer cover
8	56729	Breather tube	1	
9	56730	Clamp	1	

CARBURETORS AND INLET MANIFOLD

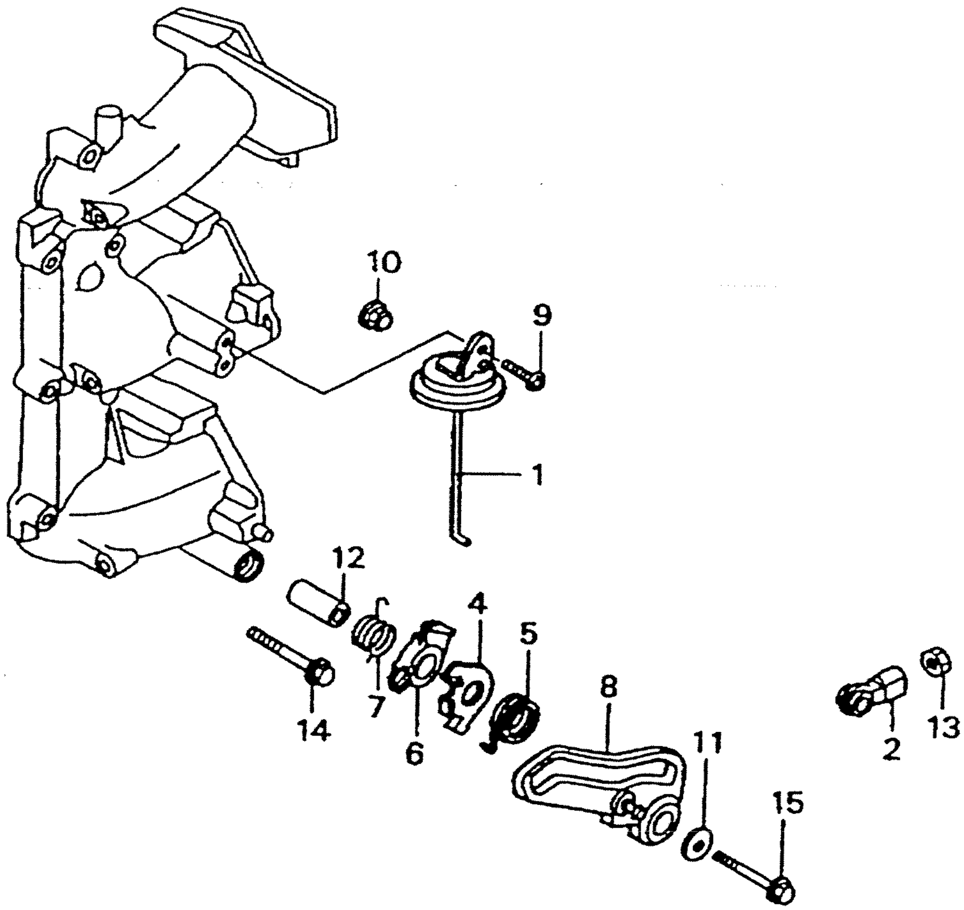


CARBURETORS AND INLET MANIFOLD

Item No	Part No.	Description	Qty	Remarks
1	56731	Anode, sacrificial	1	
5	56732	Gasket	3	
3	56733	Float-valve set	1	
4	56734	Float set	3	
5	56735	Float changer set	3	
6	56736	Screw (set)	3	
7	56737	Drain-screw set	3	
8	56738	Screw (set)	1	
9	56739	Screw (set)	2	
10	56740	Spring	3	
11	56741	Plug screw	3	
12	56742	Screw	12	
13	56743	Carburetor assy	1	
14	56744	Carburetor assy (Nos. 1 & 21)	2	
15	56745	Carburetor assy (No. 3)	1	
16	56746	Connecting link, throttles	1	
17	56747	Connecting link, chokes	1	
18	56748	Choke dust cap	3	
19	56749	Jet set	3	
20	56750	Main nozzle	3	
21	56151	Carburetor insulator	3	
22	56752	Carburetor packing	6	
23	56753	Clamp, fuel tube	1	
~~24~~	~~56754~~	~~Rod Joint~~	~~1~~	
25	56755	Choke arm (A)	1	
26	56756	Choke arm (B)	1	
27	56757	Choke rod	1	
28	56758	Choke rod knob	1	
29	MS35/5	Nut M4, choke arm	1	
30	56759	Clamp, fuel tube	1	

31	56760	Fuel tube (C)	1
32	56761	Fuel tube (D)	1
33	56762	Three-way joint	1
34	56763	Inlet manifold	1
35	56764	Packing, inlet manifold	1
36	56765	Distance collar	6
37	56766	Complete plate, silencer	1
38	56767	Packing, silencer plate	1
39	56768	Pipe	1
40	56769	Linkage bush	1
41	56770	Dashpot check valve	1
42	56771	Flange bolt 6 x 97	6
43	56772	Thrust washer M5	3
44	56773	Washer M6	2
45	56774	Clip, tube B 10	8
46	56775	Distance collar 6.5 x 10.5 x 16	1
47	MS70/25	Screw 4 x 25 pan-head, chock arm	1
48	56777	Screw 5 x 10 pan-head	5
49	56776	Screw 6 x 18 pan-head	1
50	56778	Fuel tube 3.5 x 45	3
51	56779	Fuel tube 3.5 x 60	1
52	56780	Fuel tube 5.3 x 65	1
53	56781	Fuel tube 5.3 x 110	1
54	56782	Fuel tube 5.3 x 170	1
55	56783	Tube 3.5 x 155	1
56	56784	Tube 3.5 x 190	1
57	56785	Flange bolt 6 x 28	1
58	56786	Roller 6 x 15	6
59	56787	Main jet	3

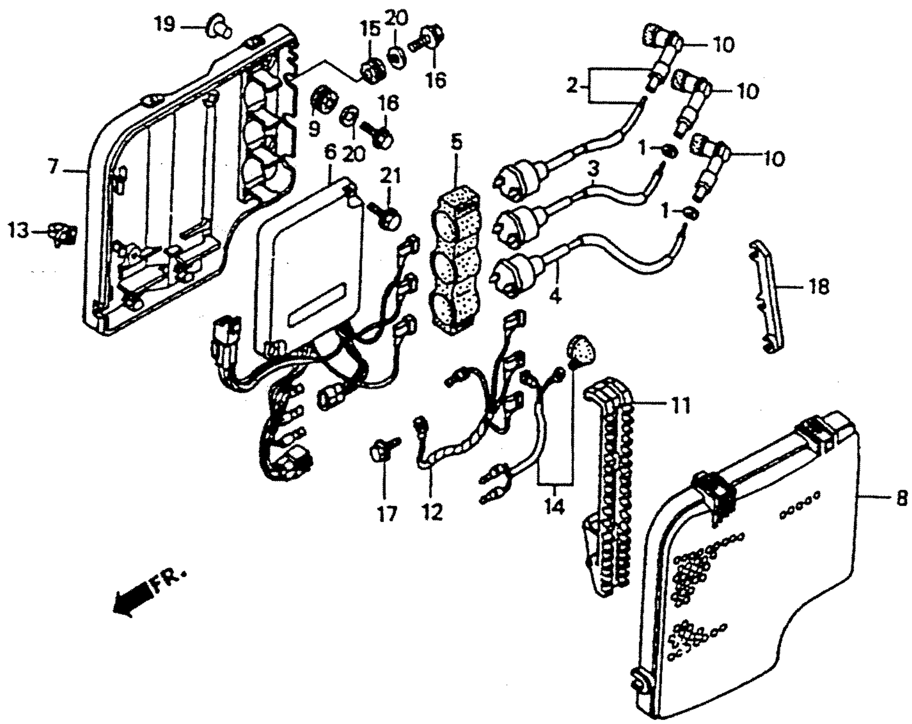
THROTTLE MECHANISM AND DIAPHRAGM UNIT



THROTTLE MECHANISM AND DIAPHRAGM UNIT

Item No.	Part No.	Description	Qty	Remarks
1	56788	Diaphragm unit	1	
2	56789	Pivot linkage, double-cable	1	
3	Not Used			
4	56790	Assist plate	1	
5	56791	Assist spring	1	
6	56792	Throttle-opener cam	1	
7	56793	Throttle-opener cam return spring	1	
8	56794	Throttle cam	1	
9	56795	Torx bolt 6 x 14	1	
10	56796	Cap nut M6	2	
11	56773	Washer M6	1	
12	56797	Collar 6.7 x 12.5 x 24	1	
13	56798	Nut M5	1	Pivot link-to-throttle enable
14	56799	Flange bolt	5	

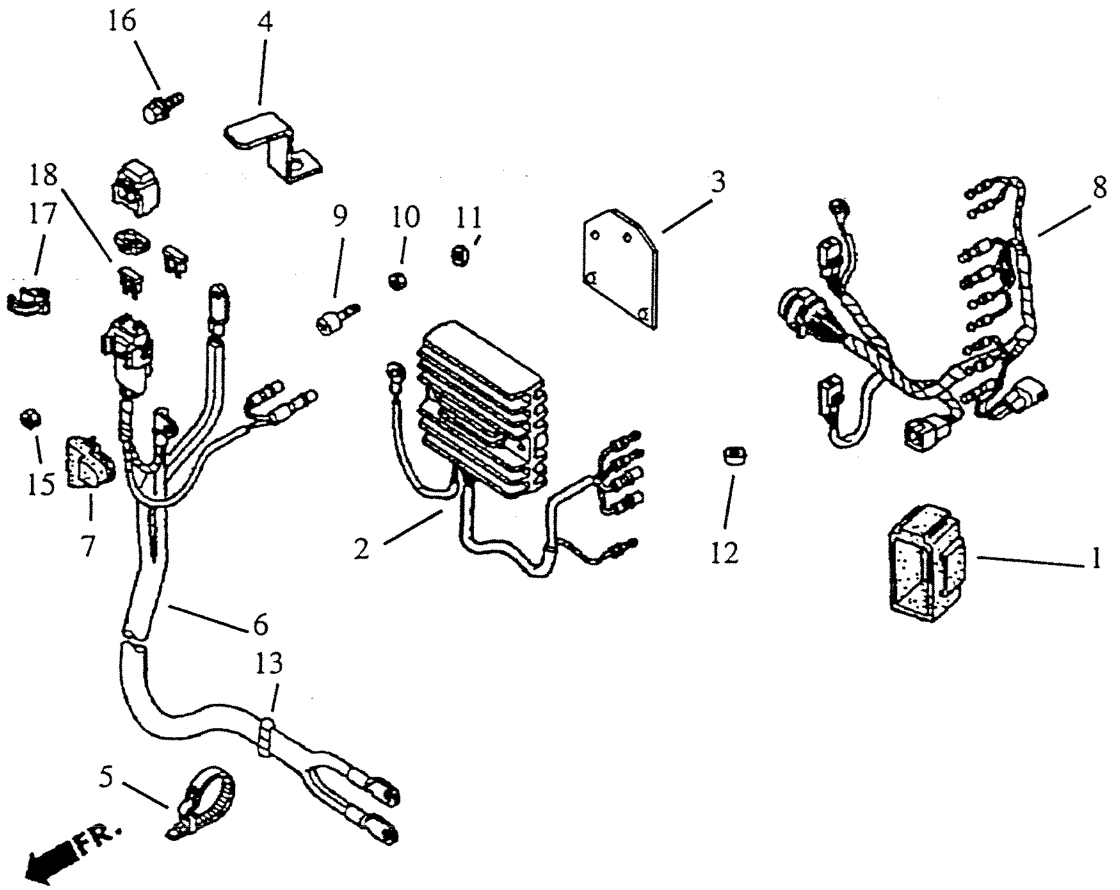
CAPACITOR DISCHARGE IGNITION (C.D.I.) SYSTEM



CAPACITOR DISCHARGE IGNITION (C.D.I.) SYSTEM

Item No.	Part No.	Description	Qty	Remarks
1	56800	Grommet, H.T. lead	2	
2	56801	Ignition coil assembly No. 1	1	
3	56802	Ignition coil assembly No. 2	1	
4	56803	Ignition coil assembly No. 3	1	
5	56804	Mounting, ignition coils	1	
6	56805	Capacitor discharge ignition (C.D.I.) unit	1	
7	56806	Case, C.D.I. unit	1	
8	56807	Cover, C.D.I. unit	1	
9	56808	Grommet, C.D.I. case (B)	2	
10	56809	Suppresser cap assembly	3	
11	56810	Connector bracket (A)	1	
12	56811	Ground cable assembly	1	
13	56812	Clip	1	
14	56813	Cord	1	
15	56814	Grommet, under case	2	
16	56690	Flange bolt 6 x 25	4	
17	56631	Flange bolt 6 x 12	1	
18	56815	Clip, H.T. lead	1	
19	56816	Collar, C.D.I. unit case	4	
20	56817	Washer M6	4	
21	56818	Flange bolt 6 x 20	2	

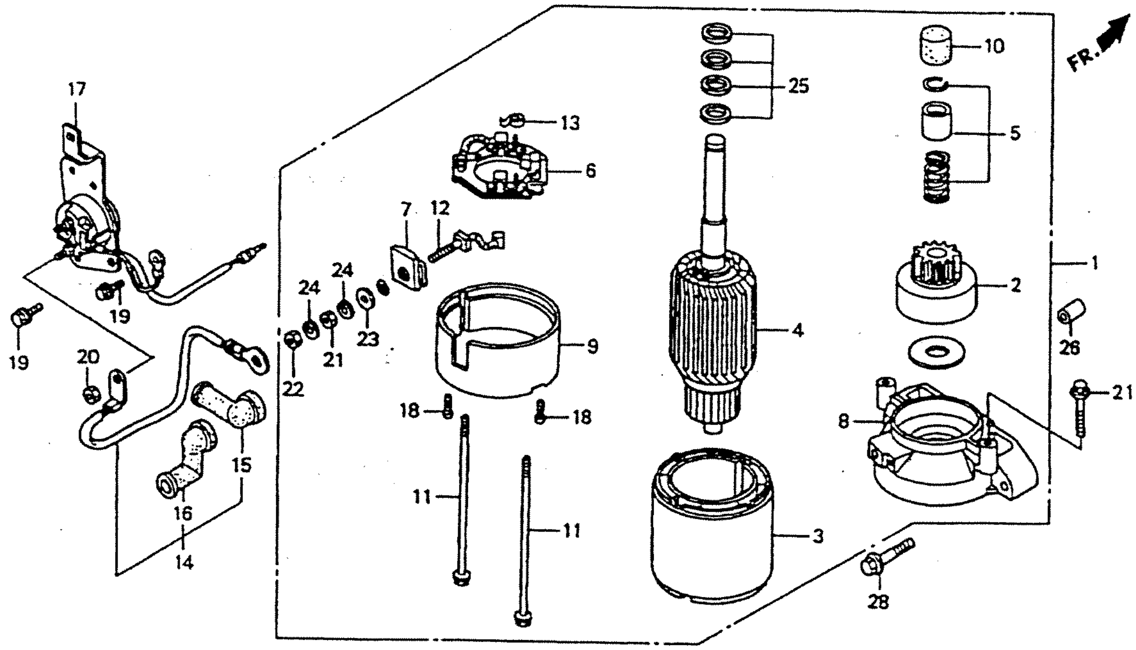
REGULATOR/RECTIFIER AND STARTER CABLES



REGULATOR/RECTIFIER AND STARTER CABLES

Item No.	Part No.	Description	Qty	Remarks
1	56819	Cushion, C.D.I. unit	1	
1	55800/61	Regulator/rectifier unit (12A)	1	
3	55893	Regulator mounting bracket	1	
4	56262	Bracket, multi-pin plug mounting	1	
5	56820	Cable tie	1	
6	56196	Starter cable assembly	1	
7	56821	Cover terminal	1	
8	56822	Cable assembly, remote control	1	
9	MS163/25	Screw M6, socket head x 25	2	Regulator/rectifier-
10	MS41/4	Nut M6, self-locking	2	to-mounting bracket
11	MS25/7	Washer M6	5	
12	56167/01	Spacer	1	Mounting bracket-to-engine
13	MS04/20	Screw M6 x 20	1	
14	56823	Clamper, battery cables	1	
15	56824	Nut M6	1	
16	56825	Flange bolt M8 x 12	2	
17	56826	Clamper, harness	1	
18	56827	Fuse blade (15A)	2	

STARTER MOTOR



STARTER MOTOR

Item No.	Part No.	Description	Qty	Remarks
1	56828	Starter motor assembly	1	
2	56829	Over-run clutch	1	
3	56830	Yoke	1	
4	56811	Armature	1	
5	56832	Pinion-stopper set	1	
6	56833	Brush holder	1	
7	56834	Bush	1	
8	56835	Bracket (FR)	1	
9	56836	Bracket (RR)	1	
10	56865	Cap stopper	1	
11	56837	Through-bolt	2	
12	56838	Brush	1	
13	56839	Brush spring	1	
14	56840	Magnetic-switch cable	1	120mm
15	56841	Terminal cover, starter motor	1	
16	56842	Terminal cover, magnetic switch	1	
17	56843	Magnetic-switch assembly	1	
18	56844	Screw M4	2	
19	56631	Flange bolt 6 x 12	3	
20	56824	Nut M6	1	
21	56845	Nut (1)	1	
22	56846	Nut (2)	1	
23	56847	Washer (1)	1	
24	56848	Washer (2)	1	
25	56849	Thrust-washer set	1	
26	56850	Dowel pin 10x 16	1	
27	56851	Flange bolt 6 x 28	1	
28	56852	Flange bolt 8 x 45	1	

GASKETS

Item No.	Part No.	Description	Qty	Remarks
-	56853	Gasket kit component parts	1	
-	56854	Packing, engine oil sump	1	
-	56855	Cylinder-head -gasket	1	
-	56856	Packing, head cover	1	
-	56857	'O' ring 4.8 x 1.9	1	
-	56858	Packing, carburetor	6	
-	56859	Packing, inlet manifold	1	
-	56860	Packing, silencer cover	1	
-	56861	Packing, silencer plate	1	
-	56862	Gasket A, exhaust pipe	1	
-	56863	Gasket, thermostat cover	1	

RECOMMENDED SPARES
ENGINE

Part No.	Description	Qty
56853	Gasket set	1
DR7 EA OR 56613	Spark plug	3
56618	'O' ring, oil orifice assembly	1
56170	'O' ring, oil cooler	1
56627	Thermostatic switch	1
56626	Oil pressure switch	1
56671	Valve stem seal	6
56686	Camshaft oil seal	1
56698	Timing belt, camshaft	1
55800/05	'O' ring, water pump	1
55800/03	Gasket, water pump	1
55810	Oil seal, oil and water pump shaft	2
55811	Oil seal, oil and water pump shaft	1
55877	Gasket, oil sump-to-adapter housing	1
56732	Carburetor gasket set	1

NOTES

The FULL Pump Serial Number must be quoted on ALL communications.

1) **COOLING**: IT IS **VERY IMPORTANT** THAT A MINIMUM DIFFERENTIAL PRESSURE OF 3 BAR IS MAINTAINED IN THE PUMP UNIT TO ENSURE THAT PUMPED WATER IS BEING CIRCULATED THROUGH THE HEAT EXCHANGER TO PREVENT OVERHEATING OF THE ENGINE UNIT.
2) **DRY RUNNING**: This pump may only be run in a dry condition during the priming procedure, i.e. typically 30 seconds at approximately 5,200 r.p.m.

Warning: Care should be taken if exceeding these figures as terminal damage may occur to the gland-seal components if water is not present in the pump casing to both cool and lubricate these components.

3) **ACCIDENTAL STARTING – PREVENTION**

a) While work is being carried out on the engine, pump or electrical Systems, disconnect the battery cables – See b) below, and the spark-plug leads.

b) When working on the HONDA engine, make sure that BOTH the BATTERY and PULSER ROTOR connections are disconnected. Battery disconnection alone DOES NOT ensure the prevention of accidental engine starting as movement of the rotor will trigger the ignition.

4) **SAFETY – BATTERY AND PULSER ROTOR**: When working on the HONDA engine, make sure that BOTH the BATTERY and the PULSER ROTOR connections are DISCONNECTED; battery disconnection alone DOES NOT ensure prevention of accidental engine starting – as movement of the rotor will trigger the ignition. The pulser-rotor connections are located under the Capacitor Discharge Ignition (CDI) cover on the R.H. – side of the engine.

GENERAL

The terms "L.H." (Left-hand) and "R.H." (Right-hand) used in this book apply when the pump unit is viewed from the suction tube-end.

ACKNOWLEDGEMENT

We acknowledge with thanks the permission given by the HONDA MOTOR CO. LTD., to reproduce material from that company's engine publications as necessary.

DELIVERY VALVES

By turning the handwheel counter-clockwise, the valve can be opened for the discharge of water. When the valve is open and no water is being discharged, the valve seal is held against the volute I discharge port by a spring in the valve body.

When the pump is priming, the valve seal acts as a non-return valve so that the prime is not lost. The release knob allows the valve seal to be lifted higher than normal by turning the handwheel with the release knob pulled out. This operation is only carried out after the pump has been stopped and allows the valve seal to be raised above the volute discharge port enabling water to drain past the valves from hoses or risers.

ASSOCIATED PUBLICATIONS

Publication	Part Number
Spare Parts Manual	GP/080/94
Operating Manual	GP/078/94

PART A

PUMP

GENERAL DATA

BRIEF ENGINE DATA (See PART B – ENGINE for full technical details)

Model..BF45A (Modified)
Type..4-stroke, O.H.C., 3-cylinder,vertical crankshaft
Capacity..808cc (49.4 cu.in)
Bore x Stroke..70 x 70mm (2.8 x 2.8in)
Rated Power..37.3Kw (50HP) 6,000r.p.m.*
Maximum Torque.....................................6,05kgm (43.8 ft lb)
Compression Ratio...................................9,2:1
Cooling System – Method........................Forced-water circulation: impeller pump + thermostat
– Capacity.............................5,0 litres
Thermostat Opening Temperature..........72°C
Ignition System..CDI (capacitor-discharge ignition)
Ignition Timing – Range..........................5° – 32° BTDC
Spark Plug – Type...................................DR7EA (NGK), X22ESR-U (NIPPONDENSO)
Carburettors...Three horizontal type – constant vacuum
Lubrication System – Type......................Pressure feed and splash
– Method..............................By trochoid pump
– Capacity.............................2,6 litres (inc. filter)
Oil Filter – Type and Capacity................Honda screw-on disposable cartridge – 0,6 litres
Starting Systems.......................................Electric starter 0,9 kw (Inertia-type) and Manual start
....(using rope-wrap on flywheel)
Stopping System......................................Grounding of primary circuit
Fuel – Type..Regular automotive gasoline (86 pump octane unleaded preferred)**
Tank-Capacity.......................14 litres
Pump-Type............................Diaphragm-type driven from camshaft

* Full throttle rpm. ** See note ref: leaded fuel under – RECOMMENDED LUBRICANTS, FUEL AND ANTI-FREEZE.

PUMP DATA

Pump – Model and Type..........................GP10/10 and single-stage centrifugal
Pump Shaft Seal.......................................Spring-loaded, self-adjusting carbon-faced gland
Delivery Valves.......................................Two DIN screw-down type
Priming System..Exhaust gas ejector and automatic priming valve
Pump Rated Output..................................1,000 litres/min. at 10bar at 3m lift

Dimensions of unit (Conforming to DIN 14 410 requirements):
Length (Handles Closed)......680 mm
Width...................................495 mm
Height (Complete Unit)........605 mm

Weight (+Battery, Oil, Coolant & Fuel)..112 kg

RECOMMENDED
LUBRICANTS, FUEL AND ANTI-FREEZE

ENGINE LUBRICANTS

Classification AP1, SG, SF/CC, CD

AMBIENT TEMPERATURE	LUBRICANT VISCOSITY
–10°C (14°F) and above	20W/40, 20W/50
–20°C(–5°C) and above	10W/40
–20°C to +32°C (–5°F to +86°F)	10W/30
–25°C (–13°F) and above	15W/40,

GASOLINE FUEL

Unleaded* Gasoline with Minimum Research Octane Number of 86

*** NOTE:** The pump can be run on 4-Star fuel, but not for sustained periods, due to probable damage being caused to exhaust valves and seats.
Therefore, Godiva cannot accept responsibility for any claims resulting from the sustained use of leaded fuel.

ANTI-FREEZE

Ethylene Glycol Base Type

GODIVA

PORTABLE PUMPS

SAFETY-RELEVANT DATA

Thank you for purchasing a Godiva Pump.

Godiva Portable Pumps are designed to give safe and reliable service – however, BEFORE operation it is essential that the Operating Instructions are carefully read and understood.

A risk-assessment of the pump has been conducted with the following results:

MAINTENANCE

It is the responsibility of the user to ensure that the equipment is maintained in a safe operational condition, as per regulation 5 in the Provision and Use of Work Equipment Regulations 1998.

TRAINING

It is essential that Godiva pumps are operated ONLY by TRAINED PERSONNEL.

ENGINE

When using Godiva pumps driven by a gasoline-powered engine, the following safety points MUST be observed:

- DO NOT OPERATE the unit close to flammable materials or structures.
- Keep ALL UNTRAINED people AWAY from the unit during operation. GASOLINE is extremely flammable and MUST be HANDLED WITH CARE.
- DO NOT OVERFILL the fuel tank. After refuelling ENSURE that the fuel cap is refitted
- DO NOT refuel whilst smoking or allow sparks or flames into the refuelling area.
- Be careful NOT TO SPILL fuel; if any fuel is spilled, ensure that the area is dry BEFORE starting the engine. Godiva recommend refuelling when the engine is cold.
- DO NOT run the engine in an enclosed area as poisonous gases are given off which can cause injury.
- The exhaust system becomes VERY HOT during operation and REMAINS HOT for a time AFTER the engine has been stopped. DO NOT TOUCH the exhaust whilst the engine is hot.
- The starting system is driven by battery. Always connect the battery positive (+ve) cable BEFORE the negative (–ve) and disconnect the negative BEFORE the positive.
- Batteries produce EXPLOSIVE GASES so keep sparks, flames and cigarettes away.

NOISE

When running, the engine-driven portable pump is noisy so EAR PROTECTION IS NECESSARY.

MANUAL HANDLING

The Godiva Portable Pump design incorporates suitable lifting handles or points.
A manual-handling sheet is provided with each model.
The secondary starting method (hand-start) provided MUST BE USED WITH CARE. Follow the operating instructions provided.

S. Tudor
Engineering Manager

February 2001

IDEX CORPORATION

CONTENTS

ENVIRONMENTAL PROTECTION

It is illegal to pour engine oil and other contaminants onto the ground, down sewers, drains, or into water courses. Dispose of these through AUTHORISED waste disposal contractors to licensed waste disposal sites, or to the waste oil reclamation trade.

IF IN DOUBT contact your Local Authority for advice on disposal facilities.

HEALTH AND SAFETY

To avoid injury, operators should take all necessary precautions to safeguard themselves and others and follow the operating procedures laid down in this book.

When handling fuel, batteries, oil or hot machinery.

a) DO NOT SMOKE.

b) DO NOT EXPOSE volatile fluids or battery gases to a naked flame.

c) DO NOT TOUCH hot parts of machinery.

d) AVOID prolonged skin contact with fluids, especially if corrosive or carcinogenic.

e) PROTECT the eyes and ears as necessary.

f) DISCONNECT the battery when working on the electrical system to avoid short circuits.

g) DO NOT LIFT heavy weights without suitable assistance.

h) DO NOT INHALE fumes or gases.

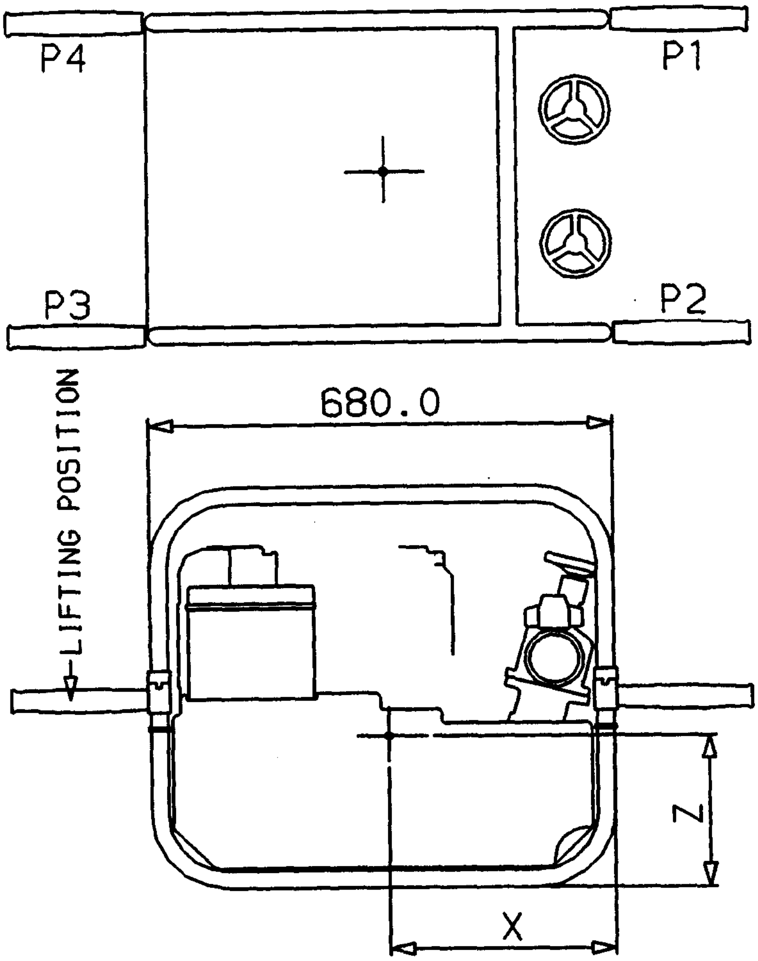
i) DO NOT REMOVE protective guards or shields.

j) DO NOT SPILL fuel when refuelling – fuel vapour or spilt fuel can ignite.

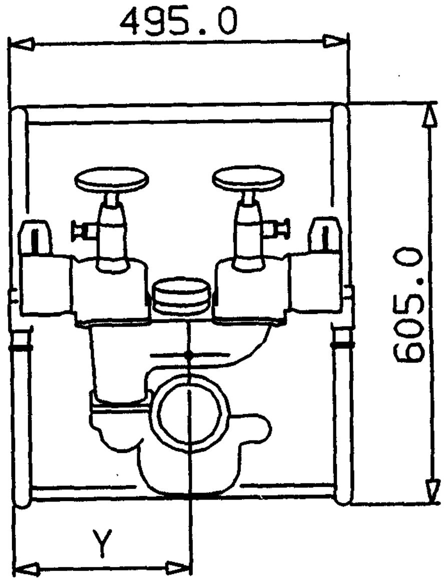
k) CLEAN UP any spilt fuel, oil or anti-freeze immediately.

l) WASH your hands thoroughly after handling fuel, oil or anti-freeze.

IMPORTANT: The following page contains further Health and Safety information that is specifically for the GP10/10 Portable Fire Pump.



GODIVA RECOMMENDS TEAM LIFTING TO BE ADOPTED IF NO OTHER FORM OF LIFTING IS AVAILABLE. USE OF THE LIFTING FACILITIES THAT ARE PROVIDED ON THE UNIT IS STRONGLY ADVISED.



		DRY	WET
WEIGHT Kg		94	112
CENTRE OF GRAVITY mm	X	354.0	367.0
	Y	237.0	225.0
	Z	318.0	316.0
LIFTING FORCES Kg	P1	21.5	26.5
	P2	24.5	28.5
	P3	25.5	29.5
	P4	22.5	27.5

CONSTRUCTION MATERIALS		
PUMP CASING		ALUM.
IMPELLER		ALUM.
PUMP SHAFT		ST.STL
WEARING RINGS		FIBRE
MANIFOLD		ALUM.
CRADLE		ST.STL
ENGINE	HEAD	ALUM.
	BLOCK	ALUM.

NOTE! THE WET WEIGHT IS INCLUSIVE OF THE FULL CAPACITY OF ENGINE OIL, COOLING WATER, AND FUEL

DESCRIPTION

The Godiva GP10/10 Fire Pump is a compact, portable, self-contained unit.

It is designed to provide a reliable, continuous performance of 1000L/min at 10Bar pressure at 3m lift.

The pump shaft is mounted vertically and the impeller operates in a horizontal plane.

Delivery
The volute and delivery manifold are manufactured from aluminium and two DIN-style delivery valves are provided; the delivery valves may be re-oriented rearwards if required.

Priming
An exhaust gas ejector-type priming unit is fitted and the system incorporates an automatic priming valve.

Fuel
The fuel tank has a capacity of 14 litres and the filler cap has a built-in fuel gauge. A quick-release fuel connector allows an optional 23,7-litre remote fuel tank to be connected if required.

Starting
A flywheel-mounted 10amp alternator charging an 18amp/hr battery (which is mounted on top of the fuel tank) and a 0.9kw inertia-engagement type starter motor are provided.
Back-up starting using a rope-wrap on the flywheel may be used, if necessary, after raising the hinged flywheel cover.

Engine Protection
The engine is provided with an electronic overspeed and engine protection system initiated by a high coolant temperature or low oil pressure, (See PART B – ENGINE).

Instrumentation
The instrumentation comprises: compound gauge, pressure gauge, high coolant temperature and low oil pressure warning lamps, choke and throttle controls, starter button and hours counter.

Illumination
illumination for the instruments along with a socket for both the battery-charging and the optional floodlighting is provided.

Cooling
The cooling system incorporates a header tank and a shell-and-tube type heat exchanger. The coolant capacity of 5.0 litres is circulated by the engine water pump and a filler/ pressure-release cap is fitted to the header tank. An engine oil cooler is also incorporated in the system.

Tools
Suction-tube wrench mountings are provided to mount two wrenches (optional) longitudinally along the cradle frame base.

SECTION 1

VOLUTE AND WEAR RING

To Remove

Drain all fluids.

Disconnect and remove the battery.

Remove the fuel tank (See SECTION 14).

Remove the delivery manifold and delivery valves (See SECTION 9).

Unscrew the union nuts and disconnect the priming pipe.

Remove priming valve. (See SECTION 6).

Unscrew the union nut and detach the compound gauge flexible pipe at the volute-end.

Turn the complete pump unit on its end – obtain assistance to perform this task.

Note: The pump suction eye should now be uppermost with the engine cylinder head-cover at the lowest point.

Remove the screws and detach the skid-plate.

Unscrew and remove the nuts, washers and bolts from the pump mountings and remove pump mountings.

Remove the five M10 nuts, one M10 socket-head screw and washers securing the pump volute.

Carefully allow the engine and pump unit to move away from the frame with the engine mountings acting as pivots.

Manoeuvre the volute from its location over the impeller and withdraw it from the cradle frame.

Maintenance

The bottom wear ring is fitted to the volute and retained by two M6 screws and washers.

The front wear ring should be checked for both wear and damage by measuring the inner diameter (A) at several places (Fig. 1-1).

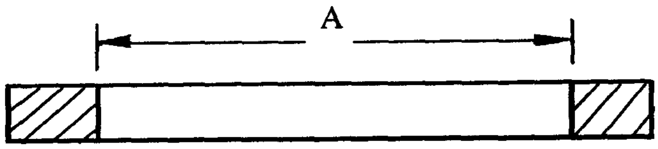


Fig. 1-1 Measuring the front wear ring

If the measurement obtained at any point is more than 105.40 mm or if any serious physical damage is apparent, a new wear ring MUST be fitted.

To Refit

Refitting is a reversal of the removal instructions.

Note: Ensure that ALL parts are thoroughly cleaned BEFORE refitting and ALWAYS fit a NEW 'O' ring.

SECTION 2

IMPELLER

To Remove

Remove the volute (See SECTION 1).

Prevent the pumpshaft from rotating and, using an accurately-fitting spanner, unscrew the M16 self-locking nut from the pumpshaft.

Recover the washer from the shaft and withdraw the impeller – taking care not to lose the key.

Recover the silicon-carbide seal and associated rubber seating from the rear face of the impeller if necessary.

Maintenance

Measure the impeller front boss (A) and rear boss (B) in several places.

if the FRONT boss measurement is LESS THAN or the REAR boss measurement is MORE THAN, the figures quoted below, fit a new impeller.

GP10/10 Model	Impeller Boss Diameter
Front Boss (A)	103.80 mm Min. O/D.
Rear Boss (B)	106.85 mm Max. I/D

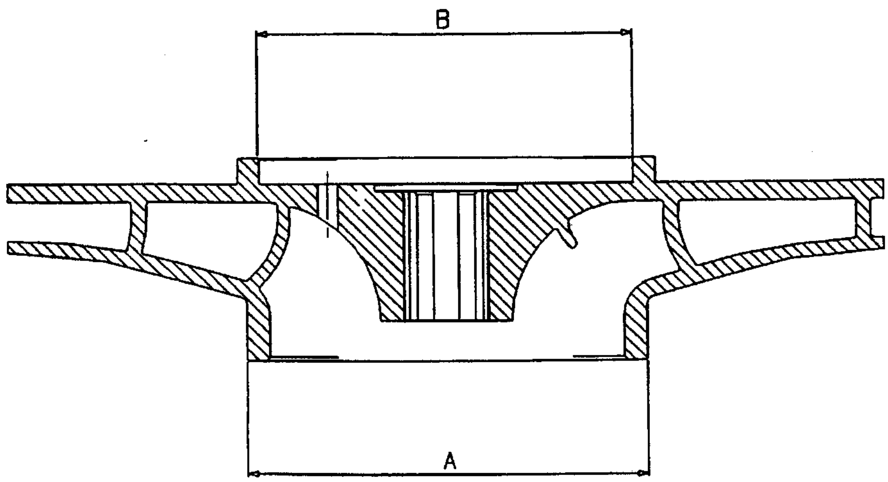


Fig. 2-1 Measuring impeller boss diameters

Inspect the impeller for damage due to foreign matter, contaminated water or cavitation.

Check for objects trapped between the vanes and, if found, remove by pushing the object from the periphery towards the centre of the impeller.

Check the impeller and pump-shaft keyways for any wear which could have resulted from a loose impeller nut. Ensure that the key is not damaged.

Note: If wear or damage is found, the appropriate components must be renewed.

IMPORTANT: Thoroughly clean ALL components BEFORE reassembly taking care not to mark the pump shaft.

To Refit

Refitting is a reversal of the removal instructions.

Ensure that the washer is refitted to the pumpshaft and that the nut is fully tightened.

IMPORTANT: Do not forget to refit the silicon-carbide seal into its rubber seating – located in the rear face of the impeller (See SECTION 3).

SECTION 3

CARBON SEAL, SEAL HOUSING AND UPPER WEAR RING

To Remove

Remove the volute and wear ring (See SECTION 1) and remove the impeller (See SECTION 2). Withdraw the 'O' ring and retaining washer from the pumpshaft.

Unscrew the four M6 screws and remove the upper wear ring. If the wear ring is a tight fit in the housing DO NOT lever on the outside of the ring, place two of the screws removed in the two M6 tapped holes and 'jack' the wear ring out evenly.

Remove the two M6 screws – these do not have the large washer under the head – from the carbon seal-and-carrier assembly.

Use two of the long M6 screws previously removed from the wear ring and screw them into the two vacant holes in the carbon seal-and-carrier assembly. Once the screws contact the cast bosses, continue to turn each screw by an equal amount, to jack' the assembly from its location.

It is not necessary to remove the two remaining screws and washers from the carbon seal-and-carrier assembly. If for any reason it is considered necessary to part the assembly, note that the carbon-seal carrier is under spring-tension and MUST BE RESTRAINED WHEN REMOVING THE SCREWS.

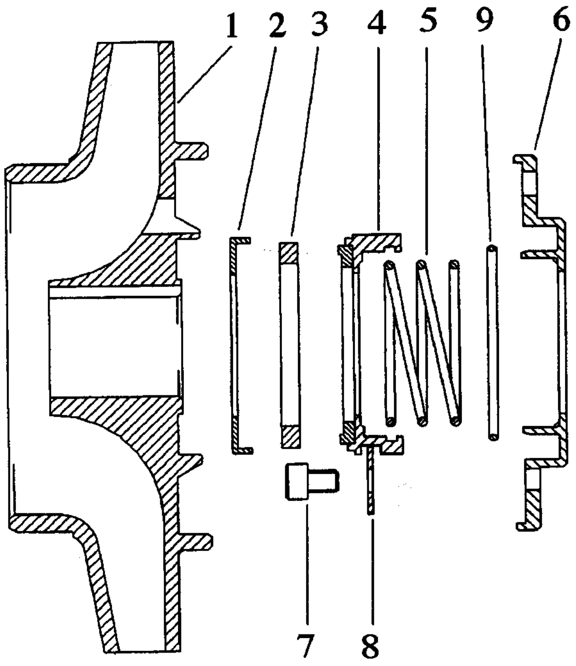
Remove the water flinger from its groove in the pump shaft.

If the mating silicon-carbide seal at the rear of the impeller requires renewing; prise it from the seating in the impeller. The seating should also be removed, since it should be renewed at the same time as the seal.

Maintenance

Fit (a) a new 'O' ring to the internal groove of the seal housing, (b) the external to ring on the boss and (c) the large 'O' ring around its periphery.

Fit a new oil seal to the seal housing with the lip facing towards the finned-area of the housing.



1. Impeller
2. Rubber cup
3. Carbon seal
4. Holder and carbon insert
5. Spring
6. Carbon seal housing
7. Cap head screw
8. Retainer
9. 'O' ring

Fig. 3-1 Carbon seal assembly

If there is excessive leakage past the carbon seal, examine all component parts for wear, damage or deterioration – Fig 3-1 refers.

First, inspect the silicon-carbide seal (3) and the carbon insert (4) for scoring, cracks or chipping of the working faces.

If ANY ONE of these problems is evident, the seals MUST BE RENEWED AS A PAIR.

Note: The silicon-carbide seal fits into a rubber seating in the rear face of the impeller.

It is unlikely that the spring (5) will require renewal.

The upper wear ring should be checked for wear and damage by measuring the outer diameter (A) at several places (Fig. 3-2).

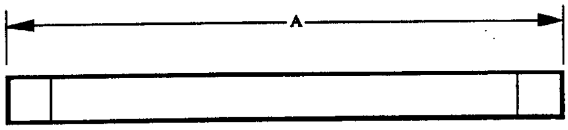


Fig. 3-2 Measuring the upper wear ring

If the measurement obtained at any point is less than 105.25 mm or physical damage is apparent, a new wear ring MUST be fitted.

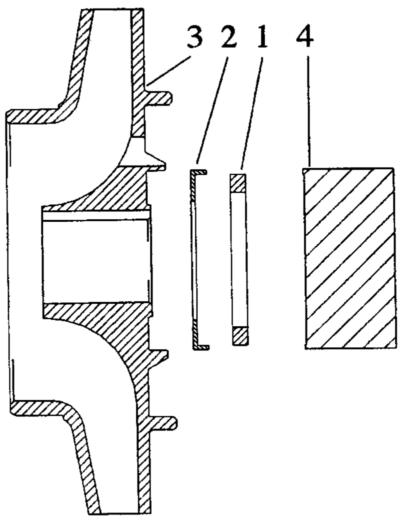
To Refit

Refitting is a reversal of the removal instructions. DO NOT OMIT the water flinger from shaft. The finned-area of the seal-housing faces nearest to the engine with the cutaway adjacent to the oil-sump pipe. Apply Loctite 574 sealant to the faces of the four tapped bosses on the carbon-seal housing BEFORE refitting the carbon seal assembly.

Note: DO NOT APPLY THE LOCTITE TO THE SCREW THREADS.

IMPORTANT NOTES

1) Remember to fit the ~ ring and washer to the pump shaft BEFORE fitting the impeller.
2) The silicon-carbide seal and rubber seating assembly must be FULLY and SQUARELY SEATED in the rear face of the impeller, by using the following assembly procedure (Refer to Fig. 3-3). Incorrect assembly will result in the seal not performing correctly and premature failure.
   i) Using soap solution as a lubricant, fit the silicon-carbide seal (1) into rubber seating (2).
   ii) Apply more soap solution to the seating periphery and use Special Tool No. 56571 (4) with its lip located over the seal, to press assembly SQUARELY into the impeller (3) rear face.
   iii) Ensure that the assembly is FULLY-SEATED in the impeller.



1. Carbon seal
2. Rubber cup
3. Impeller
4. Special Tool

Fig. 3-3 Fitting the seal-and-seating assembly

SECTION 4

PUMP SHAFT AND ADAPTOR HOUSING

To Remove

Remove the volute and wear ring (See SECTION 1) and remove the impeller (See SECTION 2).

Remove the carbon seal, the seal housing and wear ring (See SECTION 3).

Drain the engine oil.

Remove the six M6 socket-head screws – three from above and three from below and detach the engine oil sump.

Remove the nine socket-head screws securing the adaptor housing to the engine crankcase.

Recover the eight sealing washers – the screw entering the engine oil sump does not require one.

Take care not to damage the oil pick-up pipe and strainer. If detaching it, always use a new 'O' ring when refitting.

It is recommended that the drive flange is only removed if damaged, or to permit work to be conducted on the engine. If it is necessary to remove it, proceed as follows: Unscrew and remove the six M8 socket-head screws securing the pump shaft to the pump shaft drive flange.

Remove the pump shaft and store safely to avoid damage.

The staking of the crankshaft nut which secures the pump shaft adaptor MUST be released BEFORE attempting to unscrew the nut – FAILURE TO DO THIS MAY RESULT IN DAMAGE TO THE CRANKSHAFT THREADS.

Prevent the crankshaft from turning and unscrew the crankshaft nut. Remove the washer and withdraw the pump shaft adaptor from the crankshaft (using Special Tool 56566).

Maintenance

Inspect the pump shaft for physical damage and undue wear as follows:

a) The thread of the impeller nut should not be damaged – indicating that it has been loose.

b) The keyway must not be mishapen due to the key moving as a result of a loose impeller nut.

c) The shaft must not be damaged due to impact or abrasion.

d) The drive flange screw threads must be sound and the splines undamaged.

Note: ALL components must be perfectly CLEAN before they are refitted.

Refit

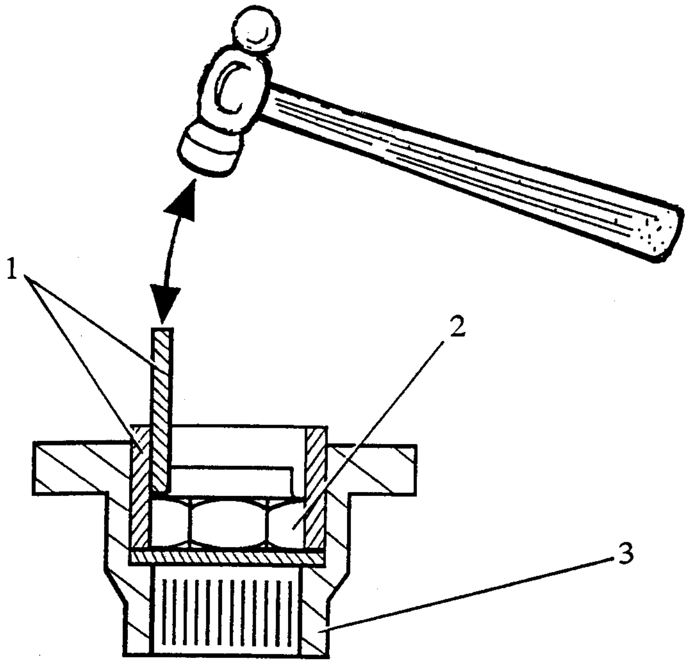
Check that no foreign matter is present on the crankshaft and the drive flange.

Slide the drive flange onto the crankshaft splines – followed by the washer and ensure that it is fully seated.

Then screw on a NEW M22 crankshaft nut and tighten to a torque of 92Nm, 68lbs ft.

Check the run-out (concentricity) of the pumpshaft adaptor – MUST NOT EXCEED 0,05mm.

Using Special Tools, Number 53563 and carefully stake the nut in the groove in the threaded portion of the crankshaft (Fig. 4-1)



1. Tool 53563
2. M22 Nut
3. Pumpshaft adaptor

Fig. 4-1 Staking the crankshaft nut

Install the pump shaft and tighten the M8socket-head screws progressively to a torque of 42Nm, 28lbs ft.

Check the run-out of the pump shaft if the adaptor has been disturbed, run-out (concentricity) MUST NOT EXCEED 0.10mm total indicator reading.

Refitting is a reversal of the removal instructions.

Use NEW 'O' rings and joints to prevent oil and water leaks.

Re-fit a new oil-seal housing, complete with new oil seal, with the open-side of the seal facing towards the engine. Pack the seal with Molyslip MPG grease to assist initial lubrication.

SECTION 5

EXHAUST GAS EJECTOR

Operation

Priming is by means of an exhaust gas ejector. With the engine running and the pump primed, the engine exhaust gases pass from the exhaust manifold, through the ejector housing and into the silencer in the normal way (Fig. 5-1).

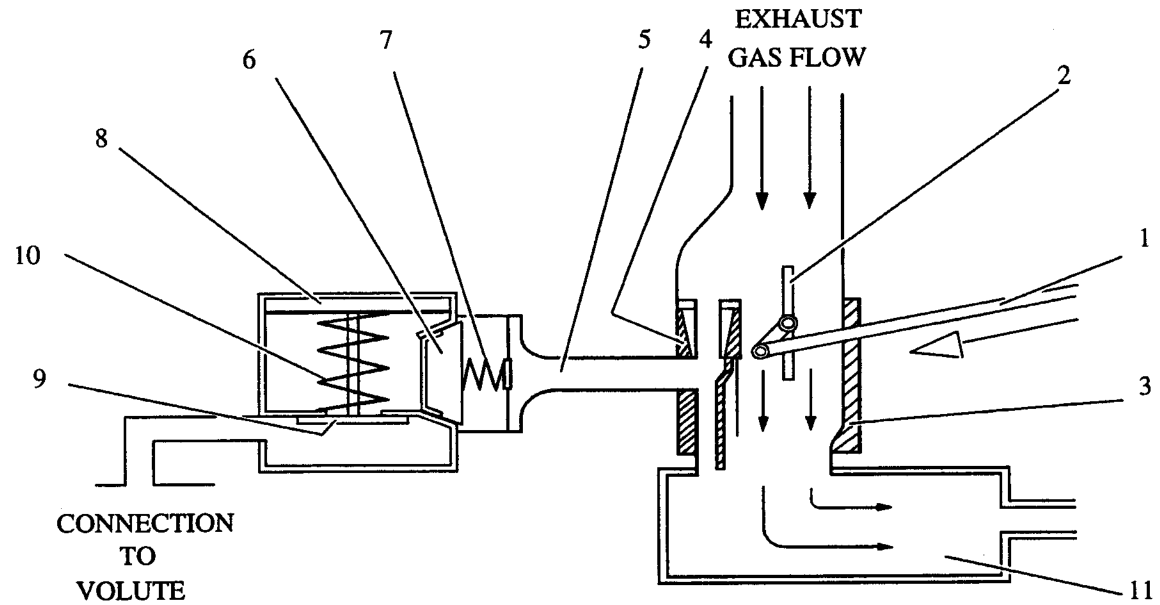


Fig. 5-1 Exhaust gas and water flow – ejector not operating

The ejector becomes operational when the primer operating rod (1) is pulled to the limit of its travel (Fig. 5-2).

The action of pulling the rod closes a butterfly valve (2) in the ejector housing (3) which then causes the exhaust to be deflected through the ejector nozzle (4) thereby creating a depression (vacuum) in the priming pipe (5) and, on the outlet side of the non-return valve (6). This causes the non-return valve to lift off its seating against the pressure of its spring (7).
It also draws the diaphragm (8) down, which moves the sealing washer (9) against the pressure of the spring (10) into the open position. The depression then allows water to flow into the volute under atmospheric pressure.

As the pump is primed, evacuated air and then water pass through the system and into the silencer (11).

When pump priming is complete (indicated by the first positive needle-movement of the pump pressure gauge) the primer operating rod (1) is released and returns to its static position under the influence of a return spring, causing the butterfly valve (2) to open.
The exhaust gases then resume their normal path (Fig. 5-1) – the depression in the priming pipe (5) and the outlet housing-side of the non-return valve (6) is then destroyed and the valve closes under the influence of its spring (7).

The diaphragm (8) returns to its static position under the influence of the spring (10) and the sealing washer (9) contacts its seating.

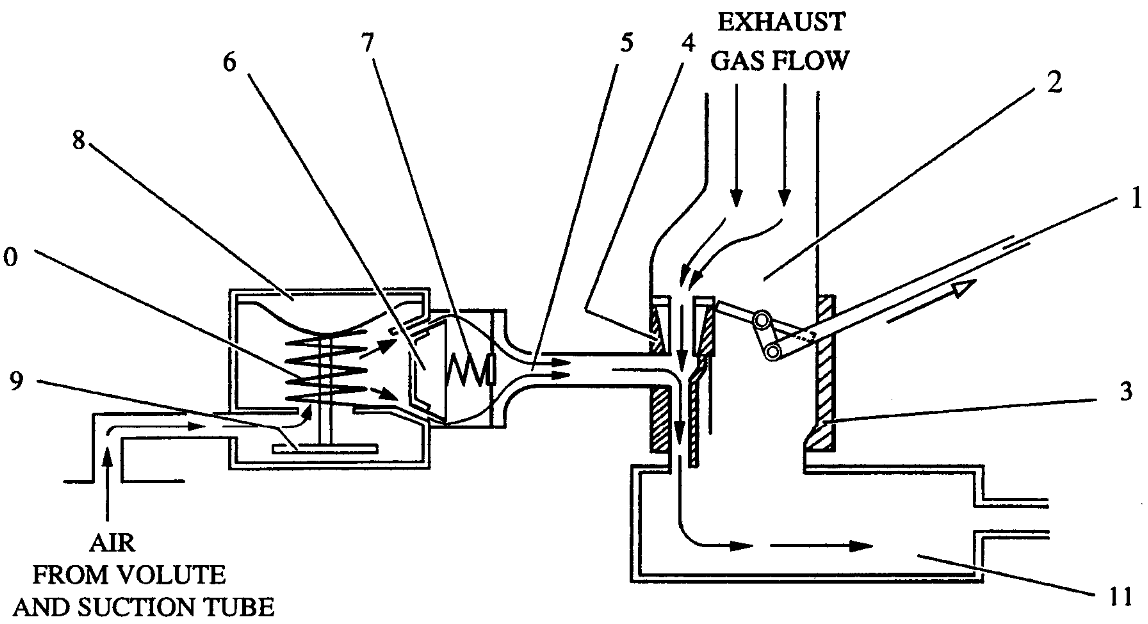


Fig. 5-2 Exhaust gas and water flow – ejector operating

To Remove

Disconnect the battery and remove the five bolts and washers securing the outer heat shield to the silencer and detach the shield.

Unscrew the four nuts and washers at the silencer-mounting flange, detach the silencer and recover the gasket. This will also release the rear section of the silencer heat shield.

Release the primer-operating rod from the priming lever by removing the split pin and washer from the end of the rod.

Unscrew the union nut at each end of the priming pipe and remove the pipe.

Remove the screws securing the pump mounting legs to the cradle and raise the engine just enough to disengage the mountings. The exhaust ejector housing may then be withdrawn from its four mounting studs. Recover the gasket.

Maintenance

Remove the nut and bolt from the priming lever and pull the lever from the butterfly valve operating shaft.

Should it be necessary to remove the butterfly valve: remove the two screws securing it to the operating shaft.

The operating shaft may then be withdrawn from the housing. If the shaft- or housing-bearing areas are excessively worn, renew the parts.

Note: They do not need to be a close-tolerance fit.

SECTION 6

PRIMING VALVE

The priming valve is automatic in action and is mounted on the suction tube. There are two modes of operation: 1) Lift Priming and 2) Relay Pumping (See Fig. 6-1).

1) Lift Priming

When the exhaust primer unit is operated (See SECTION 5) a depression is created on the outlet housing-side of the non-return valve (22) which causes it to lift off its seating. The main chamber of the body (9) then depressurises causing the diaphragm (4) to operate against the pressure of the spring (7) thereby opening the sealing washer assembly (11), (12) and (13). The depression then causes the air to be evacuated from the volute and water to be drawn into the volute and priming system.

When the exhaust primer operating rod is released, the depression is removed from the priming valve (22) which then closes under the influence of the spring (21) and seals against its seating. The depression is removed from the chamber of the body (9) and the spring (7) returns the sealing washer-assembly against its seating in the body.

2) Relay Pumping

When relaying from a hydrant or another pump the volute is, naturally already primed. The priming system is therefore not required in its normal operating mode. The priming valve is arranged so that with water pressure present below the sealing-washer assembly, the sealing washer (12) seals firmly against its seating in the body (9).

To Remove

Disconnect the battery.

Unscrew the two union nuts at each end of priming pipe, detach the priming pipe and then remove the two M6 screws and washers securing the priming valve to the volute. Take care not to lose the ‘O’ ring seal.

Maintenance (Fig. 6-1)

Unscrew and remove the four M6 bolts (1) and washers (2) from the diaphragm cover (3). The cover (3) diaphragm (4) priming valve body (9) and inlet cover (16) can then be separated.

Remove the outer housing (25) from the body (9) by unscrewing the four MS socket-head screws (18). Recover the washers (19) and separate the housing from the body taking care not to lose the spring locator (24) spring (21) and the valve (22).

1 Bolt, hex. head
2. Washer
3. Cover
4. Diaphragm
5. Screw M6, socket-head
6. Thrust pad
7. Spring
8. Spacer
9. Body
10 Gasket
11. Seal retaining washer
12. Sealing washer
13. Seal-support washer
14. Washer M6
15. Nut M6, self-locking
16. Inlet cover
17 Straight Coupler
18. Screw MS, socket head
19. Washer
20. Gasket
21. Spring
22. Valve
23. Seal
24. Spring Locator
25. Outlet housing
26. Sealing Washer
27. ‘O’ ring

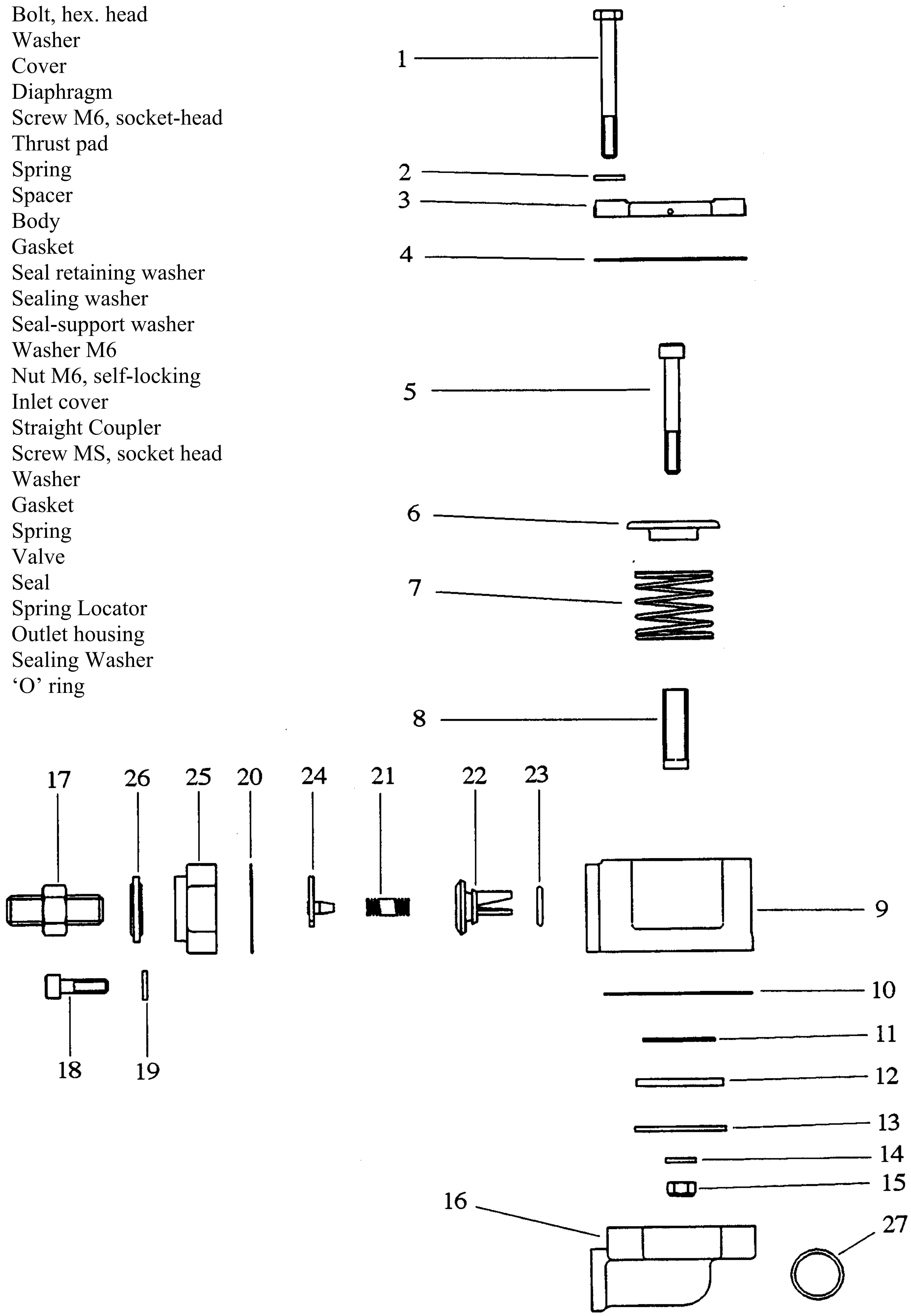


Fig. 6-1 Priming valve components

Use a socket key in the socket-head screw (5) and a spanner to unscrew the M6 self-locking nut (15). Remove the washer (14).

The seal-support washer (13), sealing washer (12) and seal retaining washer (11) may then be withdrawn from the inlet cover-end of the body (9).

From the diaphragm-end of the body, remove the socket-head screw (5), thrust pad (6), spring (7) and spacer (8).

Remove the ‘O’ ring (27) from the mounting-flange face of the inlet cover (16) and thoroughly clean the cover and fit a new ‘O’ ring. If the adaptor is damaged, fit a new one. ALWAYS use a new sealing washer.

Thoroughly clean the priming valve body (9) ensuring that all traces of the old gaskets are removed.

Check the condition of the spring locator (24), spring (21) and valve (22). If damaged or worn, renew them.

The seal (23) fitted to the valve (22) should be discarded and a new one fitted.

A new sealing washer (12) should be fitted between the seal-support washer (13) and the seal retaining washer (11).

Check the condition of the spring (7) and if damaged fit a new one.

Discard the old diaphragm (4) and use a new one.

Reassemble in the reverse order to dismantling using new gaskets (10) and (20).

To Refit

Refitting is a reversal of the removal instructions using a NEW ‘O’ ring at the priming valve-to-suction tube mounting face.

SECTION 7

INSTRUMENT PANEL

To Remove

Disconnect the battery.

Remove instrument panel cover.

Unscrew the union nut of the flexible pipe from the compound gauge.

Disconnect the multi-pin wiring plug and the two Lucar connections from the pressure-gauge lamp adjacent to the starter motor.

Release the choke-control rod by disengaging it from the choke control.

Remove the three screws securing the panel to the cradle and lift the panel-and-instruments assembly from the cradle.

To Refit

Refitting is a reversal of the removal instructions.

Ensure that the plug and wiring are correctly connected and that the internal sealing rings are in place and undamaged.

Reconnect the battery.

SECTION 8

DELIVERY VALVES AND COUPLINGS

Operation

To CLOSE the valve (non-operational position) turn the handwheel clockwise until resistance is felt. The valve plate is then firmly in contact with the seating and no water can flow in either direction (Fig. 8-1).

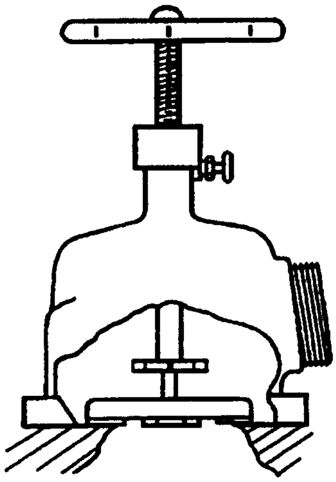


Fig. 8-1 Valve closed – no water discharge

To OPEN the valve (operational position) turn the handwheel counter-clockwise until it stops. The valve plate is then only held onto its seating by the spring fitted in the centre of the valve spindle. With the pump operational, water pressure lifts the valve plate off its seating against the spring pressure. Water will then be discharged (Fig. 8-2).

If operations temporarily cease, water flow stops and the valve plate returns to its seating under the influence of the spring. This maintains a head of water on the discharge-side of the valve and therefore prevents the prime being "lost".

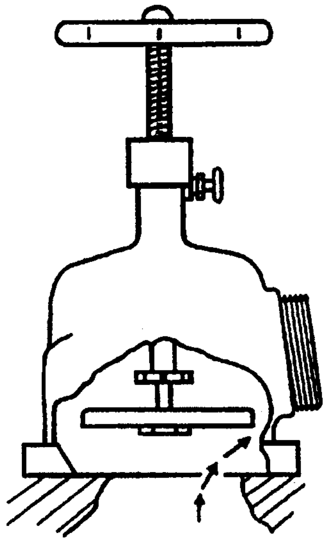


Fig. 8-2 Valve open – water discharging

To DRAIN hoses or high-risers (operations terminated). Pull out the release knob and turn the handwheel counter-clockwise until it stops. The valve plate is then raised clear of the seating and is not under any spring pressure. This then allows water to drain back from the discharge-side of the valve, through the pump volute and out of the suction tube.

Note: This operation must only be performed with the pump stopped.

Ensure that the valves are CLOSED upon completion of this operation.

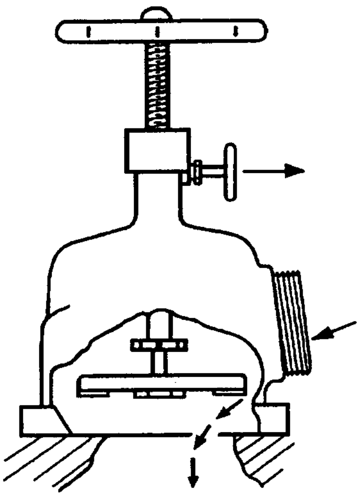


Fig. 8-3 Valve open – water draining

To Remove

Unscrew and remove the four M10 nuts and washers securing each valve to the delivery manifold. Remove the valve and recover the 'O' ring from the valve-mounting flange.

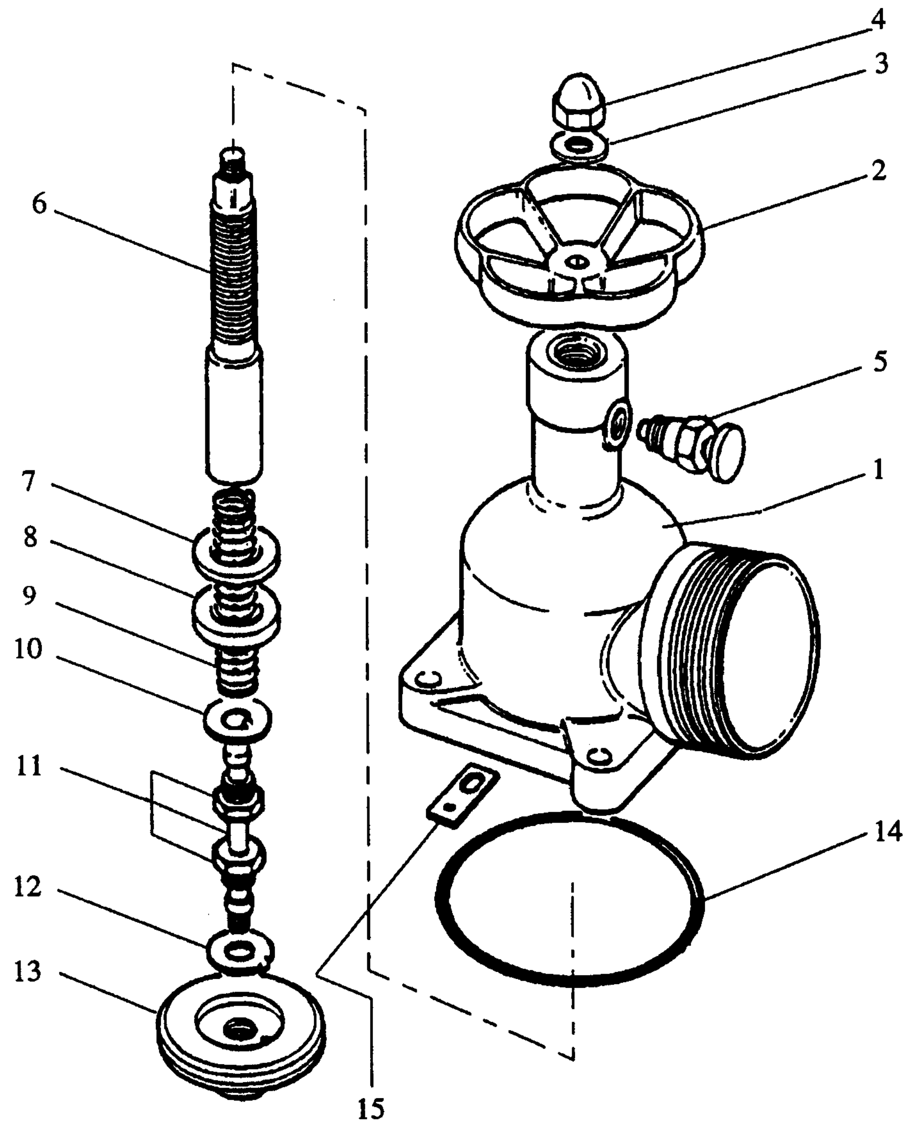
Maintenance (Fig. 8-4)

Remove the valve-spindle release knob (5). Temporarily refit the handwheel (2) or use an open-ended spanner to turn the valve spindle (6) clockwise as far as it will go. Continue unscrewing the spindle (6) counter-clockwise (viewed from the bottom) until it is released from the body (1).

Release the locking plate (12) and hold the plate (13) while unscrewing the lower nut of the stem assembly (11). Then release the locking plate (10) at the other end of the stem assembly (11) and unscrew the nut.

Note: There is a spring (9) in the spindle, therefore some spring tension will be present when the nut is unscrewed from the internal thread of the spindle (6).

If it is necessary to fit a new spindle seal (indicated by water leaking from the threaded portion of the spindle below the handwheel) carefully drift the seal (8) and the support ring (7) from the body (1).



1. Valve Body
2. Handwheel
3. Washer
4. Domed Nut
5. Spindle Release Knob
6. Spindle
7. Support Ring
8. Seal
9. Spring
10. Locking plate
11. Stem assembly
12. Locking plate
13. Plate
14. ‘O’ ring
15. Anchor (for chain)

Fig. 8-4 Delivery valve components

Reassembly is a reversal of the dismantling instructions.

Ensure that the spindle-seal support ring (7) is refitted and that the seal (8) is pressed into position with its lip towards the base of the valve body (1).

Do not forget to correctly-locate the ‘tag’ of each locking plate before bending the edge of the plate to lock the nut.

Apply a little molybdenised listate grease to the thread of the spindle.

To Refit

Refitting is a reversal of the removal instructions. Fit a new ‘O’ ring.

Instantaneous Coupling

To Remove

If it is necessary to remove the connector body, unscrew it in a counter-clockwise direction. Recover the shims.

Maintenance (Fig. 8-5)

Examine the release bolt (6) for excessive wear. If worn on the vertical face (the one nearest the valve) it must be renewed. To remove it, proceed as follows:

Unscrew the release closure disc (1) from the release cap (3) in a counter-clockwise direction.

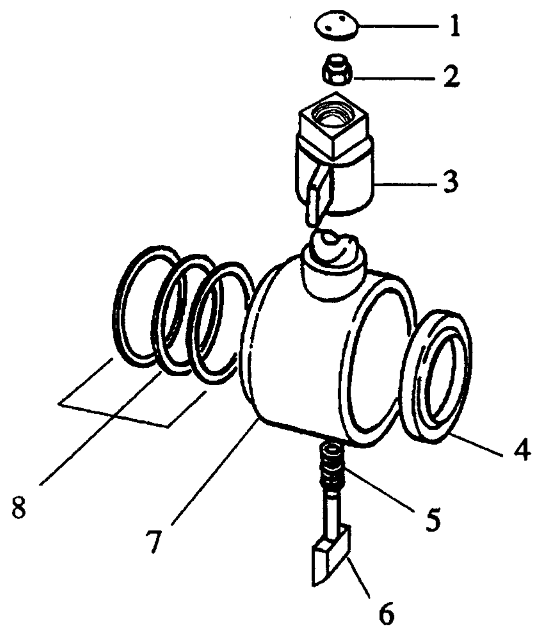
Unscrew the self-locking nut (2). This will allow the release bolt (6) and spring (7) to be withdrawn from inside the connector body (7).

Check the condition of the spring (5). It should have good tension, be unworn and clean. If the tension is weak or it is damaged or badly corroded, fit a new spring.

Check the contour of the cam for wear in the release cap (3) and on the connector itself. Renew worn components.

If, after fitting a new release bolt (6) in the connector body (7), there is still excessive movement, renew the connector.

Examine the connector seal (4) for wear or damage and renew if necessary.



1. Closure Disc
2. Self-locking Nut
3. Release Cap
4. Seal
5. Spring
6. Release Bolt
7. Body
8. Shims

Fig. 8-5 Instantaneous coupling

Reassembly is a reversal of the dismantling instructions noting the following:

Ensure that the vertical face of the release bolt (6) is nearest the valve body and always fit a new self-locking nut.

Tighten the new self-locking nut (2) until the leading edge of the curved face of the release bolt (6) is level with the edge of the bolt hole in the connector body (7). This setting will also ensure that the tension of the spring (5) is correct. Do not forget to refit and tighten the closure disc (1).

Apply Molybdenum Disulphide grease (Lithium Grease) to the spring (5) and release bolt (6).

To Refit

Refitting is a reversal of the dismantling instructions but be sure to select suitable shims (8) in order that the cap (3) is in the vertical plane when the coupling is fully-tightened. The shims are available in thicknesses of 0,75mm, 1,00mm and 1,5mm.

SECTION 9

DELIVERY MANIFOLD

To Remove

Remove the delivery valves (See SECTION 8).

Unscrew the union nuts of the flexible pipe supplying water to the engine oil cooler and remove the pipe.

Remove the screw securing the priming-operating rod to the manifold and lower both the bracket and the operating rod.

Unscrew the four socket screws securing the manifold to the volute, noting that one screw retains the chain anchor for the suction blank cap chain. The manifold may then be removed from the volute and the ‘O’ ring recovered.

If the pump pressure gauge needs to be removed, carefully unscrew it counter-clockwise from the manifold.

To Refit

Refitting is a reversal of the removal instructions.

Fit a NEW ‘O’ ring to the manifold joint if necessary.

SECTION 10

COOLING SYSTEM

(Fig. 10-1 Refers)

Operation

To enable normal operating temperatures to be maintained over extended running periods, a closed-circuit engine-cooling system is used. This system incorporates a heat exchanger and header tank.

Raw water is piped from the volute via a strainer to the engine oil cooler, then through the heat exchanger tubes and returned to the suction tube.

The closed-circuit engine-cooling system takes coolant from the engine and passes it through the heat exchanger where it comes into contact with the internal tubes containing the raw water. The raw water and engine coolant do not come into direct contact but the heat transfer takes place through the walls of the internal tubes.

The coolant then passes through the coolant header tank and is returned to the engine water pump. The total coolant capacity is 5,0 litres

Note: Always use the correct ratio of water and anti-freeze in the engine cooling system. Periodic removal and cleaning of the strainer is essential to maintain adequate cooling of the engine.

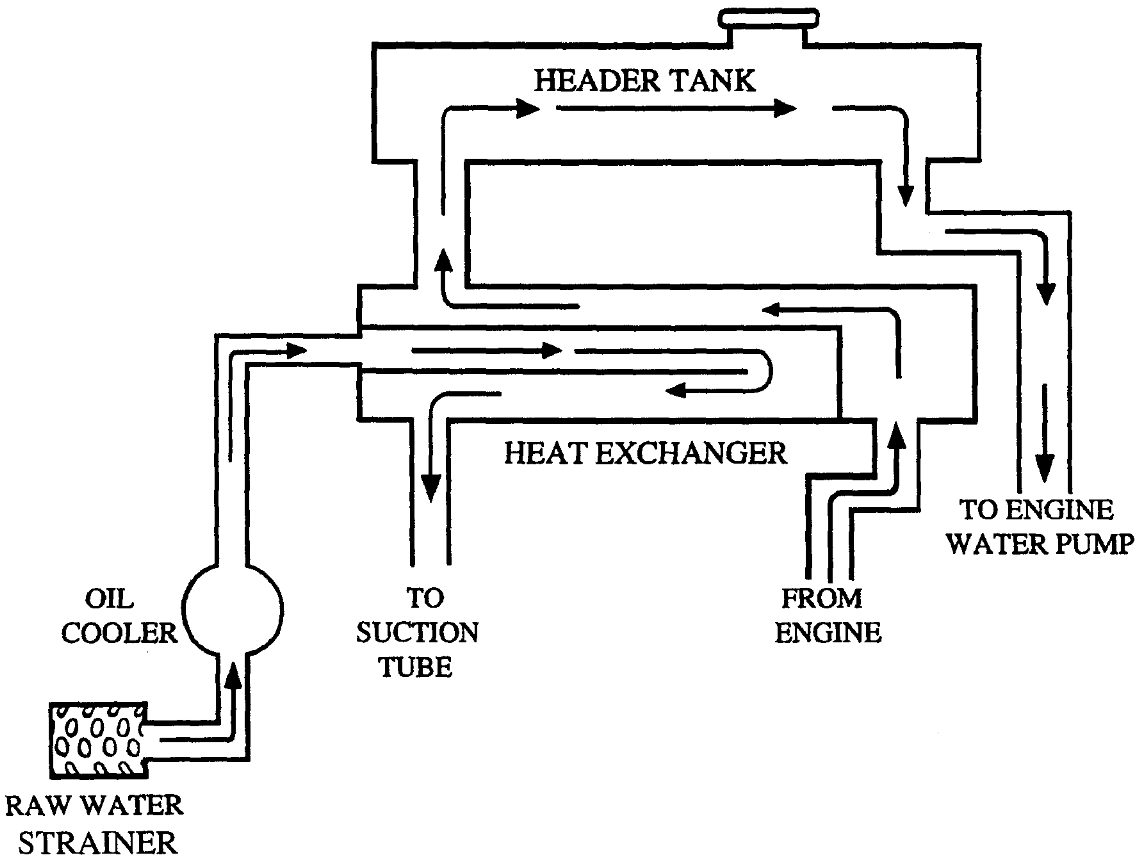


Fig. 10-1 Raw water and engine coolant circuits.

SECTION 11

HEAT EXCHANGER

To Remove

Disconnect the battery.

Drain the engine coolant.

Remove the coolant header tank (See SECTION 13).

Unscrew the four screws and washers to release the brackets securing the heat exchanger to the coolant tank.

Carefully separate the heat exchanger from the tank and recover the ‘O’ ring.

To Refit

Refitting is a reversal of the removal instructions, but use a NEW ‘O’ ring at the heat exchanger-to-coolant tank joint.

IMPORTANT: DO NOT FORGET TO REFILL THE ENGINE COOLING SYSTEM WITH THE CORRECT RATIO OF WATER AND ANTI-FREEZE.

SECTION 12

WATER AND OIL PUMP

To Remove

Drain the coolant system completely.

Undo the hose clips and remove the flexible hose from the header tank. Undo the threaded collars on the rigid plastic pipework assembly at the water pump and adaptor housing and then remove the pipe assembly.

Remove the four M6 nuts securing the impeller housing to the seal housing and lift off. Remove the pressed steel impeller cover, slide off the impeller and prise out the woodruff key in the shaft.

Remove the four M6 nuts securing the seal housing/oil pump to the cylinder head, restrain the oil pump body from moving and lift off the seal housing.

If the oil pump is to be removed, with the oil sump left fitted, then the four M6 studs retaining the oil pump will need to be removed. This may be done using a pair of M6 nuts locked together onto the stud. If the oil sump is already removed, then the oil pump will slide easily off the retaining studs.

Undo the three pan head screws and remove the cover plate.

Remove the oil pump rotors, driving pin and thrust washer, and push the drive shaft out through the oil pump body.

To Refit

Inspect ‘O’ rings and replace if damaged. Inspect the oil pump shaft for signs of wear at driving tang and where the lip seals run on the shaft, replace if damaged.

Scrupulously clean all parts prior to re-assembly. Smear Rocol anti-scuffing paste, or similar, onto the pump shaft and into the bore in the oil pump body*.

***N.B.** This is extremely important and may result in terminal engine damage if not adhered to.

Insert the pump shaft, fill thrust washers and pin , inner and outer rotors, noting that the punch mark in the outer rotor faces towards the water pump.

Place ‘O’ ring in the oil pump body, smear Rocol anti-scuffing paste into bore of cover plate, copiously smear oil rotor with clean oil and replace cover plate then retain with three pan head screws. Ensure that the pump shaft will rotate freely by hand.

Refit formed ‘O’ ring in base of the oil pump and refit the oil pump assembly onto the cylinder head ensuring that the oil pump shaft engages with the slot in the camshaft.

Replace the seals in the seal housing ensuring that the small seal is fitted open side to the water pump and the two larger seals are fitted open side to the oil pump. Pack the seals with Molyslip MPA grease or equivalent.

Refit the ‘O’ ring to the seal housing and fit the seal housing to the end of the oil pump and secure with the four M6 nuts and washers.

Fit the gasket and steel cover to the seal housing, with the gasket between the cover and housing. Fit the woodruff key to the shaft.

Examine the impeller for signs of damage or cracking, replace if necessary. Insert the impeller into the pump liner, ensuring the vanes are correctly aligned when looking into the liner. (See Fig. 12-1)

Fit the impeller and liner onto the pump shaft and, if necessary, rotate the liner anti-clockwise to align the raised tang with the slot in the impeller housing.

Refit the impeller housing and ‘O’ ring and retain with four M6 nuts. Refit the rigid plastic and flexible rubber pipes.

Refill with with coolant.

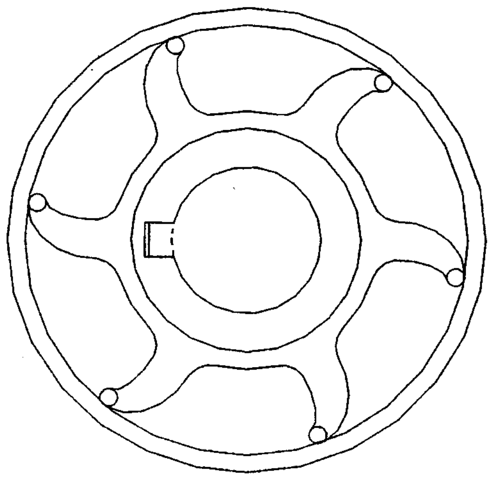


Fig. 12-1 Impeller/liner vane alignment

SECTION 13

COOLANT HEADER TANK

To Remove

Disconnect the battery.

Drain the engine coolant.

Unscrew the two union nuts of the flexible pipes at the heat exchanger.

Slacken the hose clips and detach the large hoses from the coolant header tank and heat exchanger.

Remove the three screws and washers securing the coolant header tank to the cradle and remove the tank-and-heat exchanger as an assembly.

If it is necessary to separate the heat exchanger from the coolant tank see SECTION 11.

To Refit

Refitting is a reversal of the removal instructions.

IMPORTANT: DO NOT FORGET TO REFILL THE COOLING SYSTEM WITH THE CORRECT RATIO OF WATER AND ANTI-FREEZE.

SECTION 14

FUEL TANK

To Remove

No smoking or naked lights.

Disconnect and remove the battery.

Disconnect the fuel-line connector (this is also used for connecting the optional 23,7-litre remote fuel tank).

Remove the connector from the side of the fuel tank by unscrewing the single M6 screw.

Remove the M6 screw securing the fuel line to the intake manifold.

From below the cradle, unscrew and remove the four M6 x 15 socket-head screws and washers to release the fuel tank.

Remove the fuel tank and store SAFELY away from heat and naked lights.

Note: KEEP THE FILLER CAP SCREWED ONTO THE TANK – **EVEN WHEN EMPTY**.

Maintenance

NO MAINTENANCE is necessary, or possible, apart from ensuring that the fuel tank is kept clear of sediment.

Note: All fuel should be properly filtered before use. The fuel tank capacity is 14 litres.

The filler cap incorporates a fuel-level gauge and this may be renewed as a complete assembly only.

An in-line fuel filter is incorporated in the fuel-supply line. This should be checked periodically for excessive contamination by sediment and water. It is NOT a serviceable item and must be renewed as a unit.

To Refit

Refitting is a reversal of the removal instructions.

SECTION 15

MANUAL BACK-UP STARTING

To use the manual starting facility, release the flexible tab securing the hinged-portion of the flywheel cover. Fold the hinged portion back to reveal the engine flywheel.

Unscrew the RED cap and withdraw the starter rope from the storage section which is integral with the coolant tank. DO NOT unscrew the YELLOW coolant filler cap.

Insert the knot of the rope into one of the cutaways in the periphery of the flywheel and wrap the remainder of the rope counter-clockwise around the flywheel in the groove provided.

Switch ON the ignition slightly open the throttle and give the rope a sharp, but continuous pull to start the engine.

WARNING: BE EXTREMELY CAREFUL TO KEEP CLEAR OF ROTATING MACHINERY.

When the engine has been started, immediately hinge the cover back to its normal position with the flexible tab.

Replace the starter rope in the storage facility and refit the RED cap.

SECTION 16

PUMP REMOVAL

NOTE: The pump is not removed from the engine as a complete unit, but is dismantled in-situ.

To dismantle the pump refer to the following Sections:

SECTION 1 .... VOLUTE AND WEAR RING

SECTION 2 .... IMPELLER

SECTION 3 .... CARBON SEAL, SEAL HOUSING AND WEAR RING

SECTION 4 .... PUMP SHAFT AND ADAPTOR HOUSING

SECTION 8 .... DELIVERY VALVES

SECTION 9 .... DELIVERY MANIFOLD

SECTION 17

MONTHLY PUMP TEST

VACUUM TEST

Fit the suction-tube cap in position and close the delivery valves.

Start the engine and open the throttle.

Pull the primer operating rod to activate the priming system.

When the vacuum reading of 0,75–0,80 bar is shown on the Compound Gauge, stop the engine.

The vacuum reading should NOT FALL more than 0,033 bar in one minute for a pump in excellent condition.

PRESSURE TEST

The purpose of this test is to trace a vacuum leak.

Connect the pump to a water supply which is capable of exerting a pressure of 3,5 – 7,0 bar. This can be done by fitting an adaptor in the pump-casing drain hole and then connecting this to a hose or by using a hydrant-to-suction tube adaptor.

If pressurising through a drain hole, it will be necessary to fit the suction-tube blank cap.

With a delivery valve partially-open to allow air to escape, turn on the water supply.

When the pump casing is full of water, close the delivery valve and build up the pressure to 3,5 – 7,0 bar.

If there are leaks, their locations will be shown by water seepage at those points.

Note: FAULT TRACING –

Although it is outside the scope of this manual to give full instructions on the rectification of faults on the engine and pump unit, the following Fault Tracing chart is presented in order that the user can ascertain the probable cause of any fault which may occur.

SECTION 18

PUMP FAULT-TRACING

POSSIBLE FAULT		REMEDY
HIGH VACUUM GAUGE READING RELATIVE TO SUCTION LIFT		
1.	Suction strainer choked	Remove and clean
FAILURE TO LIFT OR HOLD WATER		
1.	Suction-hose joints leaking.	Check and tighten.
2.	Suction strainer not completely immersed.	Check and submerge.
3.	Defective exhaust primer.	Check and rectify.
4.	Leaking priming valve.	Check and rectify.
5.	Delivery valve leaking.	Check and rectify.
BROKEN JETS WITH 'AIR CRACKLE'		
1.	Suction strainer not completely immersed OR too near to the surface of the water supply.	Check and submerge.
2.	Slight leaks on suction-side of the pump.	Check joints and tighten nuts.

If the remedies shown do not clear the fault, then proceed with the MONTHLY PUMP TEST as previously described in SECTION 17.

PART B

ENGINE

CONTENTS

SECTION 1

DESCRIPTION

The HONDA BF45A engine is a three-cylinder, single overhead-camshaft, water-cooled unit mounted with the camshaft in the vertical plane. The camshaft is driven by a composite rubber-toothed drive belt provided with an automatic-tensioning system.

The inlet and exhaust valves are mounted on two separate shafts. A single spring is used for each valve and all valves are fitted with oil seals.

The camshaft pulley incorporates the pulser rotor and the flywheel is mounted outboard of the crankshaft pulley. An exciter coil and two interconnected charging coils are fitted under the flywheel.

The crankshaft is mounted in four main bearings and has three connecting-rod (big-end) journals equally-disposed at 120°. All main and connecting-rod bearings are of the renewable-shell type, with the main bearings being sandwiched between the crankcase and the cylinder block.

Each piston is fitted with two compression rings, one multi-rail oil-control ring and a gudgeon pin retained by circlips.

A trochoid-type oil pump incorporating a pressure-relief valve is fitted to the cylinder head and is driven by the camshaft. A disposable cartridge-type oil filter and an oil cooler are also fitted.

An impeller-type water pump circulates the engine coolant and a thermostat, thermo-switch, coolant tank and heat exchanger are incorporated in the system.

The fuel system consists of a camshaft-actuated mechanical fuel pump, three constant-vacuum carburettors, dashpot check-valve installation and linkages for throttle and choke controls to ensure that all three carburettors operate in unison. An air-intake silencer is also fitted.

A high-output electronic ignition system, operating on the Capacitor Discharge Ignition (C.D.I.) principle, is fitted using three separate H.T. coils and circuitry.

An engine-speed limiter, coolant overheat/low-pressure alert system is incorporated for engine protection.

In the event of an engine problem occurring, the system gradually reduces the engine revolutions and, when the problem clears, progressively increases the revolutions. This is a useful feature which prevents a sudden reduction and then resumption of pump output at the hose nozzles.

Starting is accomplished by a 0,9Kw inertia-type starter motor utilising a remotely-mounted solenoid (magnetic switch). An emergency back-up rope-starting facility using the flywheel may also be used.

SECTION 2

TIMING BELT, PULLEYS AND TENSIONER

Description (Fig. 2-1)

The timing-belt driving pulley (1) is keyed (2) to the crankshaft (3) and secured with an M48 locknut (4). A guide-plate (5) for the timing belt (6) is fitted at each side of the pulley. The complete assembly is mounted inboard of the flywheel, which must be removed (see SECTION 3) before the timing belt can be renewed.

The timing belt-driven pulley is part of the pulser rotor (7) and is dowelled (8) to the camshaft (9) and secured with an M10 screw (10) and washer (11).

The pulser coil assembly (12) is mounted concentrically with, and inboard of, the pulser rotor (7) and secured with three M6 screws (13).

A belt-tensioner (14) is provided incorporating a tension spring (15) and spring anchor (16). The tensioner is secured by an M10 flange bolt (17) with a cap (18) fitted over it.

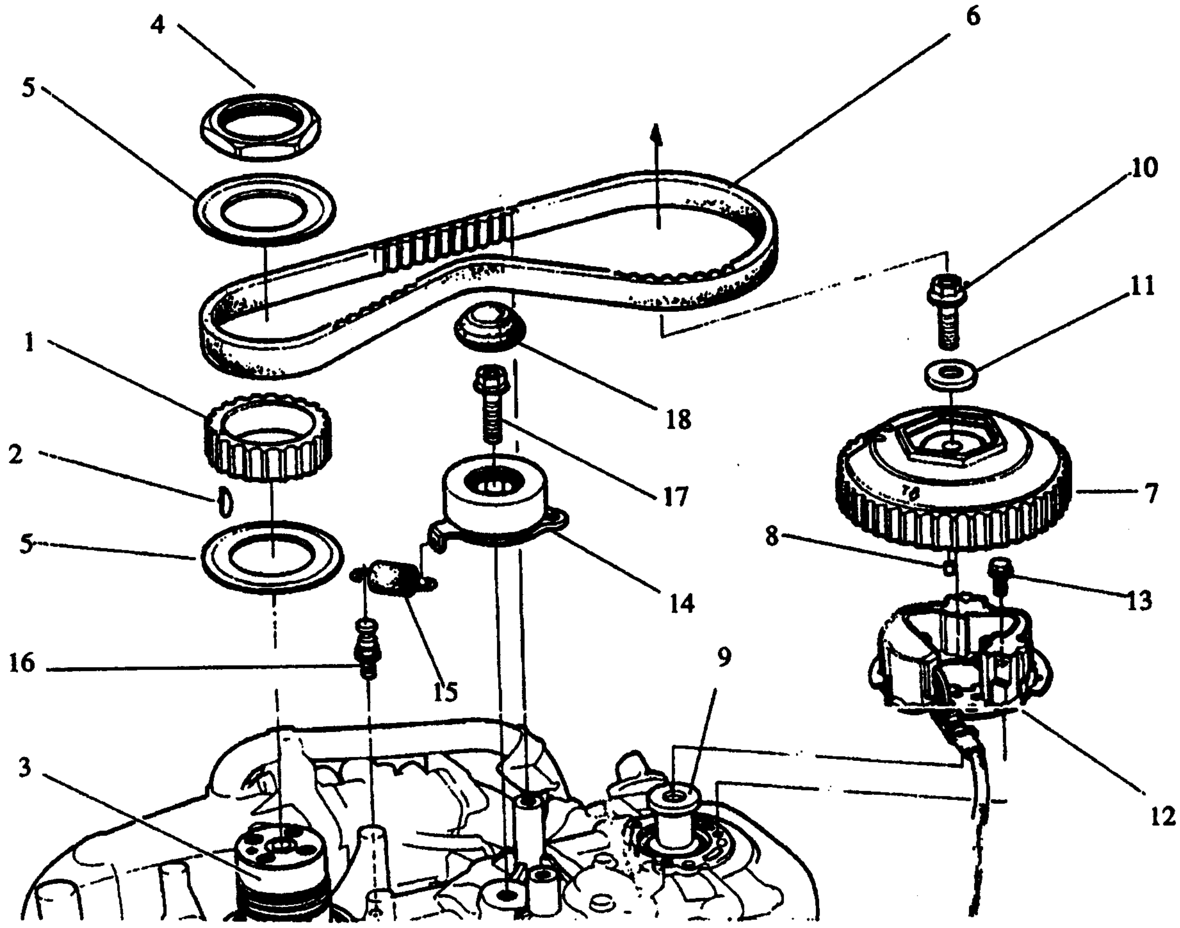


Fig. 2-1 Timing belt, pulleys and tensioner.

Inspection

Remove the timing-belt cover and check point ‘A’ of the timing belt for wear or damage. If wear or damage is evident, fit a new timing belt (Fig. 2-2).

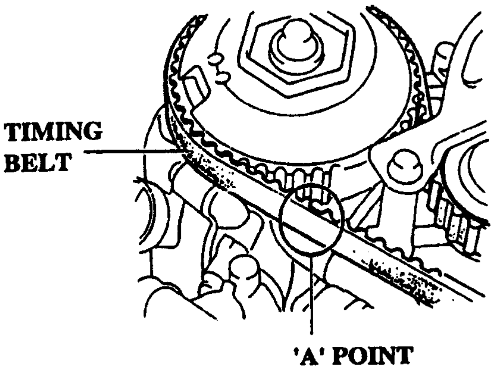


Fig. 2-2 Timing-belt inspection

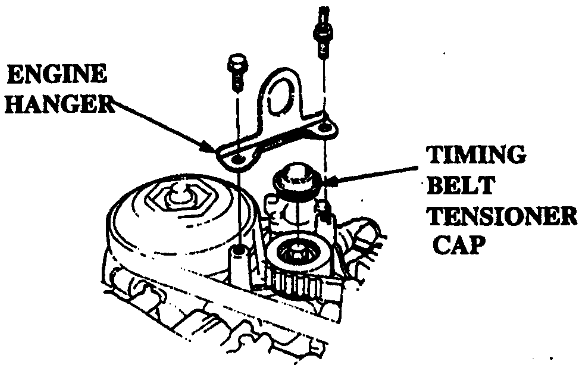


Fig. 2-3 Tensioner cap and engine hanger

Flywheel
(See SECTION 3)

To Remove

Disconnect the battery cables and charging-coil connection and **MOST IMPORTANT** – disconnect the pulser coil connections located under the CDI cover (Fig. 2-3).

Remove the two M8 flange bolts, engine hanger and timing-belt tensioner cap (Fig. 2-3).

Attach the Special Tool O7LPB – ZV30100 to the engine hanger mounting bosses to prevent the flywheel from revolving (Fig. 2-4). Remove the four M10 flange bolts from the flywheel.

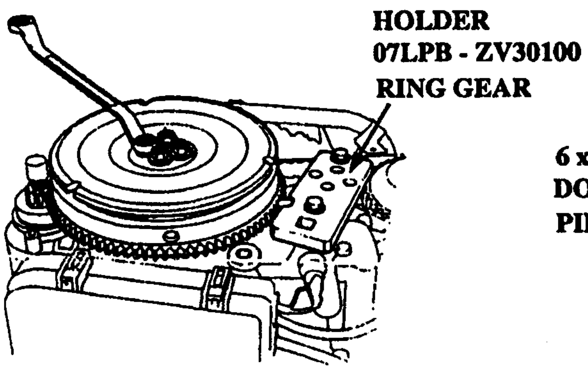


Fig. 2-4 Special tool locking flywheel

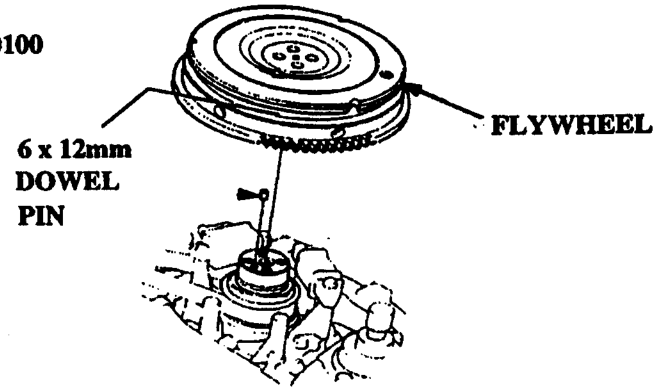


Fig. 2-5 Removing flywheel and dowel pin

Remove the flywheel from the crankshaft. It is located on a dowel fitted to the crankshaft.

Release the exciter coil and the two charging coils by unscrewing the two flange bolts securing each coil to its respective mounting pillar (Fig. 2-6).

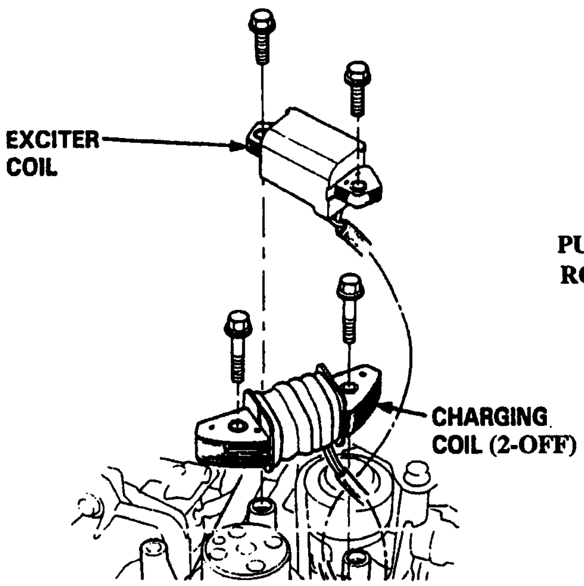


Fig. 2-6 Coil mounting and screws

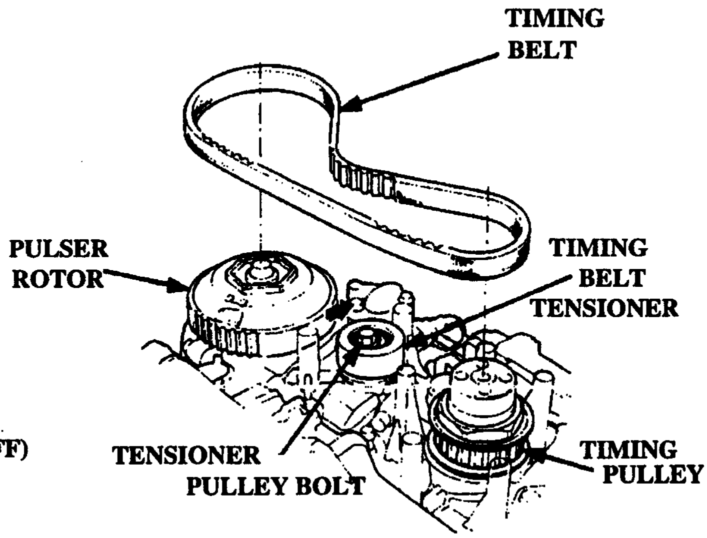


Fig. 2-7 Timing belt removal

Loosen the M10 flange bolt which secures the timing-belt chain tensioner pulley, push the tensioner in the direction of the arrow (Fig. 2-7) and then re-tighten the flange bolt.

Timing Belt

First remove the timing belt from the pulser rotor and then from the timing pulley.

DO NOT USE FORCE to remove the belt; e.g. using a screwdriver or levers and DO NOT TWIST or CONTAMINATE it with oil or grease. Store the belt by hanging it on the wall.

Belt Tensioner

If the timing belt tensioner is to be removed, unscrew the M10 flange bolt, disconnect the tension spring and remove the tensioner pulley assembly (Fig. 2-1). The spring anchor may be unscrewed if required.

Pulser Rotor

To Remove

To remove the pulser rotor, fit Special Tool 07LPA – ZV30200 to the rotor to prevent it revolving and remove the M10 screw securing the rotor to the camshaft (Fig. 2-8).

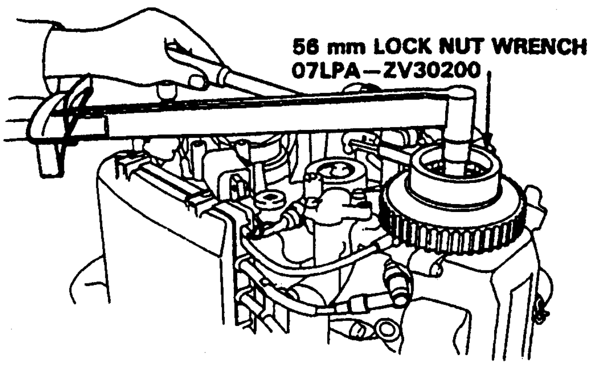


Fig. 2-8 Removing pulser rotor

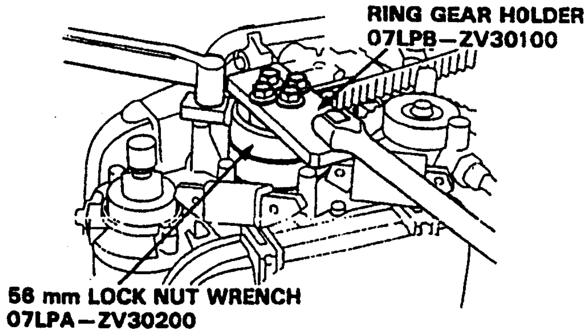


Fig. 2-9 Removing timing pulley

Timing Pulley

To Remove

Fit Special Tool 07LPA – ZV30200 over the timing pulley M48 locknut and then fit Special Tool 07LPB – ZV30100 to the crankshaft using the four M10 flywheel flange bolts (Fig. 2-9). Loosen the locknut and remove the special tools.

Unscrew the locknut from the crankshaft, remove the belt guide, the timing pulley, the Woodruff key and the second belt guide (Fig. 2-1).

To Refit

Install the first belt guide on the crankshaft with the curved surface towards the pulley position (Fig. 2-10). Fit the Woodruff key to the crankshaft and refit the timing pulley taking care not to displace the key.

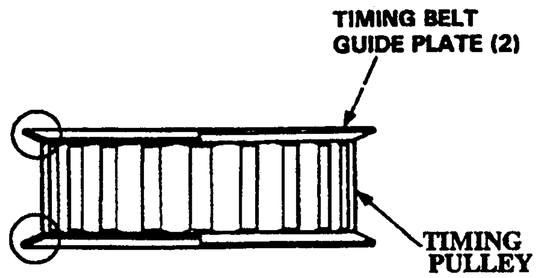


Fig. 2-10 Timing belt guide plates

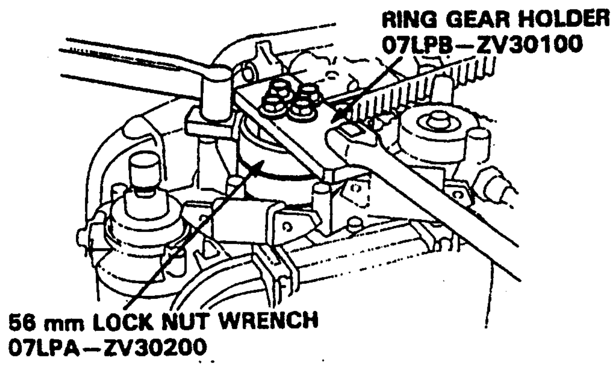


Fig. 2-11 Refitting timing pulley

Fit the second guide plate (with curved surface TOWARDS the pulley) and screw on the M48 locknut.

Using Special Tools 07LPA – ZV30200 and 07LPB – ZV30100, tighten the locknut to a torque of 130Nm.

Pulser Rotor

To Refit

Install the pulser on the camshaft ensuring that it is properly located on the dowel pin. Fit the M10 screw and washer and then fit Special Tool 07LPA – ZV30200 to hold the pulser rotor.
Tighten the screw to a torque of 57Nm.

DO NOT TURN THE PULSER ROTOR CLOCKWISE.

Belt Tensioner

To Refit

Check that the spring anchor is fitted. Fit the tensioner pulley assembly and screw in the M10 flange bolt. Reconnect the tension spring between the tensioner and the spring anchor. Move the tensioner against the spring tension and temporarily tighten the tensioner pulley bolt (Fig. 2-7).

Timing Belt

To Refit

Fit the Special Tool 07LPA – ZV30200 to the pulser rotor and turn the rotor counter-clockwise until the 'T – arrow DOWNWARDS' – mark on the rotor aligns with the 'T – arrow UPWARDS' – mark on the cylinder head (Figs. 2-12 and 2-14).

IMPORTANT: DO NOT TURN THE PULSER ROTOR CLOCKWISE

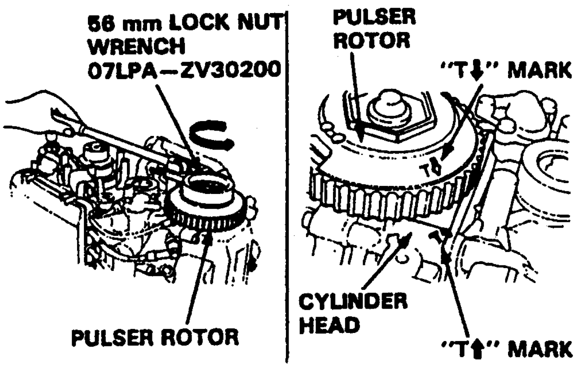


Fig. 2-12 Special Tool and timing marks

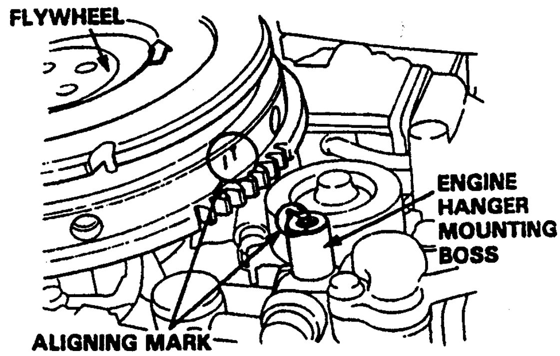


Fig. 2-13 Flywheel aligning marks

Temporarily install the flywheel, fit the four M10 flange bolts and lightly tighten them. make sure that the flywheel is correctly located on the dowel pin before tightening the bolts.

Turn the flywheel counter-clockwise to align the 'T-mark' on the flywheel with the '1-mark' located on the engine-hanger mounting boss (Fig. 2-13) and then remove the flywheel, taking care not to move the crankshaft.

IMPORTANT: DO NOT TURN THE FLYWHEEL CLOCKWISE

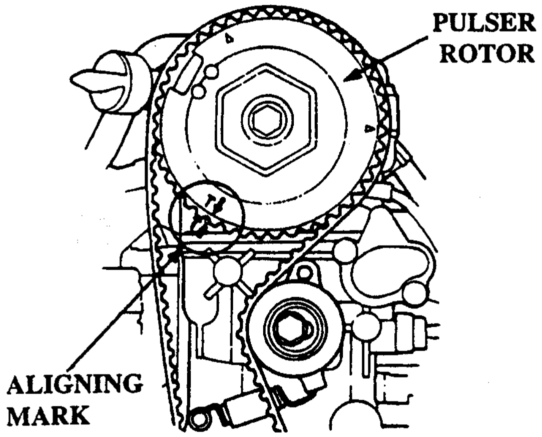


Fig. 2-14 Pulser rotor aligning marks

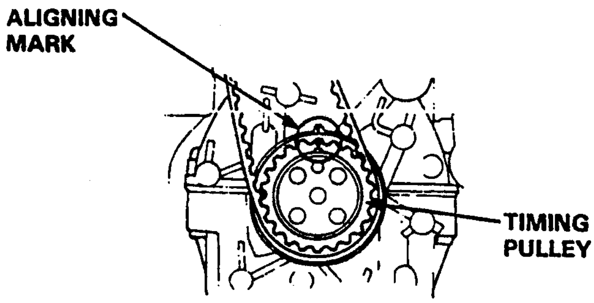


Fig. 2-15 Timing pulley aligning marks

After installing the timing belt, recheck that ALL the timing marks are STILL aligned.

Refit the 6 x 10mm dowel pin and flywheel to the end of the crankshaft.

Make sure that the mark on the pulser rotor is aligned with that of the cylinder head and that the mark on the flywheel is aligned with that on the cylinder barrel.

Loosen the M10 tensioner pulley bolt (Fig. 2-16).

The tensioner assembly will then automatically tension the timing belt. DO NOT push the tensioner agalnst the belt by hand.

Remove the flywheel and dowel pin and fit Special Tool 07LPB – ZV30100 to the crankshaft and turn the crankshaft two revolutions counter-clockwise from the alignment position with the pulser rotor (Fig. 2-17).

IMPORTANT: DO NOT TURN THE FLYWHEEL CLOCKWISE.

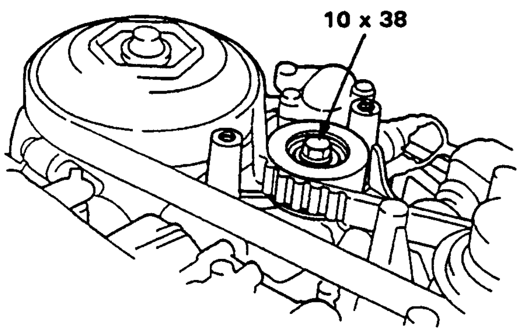


Fig. 2-16 Tensioner pulley bolt

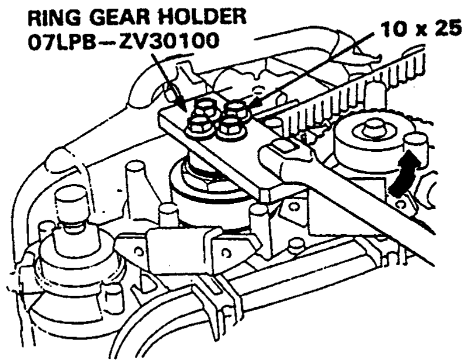


Fig. 2-17 Special Tool fitted to crankshaft

Turn the crankshaft counter-clockwise by three teeth of the pulser rotor (Fig. 2-18).

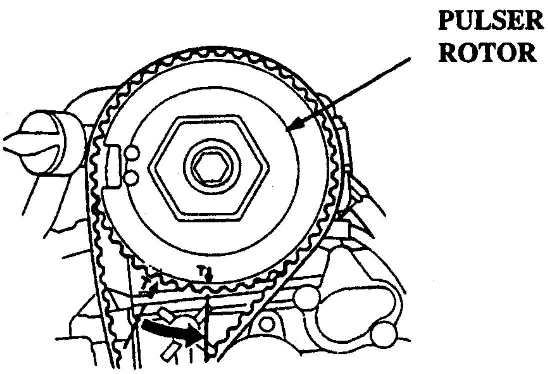


Fig. 2-18 Setting the pulser rotor

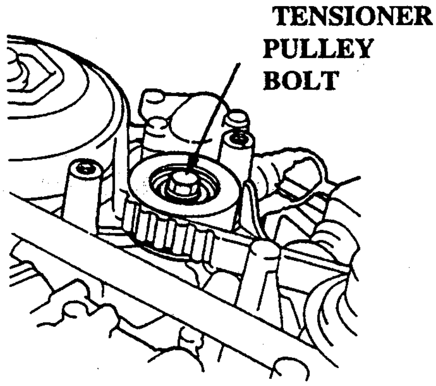


Fig. 2-19 Tensioner pulley bolt

The timing belt tensioner is automatically adjusted. DO NOT push the tensioner against the belt by hand.

Tighten the tensioner pulley M10 bolts to a torqueof45Nm (Fig. 2-19).

Refit the exciter coil and charging coils, but DO NOT RECONNECT the wiring to the wiring harness at this stage.

Refit the flywheel (see SECTION 3).

Refit the timing belt tensioner cap and the engine hanger.

Refit the flywheel cover (see SECTION 3).

SECTION 3

FLYWHEEL

The flywheel incorporates a starter ring gear and is mounted outboard of the camshaft timing belt and timing pulley.

To Remove

Disconnect the battery.

Remove the capacitor discharge ignition cover (1) and disconnect the charging-coil wire (2) – Fig.3-1, and recover the M6 washers (3), rubber grommets (4) and collars (5) – Fig. 3-2.

Unscrew the two M6 screws (1) and two M8 screws securing the flywheel cover (2) – Fig.3-2, and exciter-coil wire (3) connectors – Fig. 3-1.

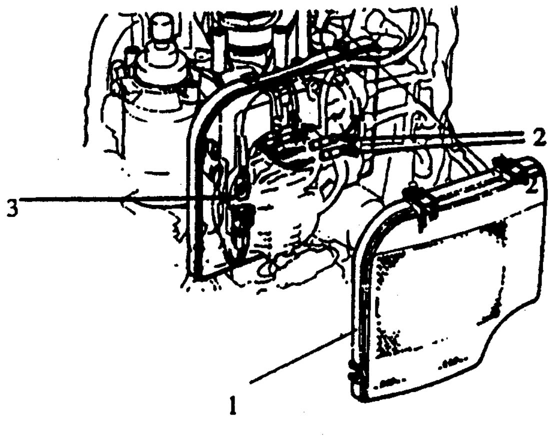


Fig.. 3-1 Coil connections

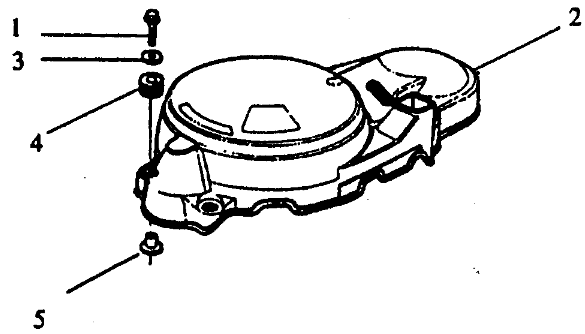


Fig. 3-2 Flywheel cover

Remove the engine hanger and install Special Tool 07LPB – ZV30100 (Fig. 3-3) to prevent the flywheel from revolving.

Unscrew the four M10 flange bolts and remove the flywheel from the crankshaft.

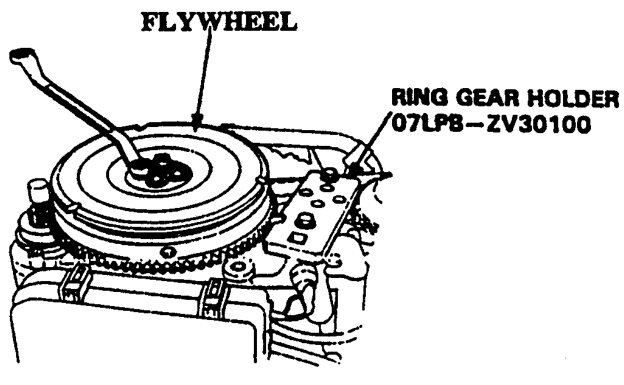


Fig. 3-3 Flywheel locking tool

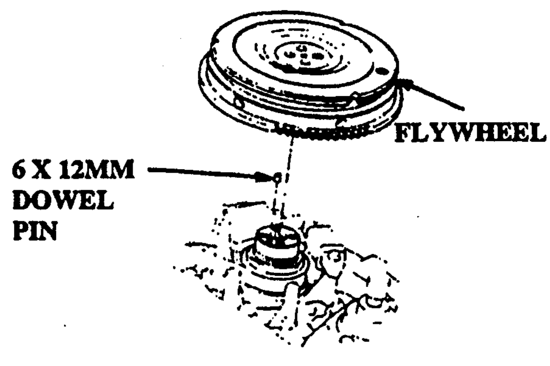


Fig. 3-4 Flywheel and dowel

DO NOT use a hammer to part it from the crankshaft and AVOID damaging the 6 x 1 2mm dowel pin in the end of the crankshaft (Fig. 3-4).

To Refit

Ensure that the flywheel and crankshaft mounting faces are clean and free of burrs. Check that metallic matter has not been attracted onto the flywheel magnets as this could damage the charging and exciter coils.

Mount the flywheel ensuring that it is correctly located on the dowel pin.

Oil the four M10 bolts and tighten to a torque of 66Nm.

Refit the flywheel cover.

SECTION 4

CHECKING VALVE CLEARANCES

The valve-clearance checking procedure must be performed with the engine COLD.

Remove the flywheel cover (see SECTION 3).

Release the clips securing the breather hoses to the cylinder-head cover and detach the hoses.

Remove the seven M6 flange bolts and CAREFULLY remove the cylinder-head cover.

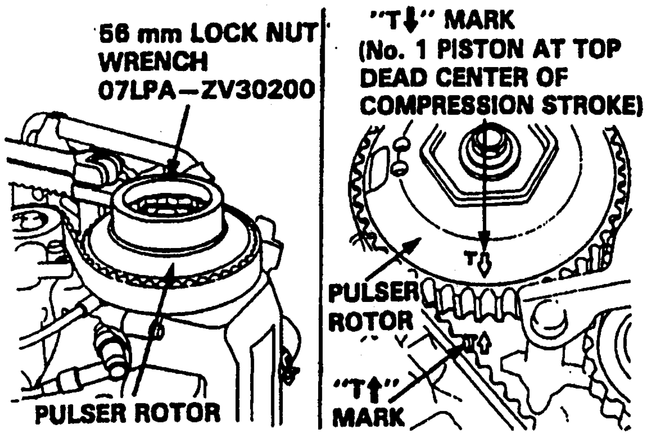


Fig. 4-1 Special Tools and timing marks

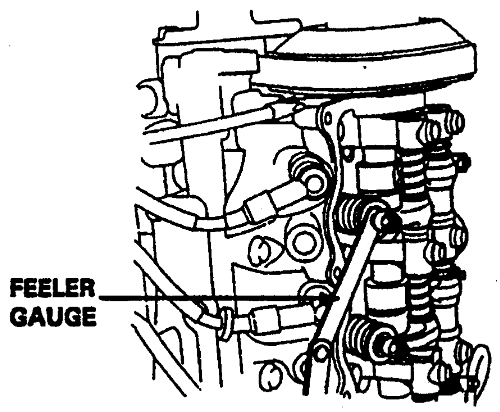


Fig. 4-2 Measuring valve clearance

Attach the Special Tool O7LPA – ZV30200 to the pulser rotor as shown, and align the 'T – arrow DOWNWARDS' mark on the pulser rotor with the 'T – arrow UPWARDS' mark on the cylinder head (Fig. 4-1).

Be sure that the 'T – mark' on the flywheel aligns with the '1 – mark' on the engine hanger mounting boss this time (which indicates that the No.1 piston is at the top dead centre of its compression stroke).

With the No.1 piston at the top dead centre of the compression stroke, measure the intake and exhaust valve clearances (Fig. 4-2).
These should be; Inlet Valve 0,13 – 0,17mm and Exhaust Valves 0,21 – 025mm.

Loosen the valve-adjusting screw locknut and turn the adjusting screw to obtain the specified intake and exhaust valve clearance.

Hold the adjusting screw and tighten the locknut to a torque of 23Nm. Recheck valve clearance after tightening the locknut.

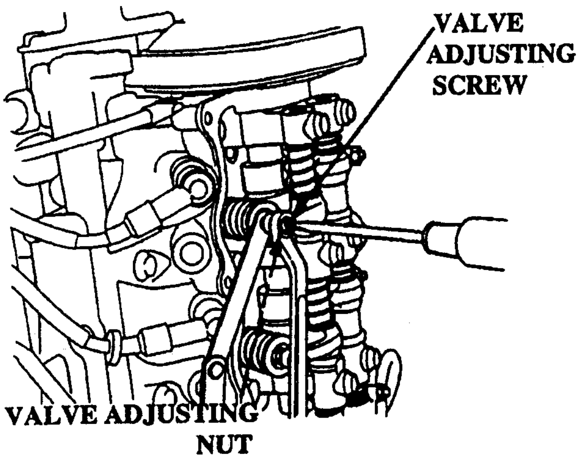


Fig. 4-3 Adjusting valve clearance

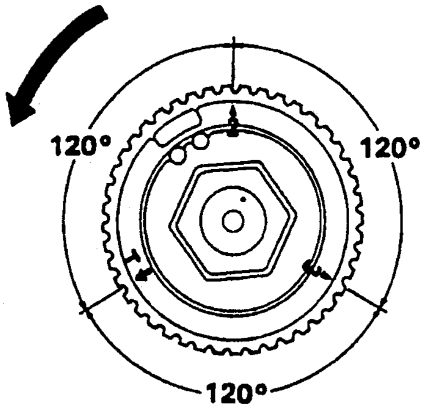


Fig. 4-4 Pulser rotor markimgs

After adjusting the intake and exhaust valve clearances of the No.1 cylinder, turn the pulser rotor 120° further and align the '2 – TRIANGLE' mark with the 'T arrow UPWARDS' mark on the cylinder head (which indicates that the No. 2 piston is at top dead centre of its compression stroke) then adjust both the intake and exhaust valve clearances (Fig. 4-4).

Finally, turn the pulser rotor 120° further and align the '3 – TRIANGLE' mark with the 'T – arrow UPWARDS' mark on the cylinder head (which indicates that the No.3 piston is at the top dead centre of the compression stroke) then adjust both the intake and exhaust valve clearance (Fig. 4-4).

Thoroughly clean the cylinder head and cover mating surfaces.

Apply 'Three Bond 1201 or 1215' or equivalent to the mating surfaces and fit a new gasket.

Refit the cylinder head and tighten the seven M6 flange bolts to a torque of 12Nm.

Reconnect the breather tubes to the head cover.

Refit the flywheel cover.

SECTION 5

CYLINDER HEAD

To Remove

Remove the flywheel cover (see SECTION 3).

Remove the pulser and rotor coils (see SECTION 2). Then slacken the clips and detach the breather hoses from the cylinder-head cover.

Remove the air filter (see SECTION 13) and also remove the carburettors (see SECTION 14).

Remove the head cover by unscrewing the seven M6 flange bolts.

Note: If checking the camshaft axial clearances (end float) this should be done BEFORE removing the cylinder head (Fig. 5-17).

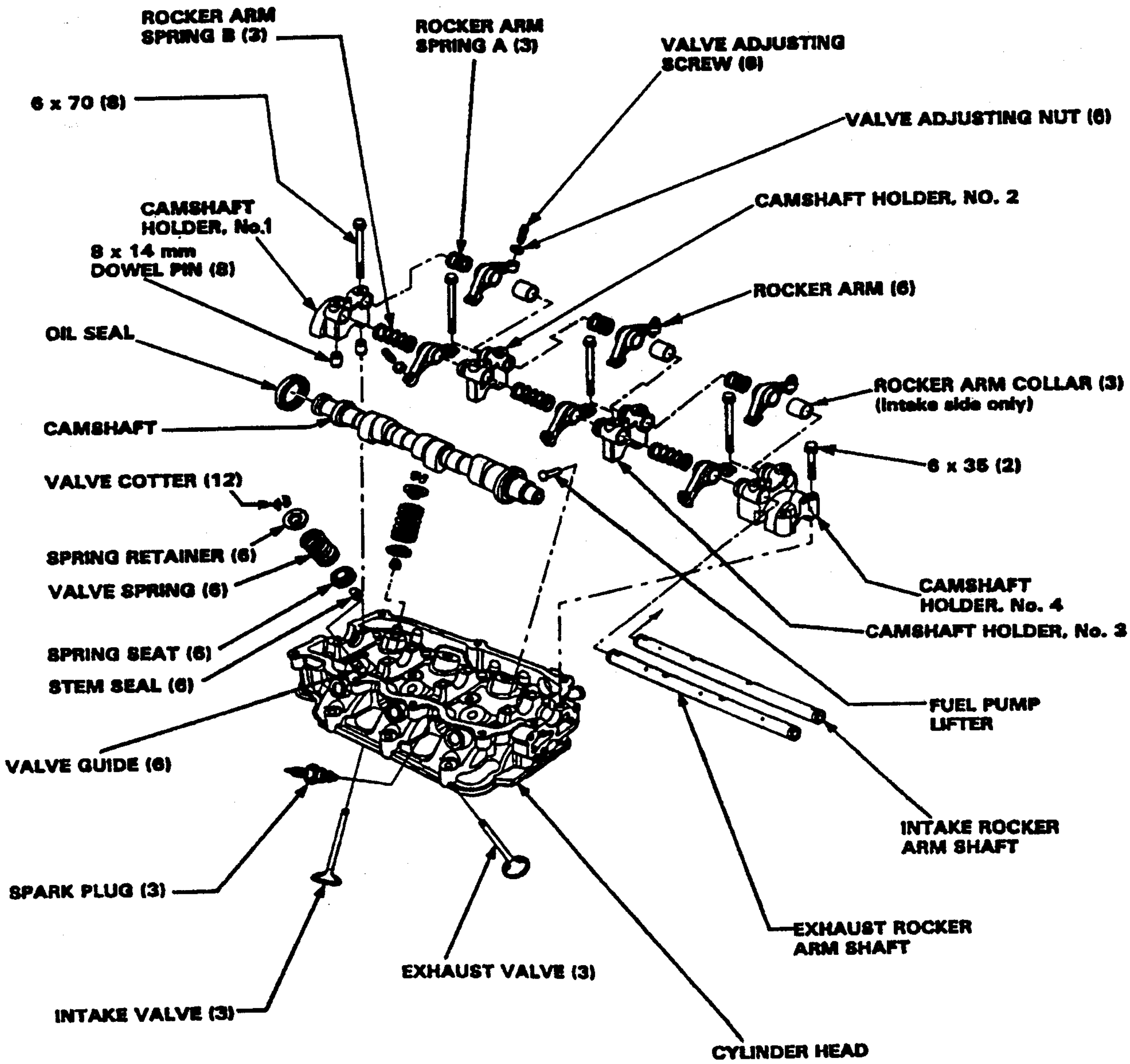


Fig. 5-1 Cylinder head and valve gear

Progressively loosen the eight M 10 and three M8 cylinder-head bolts securing the cylinder head to the cylinder block. Remove the cylinder-head assembly and recover the gasket, eight dowel pins (if loose) oil-path orifice and the ‘O’ ring from the face of the cylinder block.

Remove the oil pump (see SECTION 8).
Note: Unscrew the spark plugs to prevent accidental damage occurring to them.

Progressively loosen the eight 6 x 70mm and the two 6 x 35mm flange bolts securing the four camshaft holders to the cylinder head (Fig. 5-2).

Lift the camshaft holders and rocker-arm shafts from the eight dowel pins and carefully remove the camshaft and oil seal. Recover the fuel pump lifter from the cylinder head (Fig. 3-3).

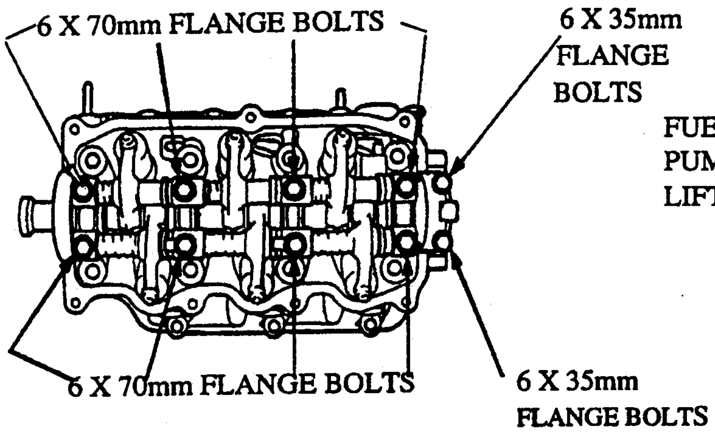


Fig. 5-2 Camshaft holder bolts

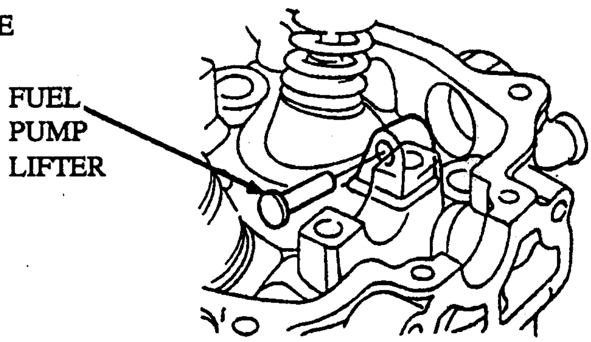


Fig. 5-3 Fuel pump lifter

Using valve-spring compressor 07757-0010000, remove the spring caps, cotters, springs, spring seats and valve-stem seals. Ensure that the components are kept in sets and marked accordingly to their respective positions in the cylinder head.

Inspection and Maintenance

Valve-Spring Free Length

Measure the free length of the valve spring (Fig. 54), – this should be 36,9mm. The service limit is 35,4mm and if shorter than this figure, fit a new spring.

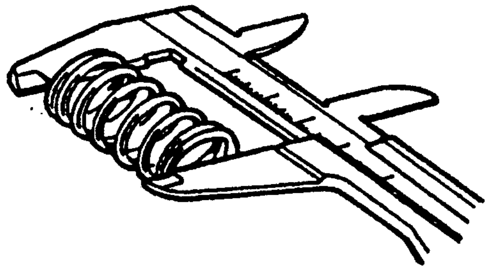


Fig. 5-4 Measuring valve-spring length

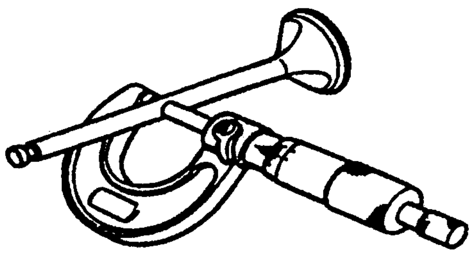


Fig. 5-5 Measuring valve stem.

Valve Stem Diameter

Inspect each valve stem for abnormal wear or bending. Measure and record each valve-stem diameter (Fig. 5-5).

The standard valve-stem diameter is:

Inlet Valve:	5,480 – 5,490mm.	Service limit 5,45mm
Exhaust Valve:	5,460 – 5,470mm.	Service limit 5,42mm.

If the measurement obtained is LESS THAN the service limit, fit a new valve.

Valve Guide Bore Diameter

Ream the valve guides to remove any carbon deposits before measuring the bore diameter.

Measure each valve guide and record the reading obtained (Fig. 5-6).

The standard bore size is:

Inlet and Exhaust Guides:	5,500 – 5,5 12mm.	Service limit 5,53mm.

If the measurement EXCEEDS the service limit, fit a new valve guide.

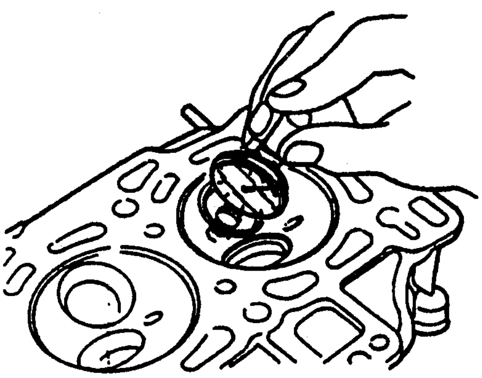


Fig. 5-6 Measuring valve guide bore

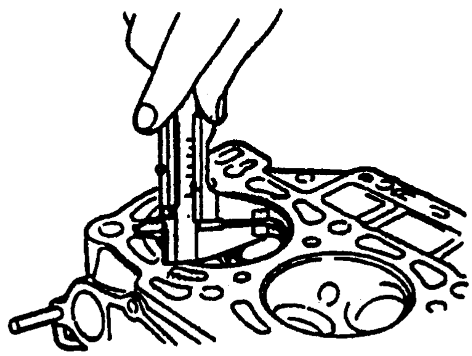


Fig. 5-7 Measuring valve seat width

Valve-Guide-to-Stem Clearance

To obtain the clearance figure; subtract the valve-stem outside diameter from the corresponding valve-guide bore figure.

The standard clearance is:

Inlet:	0,010 – 0,032mm.	Service limit 0,06mm.
Exhaust:	0,030 – 0,052mm.	Service limit

If the stem-to-guide clearance EXCEEDS the service limit, determine if a new guide of standard dimensions would bring the clearance within the correct tolerance. If it would, fit a new guide and ream to fit.

If the stem-to-guide clearance EXCEEDS the service limit WITH a new guide, fit a new valve as well.

Note: Whenever a new valve guide is fitted, the valve seat MUST be reconditioned.

Valve Seat Width

Measure the valve seat width(Fig. 5-7).

The standard width should be:

Inlet AND Exhaust Valve Seats: 1,25 – 1 ,55mm. Service limit 2,0mm.

If the seat width is UNDER the standard limit OR OVER the service limit, recondition the valve seat.

Valve Seat Reconditioning

Thoroughly clean the combustion chambers and valve seats to remove carbon deposits.

Apply a light coat of 'Prussian Blue' or equivalent engineer's marking compound to the valve face. Insert the valve into the guide and, WITHOUT ROTATING, snap it closed several times. The transferred marking compound will show any area which is not concentric with the guide and/or valve.

To recut the valve seat; carefully follow the cutter manufacturer's instructions.

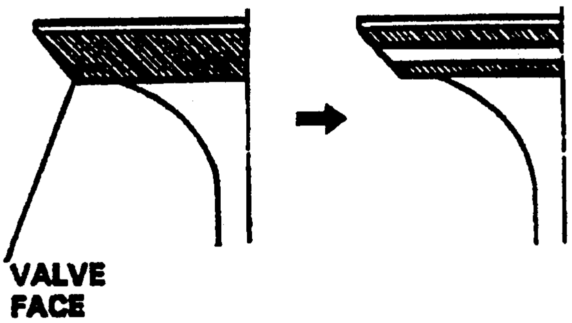


Fig. 5-8 Valve face seating area

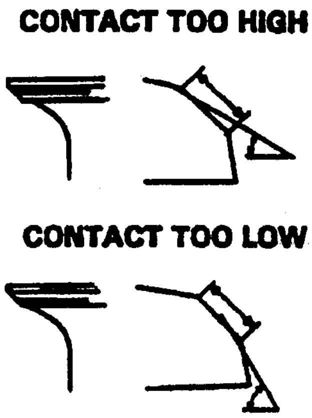


Fig. 5-9 Valve face contact point

Using cutter holder 07781-0010101 and a 45° cutter, remove enough seat material to produce a smooth concentric seat.

Turn the cutter CLOCKWISE ONLY – NEVER counter-clockwise.

Continue turning the cutter as it is lifted from the seat.

Note: Valve head diameter:

Inlet: Valve Head Diameter 24mm
Exhaust: Valve Head Diameter 30mm

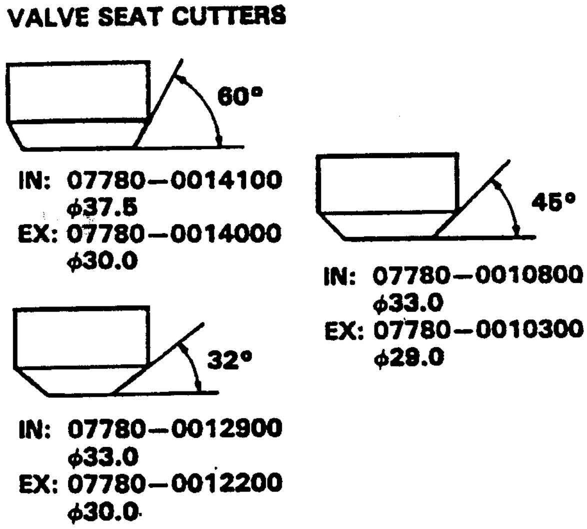


Fig. 5-10 Valve seat cutting angles

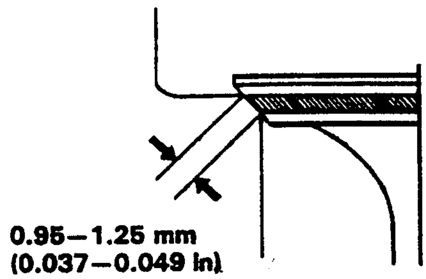


Fig. 5-11 Valve face contact width

Use the 30° – 32° and 60° cutters to narrow and adjust valve seat so that it contacts the middle of the valve face (Figs 5-8 and 5-9).

The 30° cutter removes material from the top edge and the 60° cutter removes material from the bottom edge (Fig. 5-10).

Ensure that the width of the finished seat is within specification.

Make a light pass with a 45° cutter to remove any possible burrs from the edges of the seat.

After re-surfacing the seat, inspect the valve for even seating. Check the width and concentricity of the seating by applying 'Prussian Blue' or equivalent engineer's compound to the valve face.

Snap the valve closed against the seat several times, taking care not to rotate the valve.

The seating surface is shown by the transferred compound and should have a good contact all the way round.

Lap the valves to their seating using a hand-lapper and lapping compound.

Note: DO NOT use a power drill as this will simply make a series of concentric grooves and will quickly destroy the valve seating and valve.

IMPORTANT: BE SURE TO REMOVE ALL TRACES OF THE LAPPING COMPOUND FROM THE VALVES AND SEATS. FAILURE TO DO SO WILL RESULT IN SERIOUS ENGINE DAMAGE.

Rocker Arm Shaft

Measure the outside diameter of the rocker arm shaft (Fig. 5-12). The standard size is 13,976 – 13,994mm. The service limit 13,95mm.
Renew the shaft if its diameter is less than the service limit.

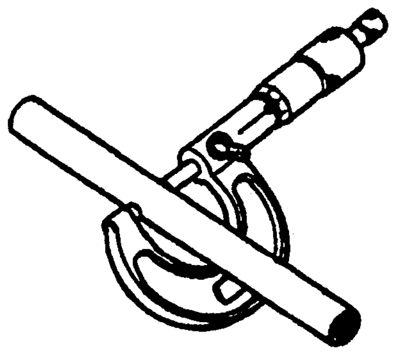


Fig. 5-12 Rocker shaft outside diameter

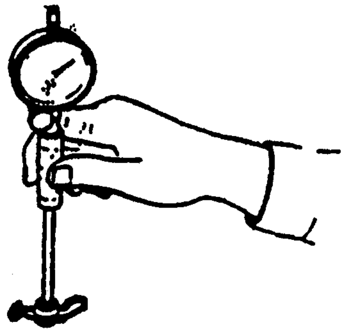


Fig. 5-13 Rocker-arm bore diameter

Rocker Arm

Measure the bore of the rocker arm (Fig. 5-13). The standard bore size is 14,010 – 14,028mm. The service limit is 14,05mm. If the bore is larger than the service limit fit a new rocker arm. Check the rocker-arm slipper surface for wear and scratches. Renew if necessary.

Rocker Arm-to Rocker-Arm-Shaft Clearance

The standard rocker-arm-to-rocker-arm clearance is 0,016 – 0,052mm. The service limit is 0,07mm. If the service limit is exceeded, fit a new rocker arm and/or rocker-arm shaft.

Cam Height

Measure the cam height (Fig. 5-14). The standard height is:

Inlet Cam:	34,928 – 35,248mm.	Service limit: 34,708mm.
Exhaust Cam:	34,973 – 35,293inrn.	Service limit: 34,753mm.

If the cam height is less than the service limit, fit a new camshaft.

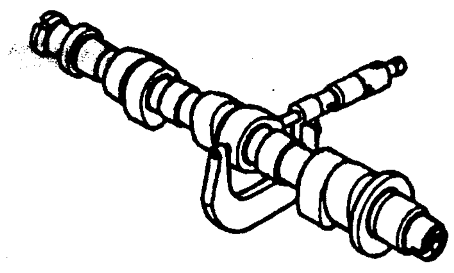


Fig. 5-14 Measuring cam height

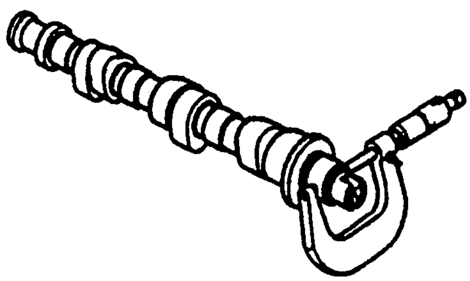


Fig. 5-15 Measuring camshaft journal

Camshaft Journal Diameter

Measure the camshaft journal diameter (Fig. 5-15). The standard diameter is 22,959 – 22,980mm.

The service limit is 22,93mm. If the journal diameter is smaller than the service limit, fit a new camshaft.

Camshaft Run-Out

Check the camshaft run-out (Fig. 5-16).

Note that the camshaft run-out is half of the maximum gauge reading already obtained.

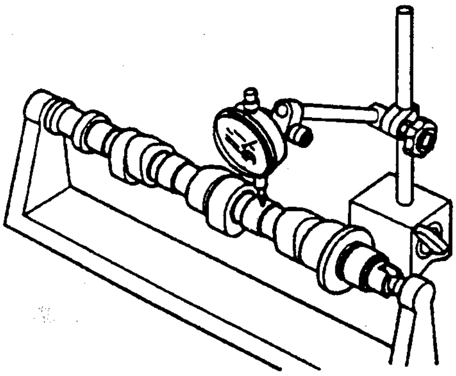


Fig. 5-16 Checking camshaft run-out

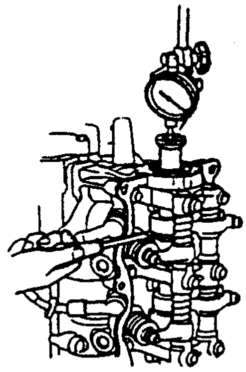


Fig. 5-17 Camshaft axial clearance

The standard maximum run-out is 0,03mm and the service limit is 0,05mm.

Camshaft Axial Clearance

The camshaft axial clearance (end float) should be checked BEFORE removing the cylinder head from the cylinder block (Fig. 5-17).

Loosen the valve-adjusting locknuts and unscrew the adjustment screws before performing the check.

The standard axial clearance is 0,03 – 0,11 mm. The service limit is 0,3mm and, if exceeded, a new camshaft should be installed and the clearance re-checked. If the service limit is STILL exceeded, a new cylinder head must be

Camshaft Oil Clearance

Set the Plastigauge axially on each camshaft journal (Fig. 5-18).

Install camshaft holders – Numbers l,2,3,and 4 and the eight 8 x 14mm dowel pins.

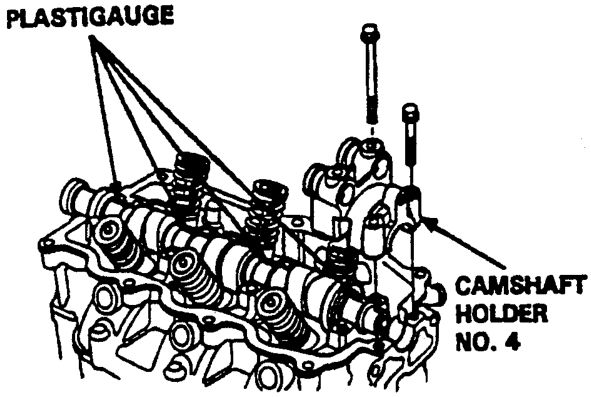


Fig. 5-18 Plastigauge locations

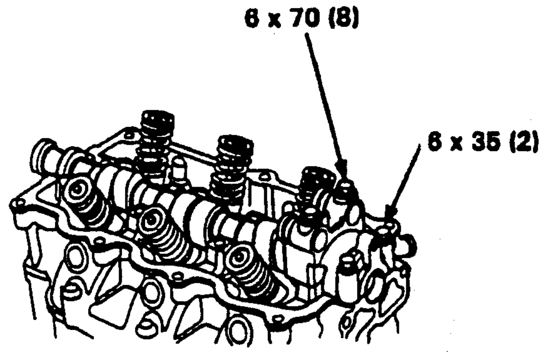


Fig. 5-19 Flange bolt location

Tighten the eight 6 x 70mm and two 6 x 35mm flange bolts to the correct torque:

For 6 x 70mm bolts – 14Nm and for 6 x 35mm bolts – 12Nm.

DO NOT rotate the camshaft while tightening the bolts. The inner bolts should be tightened first followed by the outer side to the same torque value (Fig. 5-19).

Remove camshaft holders 1,2,3 and 4 and check the width of each Plastigauge using the scale (Fig. 5-20). Measure the width at its widest point.

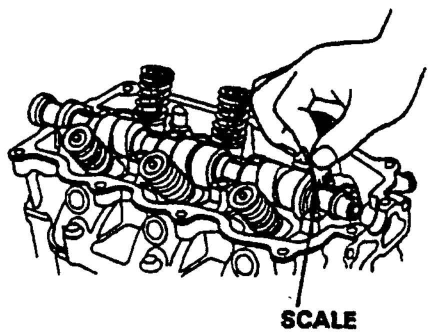


Fig. 5-20 Checking Plastigauge width

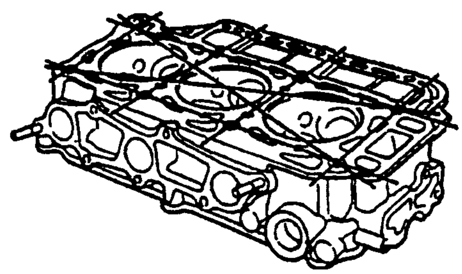


Fig. 5-21 Checking cylinder-head warpage

The standard oil clearance is 0,020 – 0,065 mm. The service limit is 0,08 mm. If the oil clearance exceeds the service limit, install a new camshaft and measure the clearance again. If it STILL exceeds the service limit, fit a new cylinder head.

Cylinder Head Inspection

Clean any gasket material from the gasket face and any carbon deposits from the combustion chambers. Carefully check the areas around the plug holes and valve seats for cracks. Using a known straight-edge and feeler gauge, check the cylinder head for warpage (Fig. 5-21). The service limit is 0.1mm.

Renewing Valve Guides

Chill the new valve guide(s) in the freezer-section of the refrigerator for approximately one hour. Using valve-guide driver Number 07742 – 0010100, drive out the valve guide from inside the combustion chamber (Fig. 5-22). Take care not to damage the cylinder head during valve-guide removal.

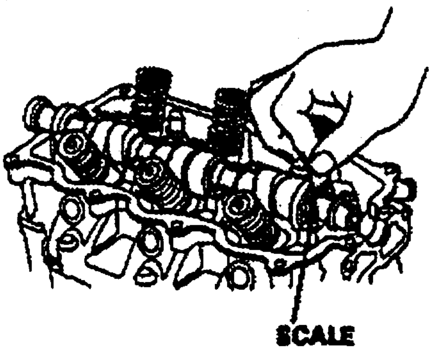


Fig. 5-22 Driving out old valve guide

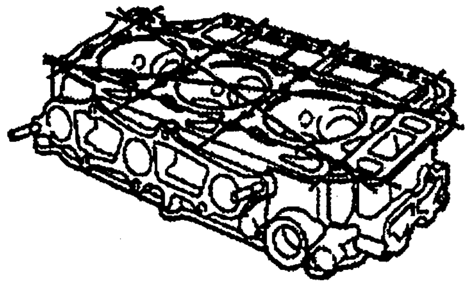


Fig. 5-23 Installing new valve guide

Remove the new valve guide(s) one at a time as required for immediate installation. Position the new valve guide at the valve spring-side of the cylinder head and drive in towards the combustion chamber (Fig. 5-23).
Following installation, check the guide for damage. If damaged, a new guide must be fitted.

Valve Guide Reaming

For best results ensure cylinder head is at room temperature before reaming the valve guides and coat the valve-guide reamer Number 07984-2000001 and the valve guide with cutting oil.

Turn the reamer clockwise through the valve guide for the full length of the reamer and keep turning the reamer during its withdrawal from the guide (Fig. 5-24).

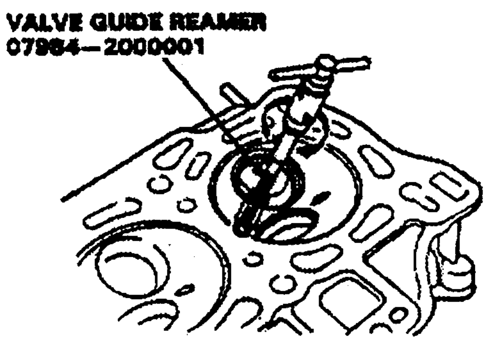


Fig. 5-24 Reaming valve guide

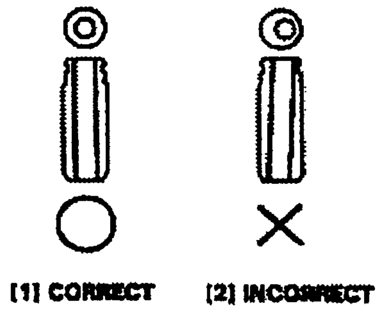


Fig. 5-25 Showing valve-guide bore

Thoroughly clean the cylinder head and valve guide to remove any debris and cutting oil from the reaming operation.

Ensure that the valve-guide bore is straight, circular in section and concentric with the guide body (Fig. 5-25). Insert the valve and check that its operation is smooth over the working area of the valve stem. If it does not operate smoothly, the guide may have been bent during installation. If it has a new one must be fitted.

Finally, check the valve-guide-to stem clearance.

Cylinder Head Bolts Check

10 x 85mm Bolts

Measure the length of the bolts as shown (Fig. 5-26). The standard length is 84,5 – 85,5mm. The service limit is 86,9mm and if not within the service limit, new bolt(s) must be fitted.

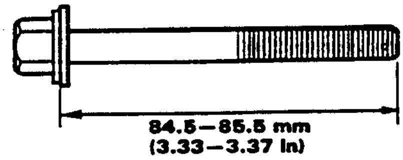


Fig. 5-26 Cylinder head bolt length check

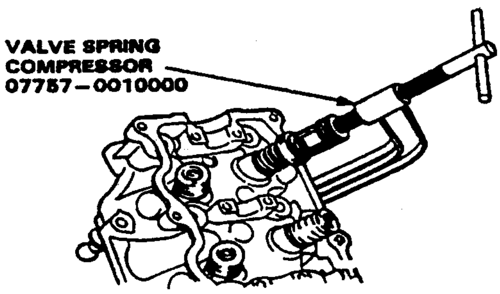


Fig. 5-27 Installing valve springs

To Refit

Refitting is a reversal of the removal instructions, noting the following:

When refitting valves, fit a new stem oil seal to each valve and lubricate stem with engine oil. Use the valve-spring compressor Number 07757 – 0010000 to compress the valve springs and install the valve cotters (Fig. 5-27). Ensure that they are correctly seated in the groove of the valve stem.

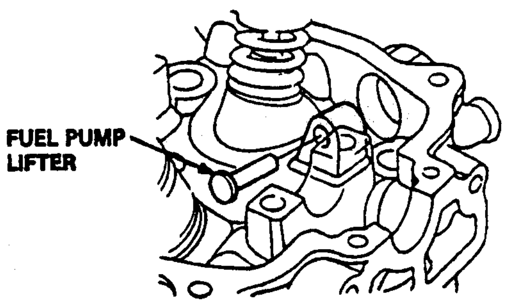


Fig. 5-28 Fuel pump lifter location

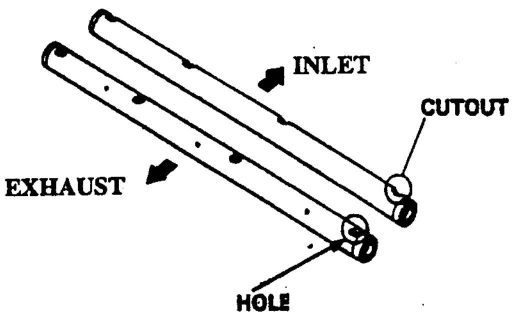


Fig. 5-29 Rocker-arm :shaft installation

DO NOT FORGET to install the fuel-pump lifter in the cylinder head before fitting the camshaft and rocker-arm shafts. Lubricate with engine oil.

Rocker Arm Shafts

The rocker-arm shafts MUST NOT be interchanged.

Note: The shaft with the hole in it is fitted to the exhaust side and the one with the cut-out ia fitted to the inlet side (Fig. 5-29).

Lubricate with engine oil.

Cam Holder No.1 and 4

Before installing, apply ‘Three Bond 141’ or equivalent, sealing compound to the installation surfaces.

Grease between the lips of the oil seal in No. 2 cam holder.

Install with the cam-holder number facing the pulser rotor (Fig. 5-30).

Rocker Arms, Springs and Collars

These components must be assembled in the positions shown and lubricated with engine oil – (Fig. 5-31).

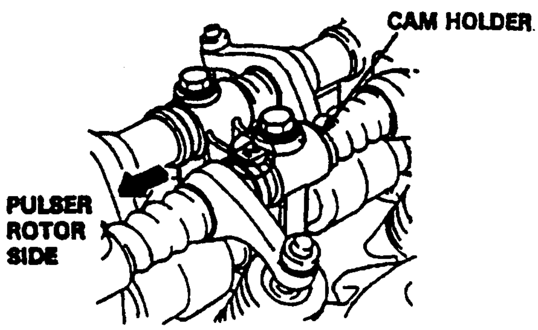


Fig. 5-30 Cam-holder position

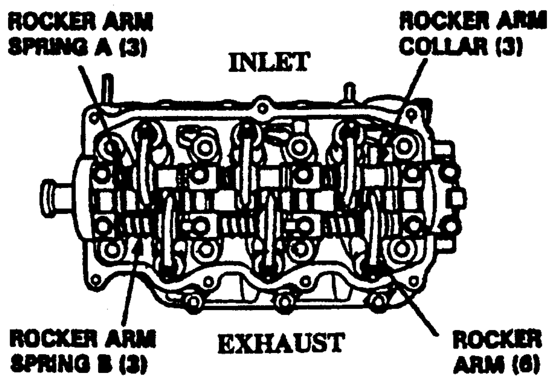


Fig. 5-31 Rocker arms, springs and collars

6 x 70 and 6 x 35mm Flange Bolts

Install the eight 6 x 70mm and the two 6 x 35mm flange bolts and tighten in the sequence shown (Fig. 5-32). The 6 x 70mm bolts should be tightened to a torque of I4Nm and the 6 x 35mm bolts to a torque of 12Nm.

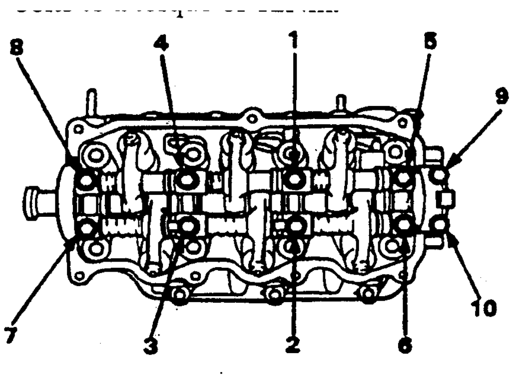


Fig. 5-32 Camshaft-holder bolt tightening

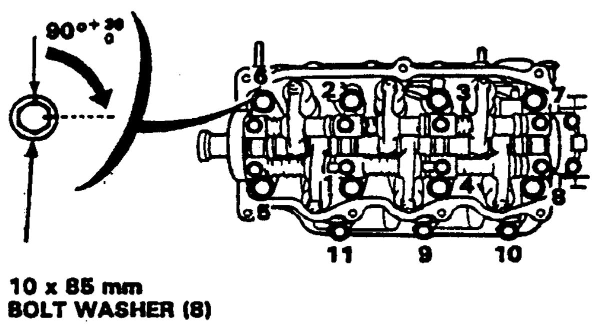


Fig. 5-33 Cylinder-head bolt tightening

10 x 85mm Bolts and 8 x 40mm Flange Bolts

Before fitting the cylinder head and cylinder-head bolts, ensure that the eight 8 x 14mm dowel pins and the oil-path orifice and 'O' ring are installed in the joint face of the cylinder block. Fit a new cylinder-head gasket, position the cylinder head on the block, lightly oil the bolts and install them in their correct locations.

Tighten the eight 10 x 85mm bolts and the three 8 x 40mm flange bolts in the sequence shown (Fig. 5-33). The 10 x 85mm bolts should be tightened to 38Nm then a further 90° +30°. The 8 x 40mm flange bolts should be tightened to a torque of 27Nm.

Adjust valve clearances and tighten adjuster locknuts to a torque of 23Nm. (see SECTION 4).

Use a new head-cover gasket coated on both surfaces with 'Three Bond 1201 and 1215' or equivalent sealing compound.

Tighten the seven head-cover bolts to a torque of 12Nm.

Compression Check

Whenever work has been carried out involving valves, cylinder head or pistons and rings, a compression check may be performed if required, using the following procedure:

Remove all three spark plugs.
Fully-open the throttle. Check that the choke is in the 'OFF' (Inoperative) position.
Install a compression gauge in one of the spark plug holes.
Operate the starter motor until the highest pressure reading is obtained.
Install the compression gauge in each of the remaining plug holes in turn and obtain the highest pressure reading as previously described. The correct reading should be 15+/–1kg/cm² (212+/–14 p.s.i.) at 500 r.p.m.

SECTION 6

CRANKCASE

To Remove

Disconnect and remove the battery.

Disconnect the exciter coil and charging-coil wires under the capacitor-discharge ignition cover (Fig. 3-1).

Drain the engine coolant. Then drain the engine oil.

Remove the pump unit. (see PART A – SECTION 16).

Remove the engine unit and mount in a suitable jig to enable engine-stripping operations to be performed safely.

Remove the flywheel. (see SECTION 3). Then remove the timing belt and pulleys. (see SECTION 2). Finally remove the cylinder head. (see SECTION 5).

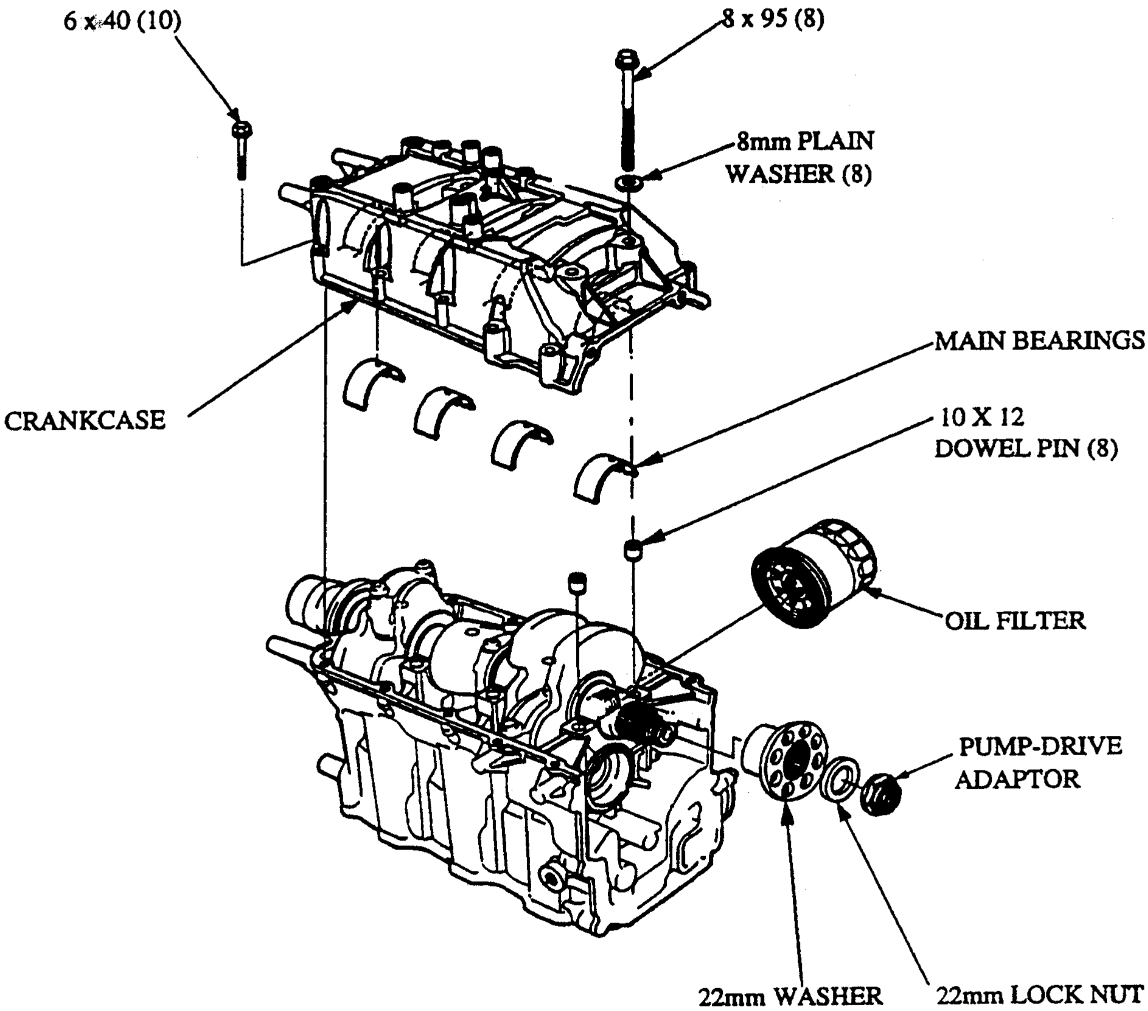


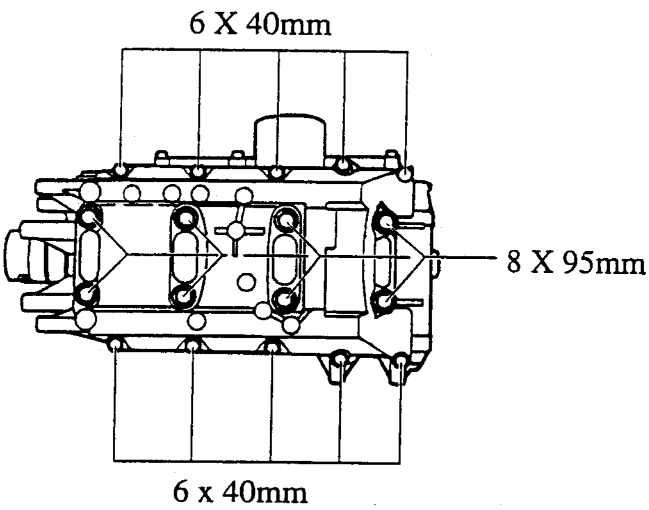
Fig. 6-1 Crankcase components

Install the ring gear holder 07LPB – ZV 30100 to prevent the crankshaft from revolving.

Unscrew the eight nuts and bolts from the pump shaft-to-pump drive adaptor and remove the pump shaft.

Using locknut wrench 07916 – 7500000 unscrew the M22 locknut securing the pump drive shaft adaptor to the crankshaft. Recover the M22 washer and withdraw the adaptor from the splines.

Progressively loosen the ten 6 x 40mm flange bolts around the perimeter of the crankcase and then the eight 8 x 95mm bolts from the raised part of the crankcase.



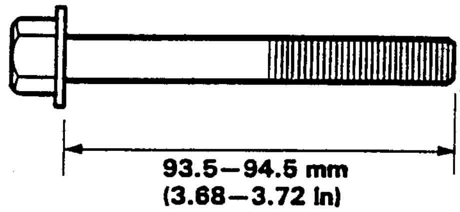


Fig. 6-2 Crankcase flange bolts

Fig. 6-3 Checking flange bolt length

Check the length of the 8 x 95mm flange bolts. The standard length should be 93,5 – 94,5mm and the service limit is 95,4mm.
If the bolt is not within the service limit it MUST NOT be re-used; use a NEW bolt.

Maintenance

Thoroughly clean the crankcase, particularly the crankcase-to-cylinder block joint faces.

Ensure that the new main bearing shells are correctly located with the locking lug of each shell in the corresponding notch in the crankcase.

Apply Molybdenum disulphide oil to the bearing working faces but not to the mating surface with the crankcase.

Check that the eight 10 x 12mm dowel pins are in position in the cylinder block.

To Refit

Apply 'Three Bond 1141C' or equivalent, liquid gasket to the crankcase-joint face (Fig. 6-4) – DO NOT apply to the crankshaft journal or bolt holes.

Apply locking agent to the plain shank and oil threads and flange of the eight 8 x 95mm flange bolts – insert into their respective crankcase bolt holes. Remember to fit the M8 plain washers.

Insert the ten 6 x 40mm flange bolts into the remaining crankcase bolt holes after applying oil to the thread and flange of each bolt.

Tighten the 8 x 95mm flange bolts in the sequence shown (Fig. 6-5) to a torque of 28Nm. Mark the bolt heads and crankcase and tighten through a further 900+300.

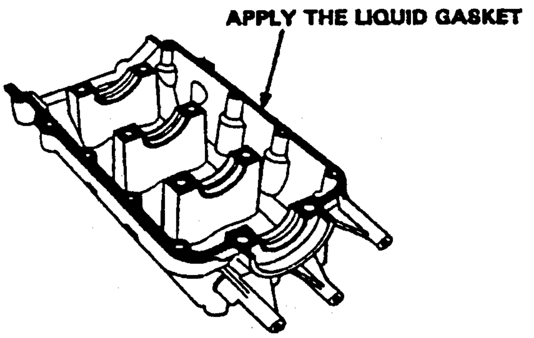


Fig. 6-4 Applying liquid gasket

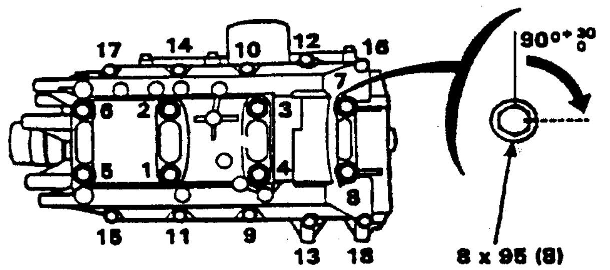


Fig. 6-5 Crankcase bolt tightening

Tighten the ten 6 x 40mm flange bolts in the sequence shown (Fig. 6-5) to a torque of 11Nm.

Secure the crankshaft with ring-gear holder Number 07LBP – ZV 30100.

Oil the threads of the crankshaft, install the pump-drive shaft adaptor, M22 locknut. Tighten to a torque of 92Nm using locknut wrench Number 07916-7500000.

Use the staking tool (Part Number 53563) to secure the locknut by staking it into the groove provided in the threaded-portion of the crankshaft.

Check the run-out (concentricity) of the pump shaft adaptor.

IMPORTANT: This MUST NOT EXCEED 0.02mm total indicator reading.

Note: Before staking, make absolutely sure that the adaptor is fully-seated and recheck the torque loading on the locknut.

IMPORTANT: It is ESSENTIAL to use the staking tool when refitting the pump shaft adaptor locknut. FAILURE TO DO SO WILL ALLOW THE NUT TO BECOME LOOSE RESULTING IN SERIOUS ENGINE AND/OR PUMP DAMAGE.

Fit a new engine oil filter. (see SECTION 10).

Refitting the remaining components is a reversal of the removal instructions. Refer to the appropriate sections.

SECTION 7

CYLINDER BLOCK, CRANKSHAFT AND PISTONS.

To Remove

Remove the crankcase (see SECTION 6) and unscrew the connecting-rod nuts and lift off the connecting-rod cap.

Lift the crankshaft from the main bearings in the cylinder block and remove the 50 x 70 x 8mm oil seal from the flywheel-end of the crankshaft. Recover the two thrust bearings and the main bearings.

Remove the piston and connecting-rod assemblies and mate with the previously removed connecting-rod caps.

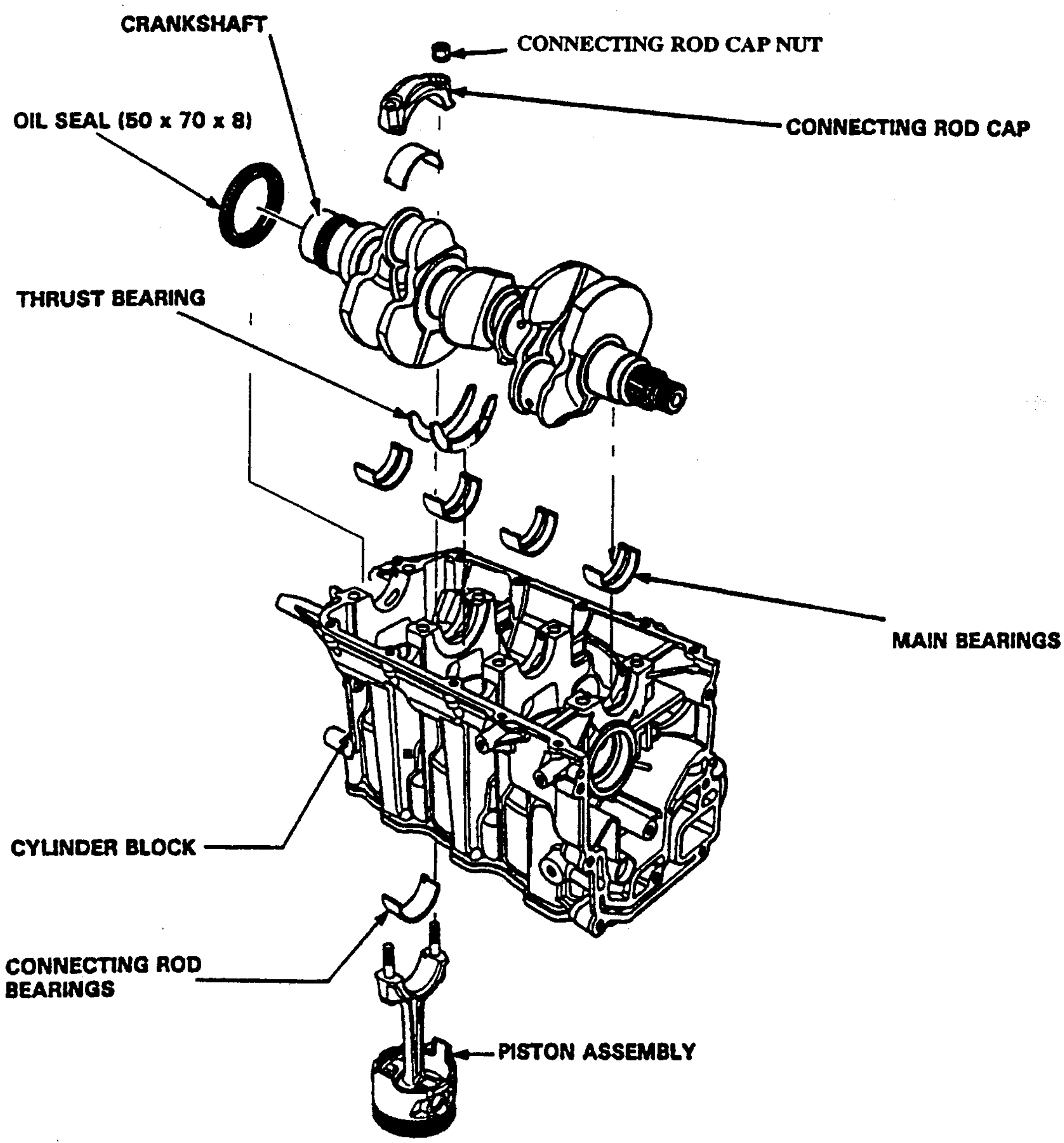


Fig. 7-1 Cylinder block, crankshaft and pistons.

Using a pair of needle-nosed pliers, remove the circlips from the piston taking care NOT to scratch or damage the piston body.

Push the piston pin from the piston. This action will also release the connecting rod assembly from the piston.

Carefully remove the two compression and the three-piece oil-control ring from the piston, again taking care not to damage the piston-ring lands.

Inspection and Maintenance

Piston Skirt O.D.

Measure and record the piston O.D. at 10mm from the bottom of the skirt at a point 90° from the piston pin bore (Fig. 7-2).

The standard O.D. is 69,970 – 69,990mm and the service limit is 69,910mm.

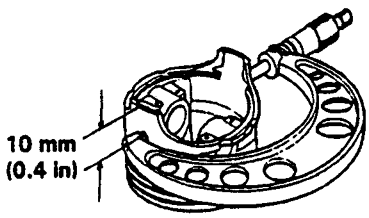


Fig. 7-2 Piston outside diameter

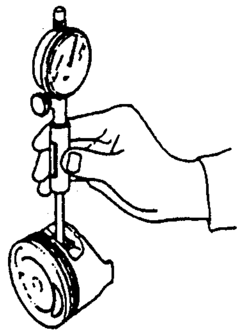


Fig. 7-3 Piston pin hole diameter

Piston Pin Hole Diameter

Measure the bore of the piston pin hole (Fig. 7-3). The standard diameter is 18,002 – 18,008mm and the service limit is 17,96mm.

Piston Pin O.D.

Using a micrometer measure the outside diameter of the piston pin at three points i.e. the two bearing surfaces which are normally in contact with the piston pin hole and the area upon which the connecting rod operates (Fig. 7-4).

The standard diameter is 17,994 – 18,000mm and the service limit is 17,954mm.

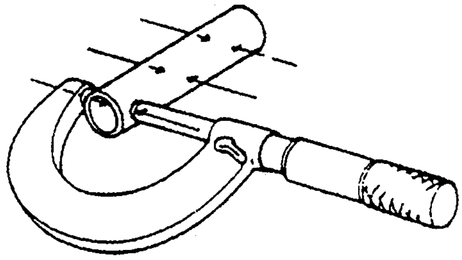


Fig. 7-4 Measuring piston pin O.D.

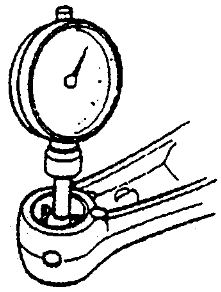


Fig. 7-5 Connecting rod small end I.D.

Measure the inside diameter of the connecting rod small end (Fig. 7-5). The standard diameter is 18,016 – 18,034mm with a service limit of 18,05mm.

Piston Ring Width

Measure the width of the top (chrome-plated) and the second piston rings (Fig. 7-6). The standard width is 0,990 – 1,025 mm with a service limit of 0,96mm.

Piston Ring Side Clearance

Use a feeler gauge to determine the side clearance between the piston rings and the piston body (Fig. 7-7). The clearances should be as follows:

Top ring standard clearance is 0,040 – 0,065 mm and the service limit is 0,1 mm.
Second ring standard clearance is 0,015 – 0,045mm and the service limit is 0,1mm.

Oil control ring standard clearance is 0,55 – 0,140mm and the service limit is 0,15mm.

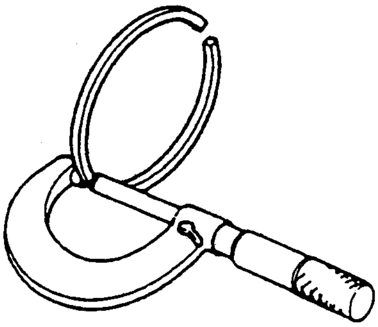


Fig. 7-6 Measuring piston ring width

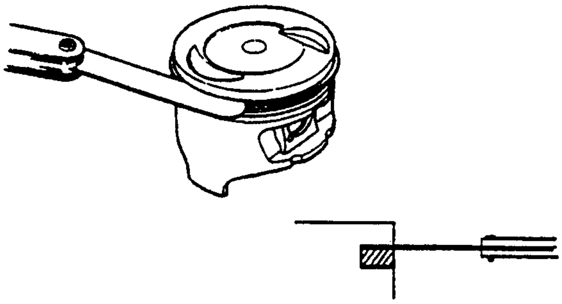


Fig. 7-7 Piston ring side clearance

Cylinder Bore Diameter

Measure and record the cylinder bore diameter at three levels in both the X and Y axis (Fig. 7-8). Use the maximum reading obtained to determine the cylinder bore wear. The standard bore measurement is 70,0 – 70,01 5mm with a service limit of 70,06mm.

Piston-to-Cylinder Clearance

This is calculated by comparing the piston diameter previously obtained with the cylinder bore diameter. The standard clearance is 0,010 – 0,045mm with a service limit of 0,09mm.

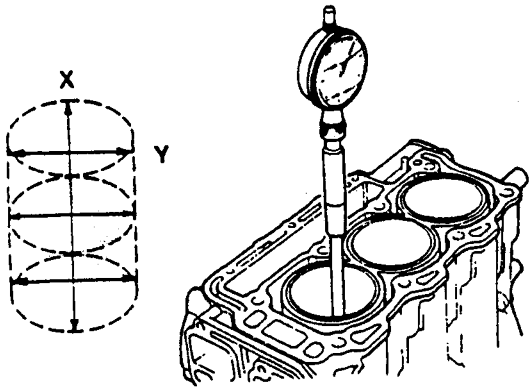


Fig. 7-8 Measuring cylinder bore

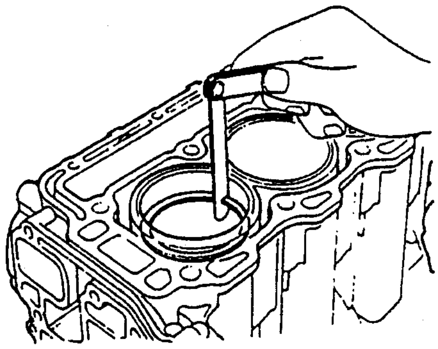


Fig. 7-9 Measuring piston ring gap

Piston Ring End Gap

Insert each piston ring into the appropriate cylinder bore and measure the end gap (Fig. 7-9).
The top ring standard gap is 0,15 – 0,3mm with a service limit of 0,8mm.
The second ring standard gap is 0,30 – 0,45mm with a service limit of 0,95 mm.
The oil control ring standard gap is 0,2 – 0,7mm with a service limit of 1,0mm.

Crankshaft Main Journal O.D.

Measure the crankshaft main bearing journals O.D. (Fig. 7-10).
The standard size is 39,982 – 40,006mm with a service limit of 39,95mm.

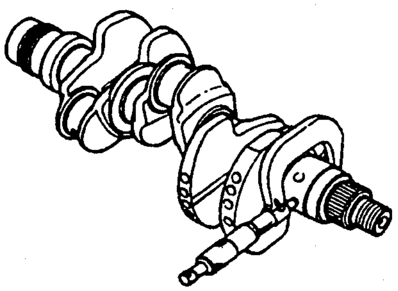


Fig. 7-10 Measuring main journal O.D.

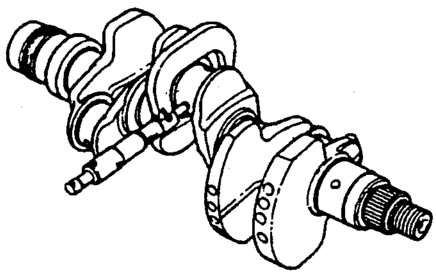


Fig.7-11 Measuring crankpin journal O.D.

Crankpin (Big-End) Journal

Measure the crankpin journal O.D. (Fig. 7-11). The standard crankpin journal diameter is 37,976 – 38,0mm with a service limit of 37,94mm.

Connecting Rod Big-End Oil Clearance

Thoroughly clean all oil from the crankpin and connecting-rod bearing surfaces.

Position a piece of Plastigauge on the crankpin and assemble the connecting rod and cap and tighten nuts to a torque of 28Nm (Fig. 7-12).

Note: Do not rotate the crankshaft or connecting rod with the Plastigauge in place.

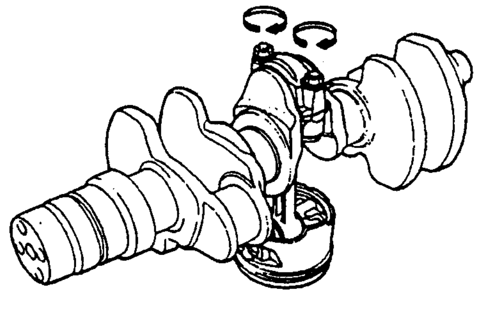


Fig. 7-12 Fitting connecting rod

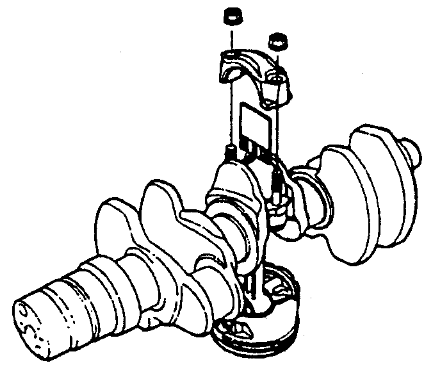


Fig. 7-13 Measuring the Plastigauge

Remove the nuts and connecting rod cap and measure the Plastigauge (Fig. 7-13).

The standard oil clearance is 0,020 – 0,038mm with a service limit of 0,08mm.

Connecting Rod Axial Clearance

Measure the axial clearance of the connecting rod with a feeler gauge (Fig. 7-14).

The standard clearance is 0,05 – 0,2mm with a service limit of 0,3mm.

Crankshaft Side Clearance

Measure the clearance with a feeler gauge (Fig. 7-15).

The standard clearance is 0,05 – 0,3mm with a service limit of 0,45mm.

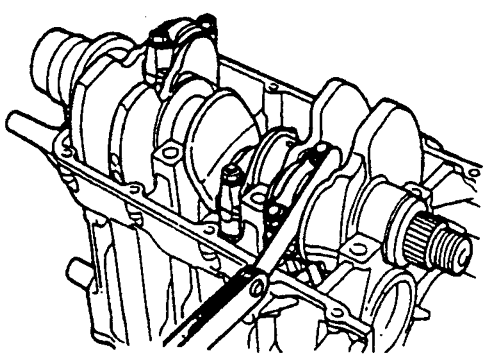


Fig. 7-14 Connecting rod axial clearance

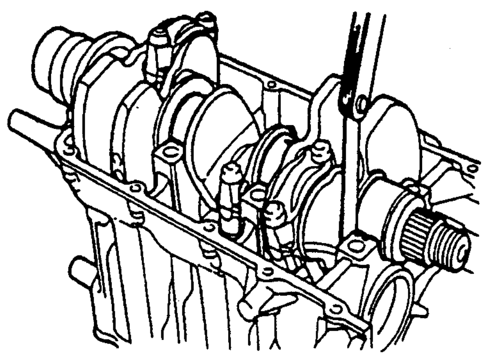


Fig. 7-15 Crankshaft side clearance

Bearing Selection

1. Main Bearing

Record the crankshaft main journal O.D. code numbers from the crankshaft web (Fig. 7-16). Alternatively, measure the main journal O.D.

Record the crankcase identification code numbers (Fig. 7-17).

Note: Numbers on the crankcase are codes for the main bearing journal I.D. from front to rear.

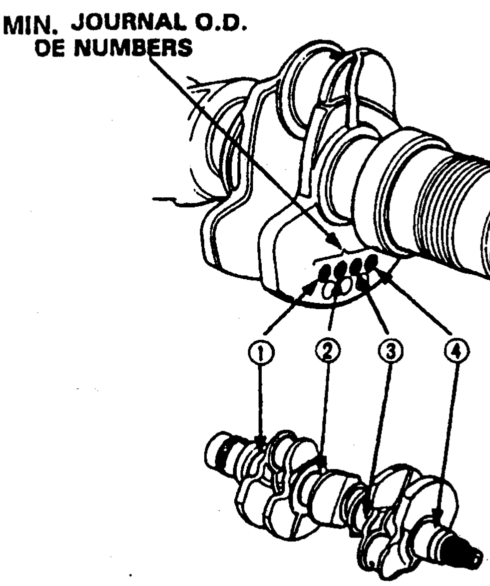


Fig. 7-16 Main journal O.D. code numbers

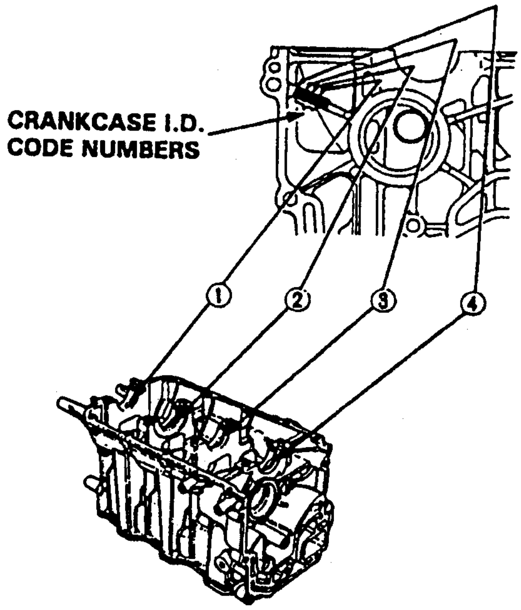


Fig. 7-17 Crankcase I.D. code numbers

Cross reference the crankcase and journal codes to determine the replacement bearing colour. code (Fig. 7-18). The standard oil clearance is 0,020 – 0,038mm.

Unit: mm (in)

Crankcase I.D. 44 ø / Crankshaft O.D. 40 ø		Mark A	Mark B	Mark C	Mark D
		0 – Less than 0.006(0.0002)	0.006(0.0002) – Less than 0.012(0.0005)	0.012(0.0005) – Less than 0.018(0.0007)	0.018(0.0007) – Less than 0.024(0.0009)
Mark 1	Less than 0.006(0.0002) – 0	RED	PINK	YELLOW	GREEN
Mark 2	Less than 0 – –0.06(–0.0002)	PINK	YELLOW	GREEN	BROWN
Mark 3	Less than –0.006(–0.0002) – –0.012(–0.0005)	YELLOW	GREEN	BROWN	BLACK
Mark 4	Less than –0.012(–0.0005) – –0.024(–0.0009)	GREEN	BROWN	BLACK	BLUE

Fig. 7-18 Main journal colour code

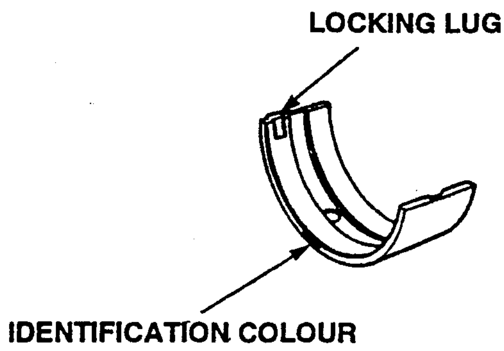


Fig. 7-19 Bearing colour code and lug

2. Connecting Rod Bearing

Record the crankpin O.D. code letters (Fig. 7-20). Alternatively, measure the crankpin journal O.D. The three crankpin locations are shown in Fig. 7-21.

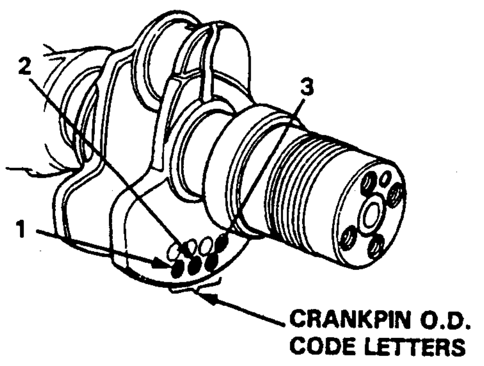


Fig. 7-20 Crankpin O.D. code letters

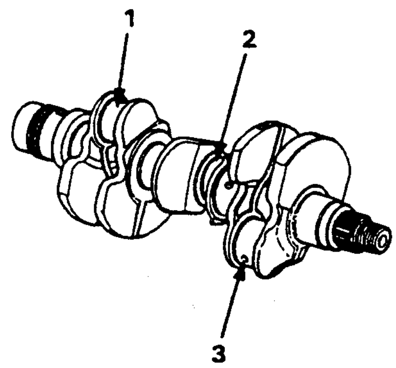


Fig. 7-21 Crankpin locations

Record the connecting rod I.D. code letters (Fig. 7-22). Alternatively, assemble the connecting rod and end cap WITHOUT bearings and measure the I.D. of the big-end eye.

Cross reference the crankpin and connecting-rod codes to determine the replacement bearing colour (Fig. 7-23).

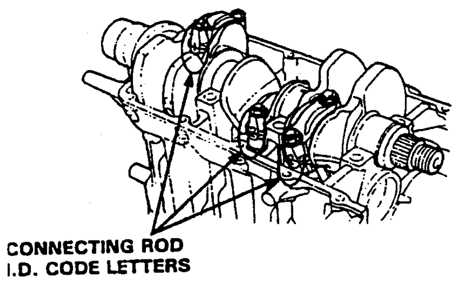


Fig. 7-22 Connecting rod I.D. code letters

Unit: mm (in)

Crank pin O.D. 38 ø / Connecting rod I.D. 41 ø		Mark A	Mark B	Mark C	Mark D
		Less than 0 – –0.006(–0.0002)	Less than –0.006(–0.0002) – –0.012(–0.0005)	Less than –0.012(–0.0005) –0.018(–0.0007)	Less than –0.018(–0.0007) –0.024(–0.0009)
Mark 1	0 – Less than 0.006(0.0002)	RED	PINK	YELLOW	GREEN
Mark 2	0.06(0.0002) – Less than 0.012(0.0005)	PINK	YELLOW	GREEN	BROWN
Mark 3	0.012(0.0005) – Less than 0.018(0.0007)	YELLOW	GREEN	BROWN	BLACK
Mark 4	0.018(0.0007) – Less than 0.024(0.0009)	GREEN	BROWN	BLACK	BLUE

Fig. 7-23 Crankpin bearing colour code

When reassembling the connecting rods, end caps and bearings ensure that the locking lug on each bearing is correctly located in the notch of the rod and end cap. Be careful not to damage the bearings in any way.

To Refit

When all inspections have been completed and replacement parts have been selected, rebuilding can commence.

Fit the piston rings to the pistons ensuring that the end caps are 120° apart (Fig. 7-24). The three-piece oil control ring should be fitted first. Position the bottom rail, spring rail and top rail with their end caps staggered at least 20mm apart. Do NOT align the end gaps with either of its neighbours, the piston pin or thrust faces. ALL PISTON RINGS MUST BE FITTED WITH THEIR MARKINGS UPPERMOST i.e. TOWARDS THE PISTON CROWN.

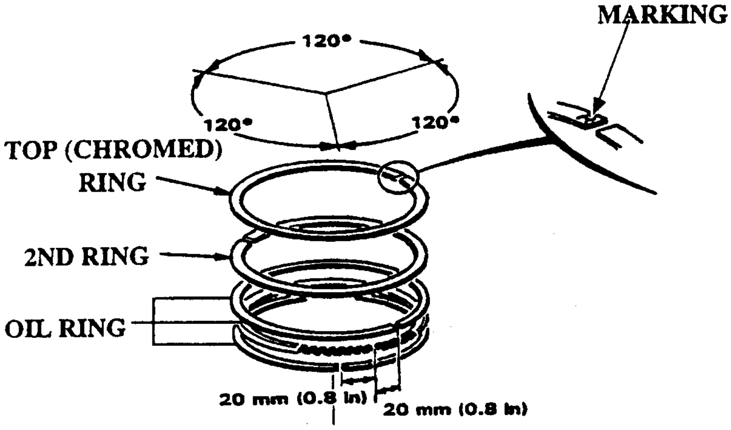


Fig. 7-24 Piston ring fitting

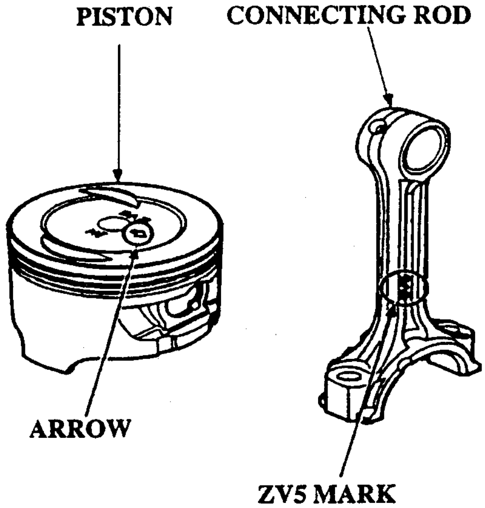


Fig. 7-25 Piston connecting rod marks

Assemble the piston pin and connecting rod assembly to the piston. Fit the piston-pin clips by first inserting one end of the clip into the groove and working the opposite end around into the groove, using a pair of needle-nosed pliers. Do NOT align the end gap of the clip with the notch in the piston.

Note: Ensure that the piston and connecting rod assembly has the arrow on the piston crown pointing in the same direction as the ZV5 mark on the connecting rod (Fig. 7-25).

Oil the piston, piston pin connecting rod bearings and, using a commercially-available piston ring compressor, fit the piston and connecting-rod assembly into the cylinder block.

Note: Install the piston with the IN mark towards the intake (carburettor) side of the engine and the arrow towards the up side (Fig. 7-26).

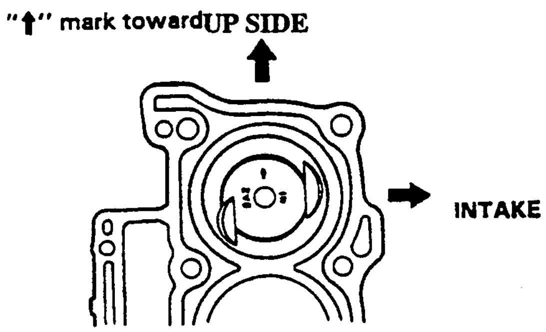


Fig. 7-26 Piston markings

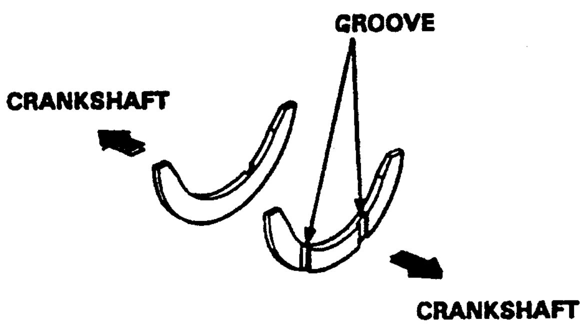


Fig. 7-27 Crankshaft thrust washers

After installation of the piston and connecting-rod assemblies, fit the crankshaft bearings, crankshaft and thrust washers. The thrust washers must be fitted with their grooves towards the crankshaft (Fig. 7-27). Oil all parts before fitting.

Fit the connecting rod end caps ensuring that the rod and cap markings are correctly aligned. Fit the end cap nuts and tighten to a torque of 28Nm. Oil all parts before assembly including the connecting rod bolts but not the mating faces of the connecting rods and end caps.

Refit the crankcase. (see SECTION 6).

Refitting the remaining components is a reversal of the removal instructions. Refer to the appropriate sections.

SECTION 8

OIL PUMP

The oil pump is of the trochoid-type construction, mounted on the cylinder head and driven by the end of the camshaft. An oil pressure relief valve is incorporated in the pump.

To Remove (Fig. 8-1)

Disconnect the battery, exciter coil and charging coil connections (Fig. 3-1). Drain the engine coolant.

Remove the cylinder head (see SECTION 5) and remove engine water pump.

Unscrew the four M6 flange bolts securing the oil pump to the cylinder head, disengage the pump drive from the crankshaft and remove the pump. Recover the ‘O’ – section joint washer.

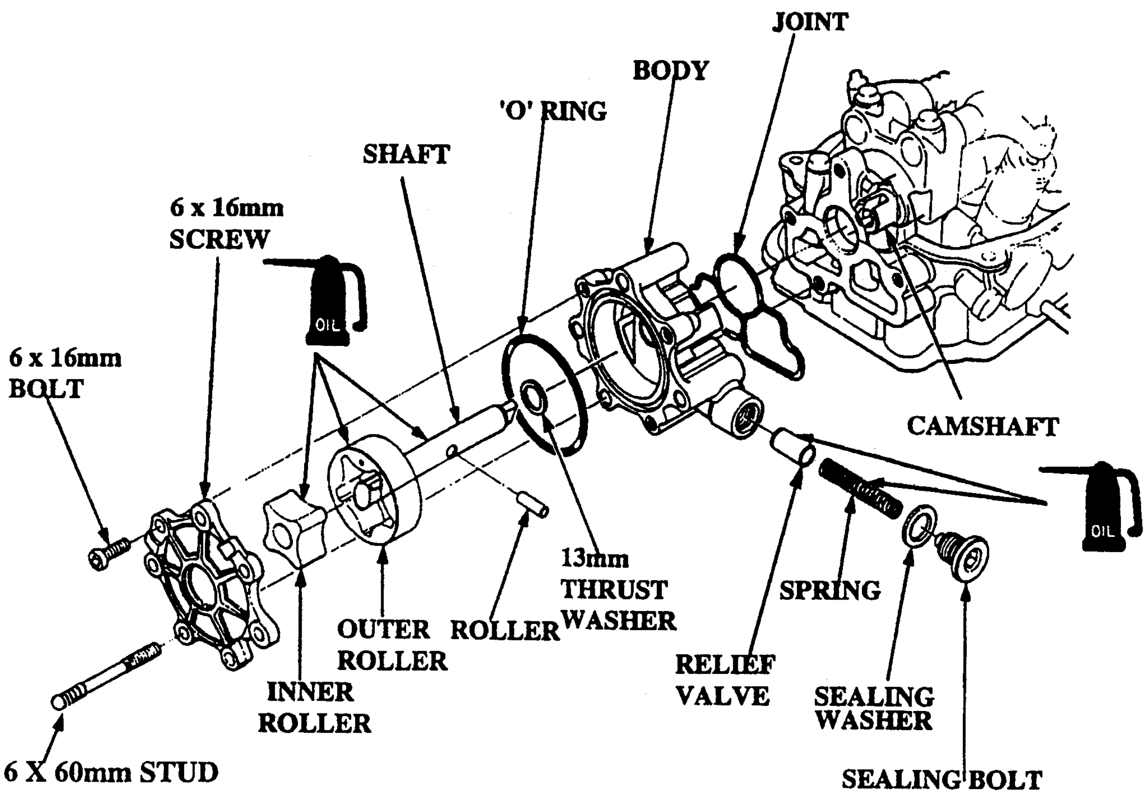


Fig. 8-1 Oil pump component parts

Maintenance

Remove the three M6 screws and detach the oil pump cover. Recover the 0 ring from the groove in the face of the pump body.

Withdraw the inner rotor, shaft, outer rotor and thrust washer from the pump body.

Remove the roller from the shaft.

Measure the pump body inner diameter at the point which is normally occupied by the outer rotor (Fig. 8-2). The standard diameter is 50,15 – 50,18mm. The service limit is 50,2mm.

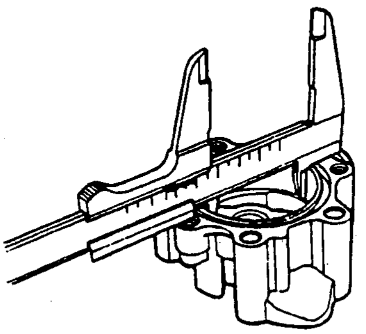


Fig. 8-2 Checking body inner diameter

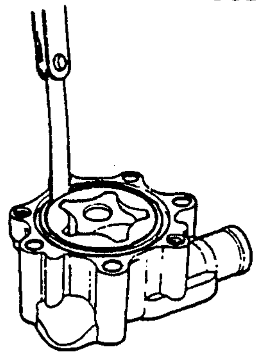


Fig. 8-3 Outer rotor to body clearance

Install the outer rotor and measure the clearance between it and the body (Fig. 8-4). The standard clearance is 0,15 – 0,22mm. The maximum permitted clearance is 0,26mm.
Fit the inner rotor and measure the clearance between the inner and outer rotors (Fig. 8-4). The standard clearance is 0, 15mm with a service limit of 0,20mm.

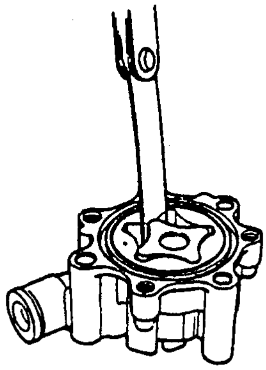


Fig. 8-4 Inner to outer rotor clearance

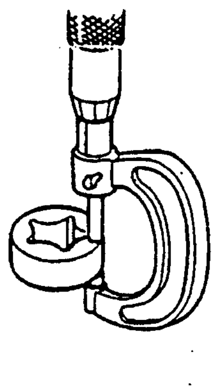


Fig. 8-5 Checking height of outer rotor

Remove both rotors and measure the height of the outer rotor (Fig. 8-5) which should be 16,98 – 17,00mm. The service limit is 16,93mm.

Measure the depth of the pump body (Fig. 8-6). The clearance should be 17,02 – 17.05mm with a service limit of 17,09mm.

Install the inner and outer rotors and using a known true straight-edge, measure the rotor end clearance (Fig. 8-7). The clearance should be 0,02 – 0,07mm with a limit of 0,1mm.

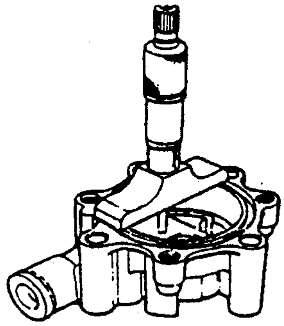


Fig. 8-6 Measuring pump body depth

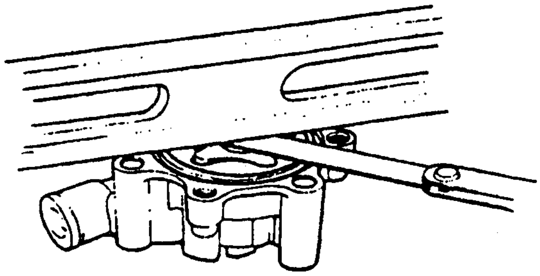


Fig. 8-7 Checking rotor end clearance

Unscrew and remove the sealing bolt and washer and remove the oil pressure relief valve spring and valve (Fig. 8-1).

Note: Restrain the sealing bolt during removal as some spring pressure will still be present as the final threads of the bolt are unscrewed from the body.

Inspect the valve and the body seating for damage or scoring and renew parts as necessary. It is a sound policy to fit a new spring at the same time.

To Refit

Refitting is a reversal of the removal instructions.

Liberally oil the oil pressure relief valve and spring before reassembly.

Do not omit the thrust washer or roller from the pump shaft.

Clean all parts thoroughly and install the outer rotor with the punch mark towards the cover.

Use a new ‘O’ ring and ‘O’ section joint washer.

Pour approximately 5cc of engine oil into the pump before refitting to the cylinder head.

Ensure that the tongue of the pump shaft engages correctly with the camshaft slot, fit the three M6 bolts and tighten to a torque of 13Nm.

SECTION 9

ENGINE OIL PRESSURE TEST

Check the engine oil level and add oil to the correct level if necessary. Remove and detach the pressure switch wire. Unscrew and remove the pressure switch (Fig. 9-1).

Install the pressure gauge attachment 07406 – 0030000 and the oil pressure gauge 07506 – 3000000 (Fig. 9-2). The pressure gauge has a scale calibrated up to 7 – 10kg/cm Tighten the gauge attachment to 9Nm. Over-tightening will damage the threads.

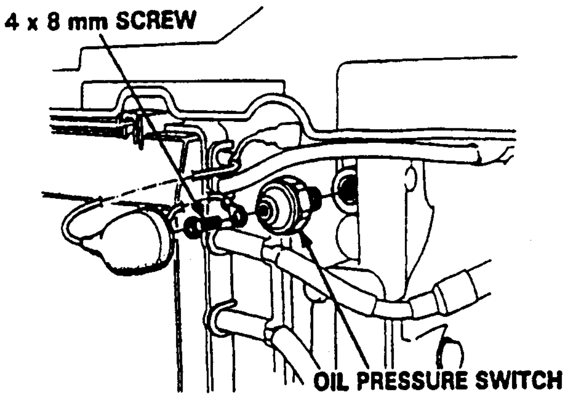


Fig. 9-1 Oil pressure switch removal

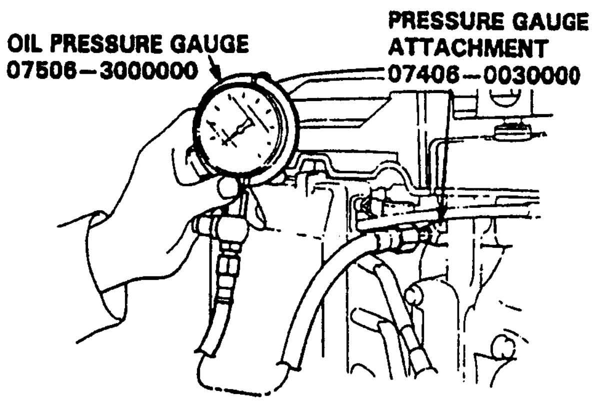


Fig. 9-2 Test equipment installed

Connect a water supply to the pump and run the engine until its temperature reaches 80°C. Check the gauge reading which should be 1,5kg/cm at 950+/– 50r.p.m.
If the reading is less than above, check oil pump rotors and body for wear. (see SECTION 8).

Remove the test equipment.

Clean the oil pressure switch and apply liquid sealant (Three Bond 1215 or equivalent) to the threads before installing. Tighten to a torque of 9Nm. Overtightening will damage the threads.

SECTION 10

ENGINE OIL AND FILTER

Engine Oil

Remove the oil sump drain plug and sealing washer and drain the oil into a suitable container. (See – ENVIRONMENTAL PROTECTION.)

The oil will drain much more easily if it is warm as much of the sludge-forming matter will still be in suspension.

When fully drained, refit the drain plug using a new sealing washer. Refill with new oil of the correct grade (see – RECOMMENDED LUBRICANTS) up to the top of the knurled area of the dip-stick, but DO NOT OVER-FILL. The oil capacity is 2,4 litres.

Oil Filter

Install Special Tool 07HAA – PJ70100 and unscrew the filter counter-clockwise (Fig. 10-1).
Be prepared to catch the oil draining from the filter.

Clean the area around the face of the oil cooler taking care not to introduce foreign matter.

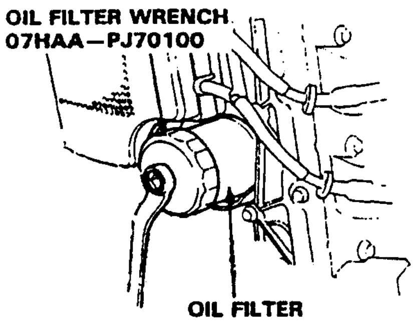


Fig. 10-1 Oil filter special tool

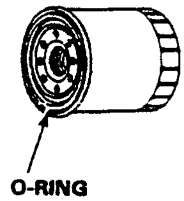


Fig. 10-2 Filter 'O' ring location

Apply 'Three Bond 1323 B' or equivalent, sealant to the adaptor fitted to the cylinder block.

Apply a light coating of engine oil to the filter 'O' ring (Fig. 10-2), screw on the filter and tighten by hand in a clockwise direction.

Install Special Tool 07Haa – PJ70100 and tighten the filter to a torque of 8Nm.

Run the engine for a few minutes (water supply connected to the pump) and then stop it. Wait a few minutes, then check the oil level on the dipstick and add oil if necessary. Check for leaks.

SECTION 11

WATER JACKET, THERMOSTAT AND THERMO SWITCH

Water Jacket

To Remove

Disconnect and remove the battery.
Drain the engine coolant. Then remove the coolant tank and heat exchanger assembly.
(see Part A – SECTION 13). Disconnect the spark-plug leads.
Release the water jacket (1) by removing the seven 6 x 22mm screws (2) around its periphery and remove the water jacket and packing (3) (Fig.11-1).

Maintenance

The removal of the water jacket (1) will reveal an anode (5) which is secured by a 6 x 18mm screw (4). This is a sacrificial device to prevent excessive corrosion in the coolant circuit. If excessively corroded, a new anode should be fitted.

To Refit

Refitting is a reversal of the removal instructions.

Clean all joint (packing) faces and use a new packing (3).

Tighten the seven 6 x 22mm screws (2) to a torque of

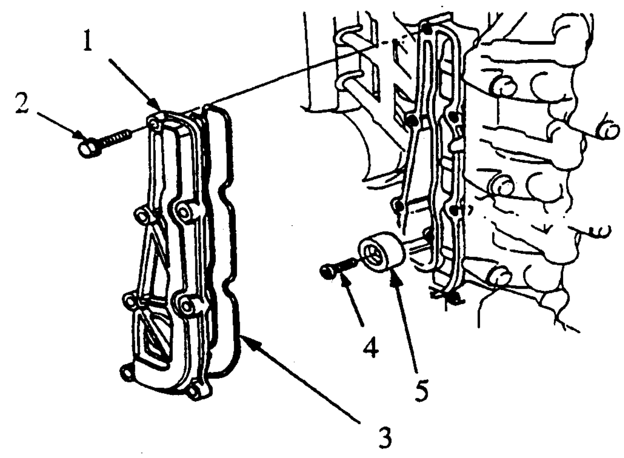


Fig. 11-1 Water jacket and anode

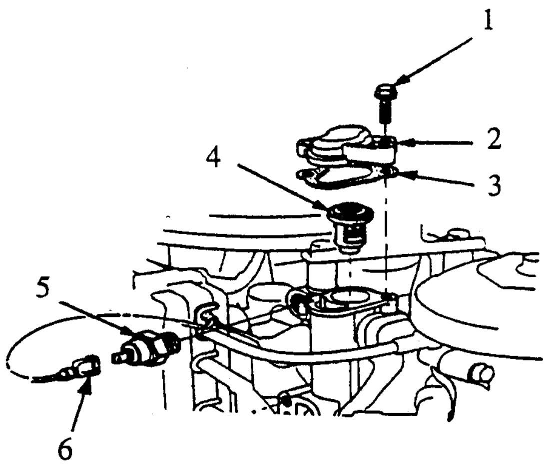


Fig. 11-2 Thermostat and thermo switch

Thermostat

To Remove

Drain the engine coolant.
Remove the two 6 x 20mm screws (1) securing the thermostat cover (Fig. 11-2).
Remove the cover (2) and the joint washer (3) and lift the thermostat (4) from its housing.

Maintenance

Immerse the thermostat in water in a container capable of being heated (Fig. 11-3).

Heat the water and observe the operation of the thermostat as the temperature of the water inceases. Note the temperature of the water at the point when the thermostat starts to open. This should be 52°C. Do not allow the thermostat to come into contact with the container as this may cause a false reading.

The thermostat should be fully open at 620C. With it fully open, measure lift height. This should be more than 3,0mm. If it does not comply with these figures, fit a new one.

To Refit

Refitting is a reversal of the removal instructions.

Use a new joint washer.

Tighten the two 6 x 20mm screws to a torque of 12Nm.

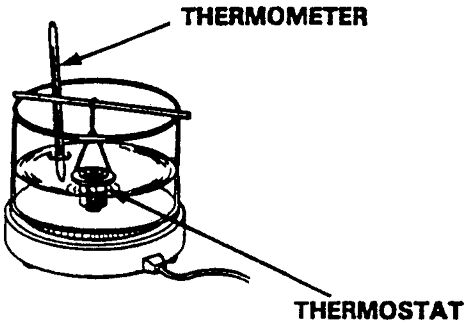


Fig. 11-3 Testing the thermostat

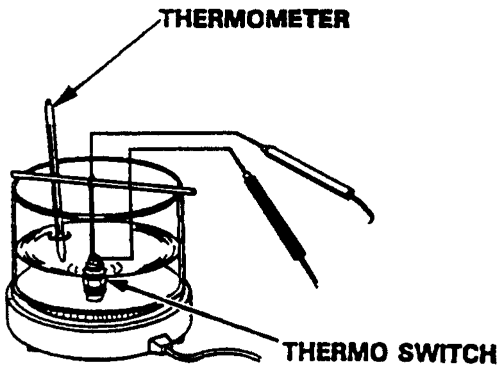


Fig. 11-4 Testing the thermo switch

Thermo Switch

To Remove

Disconnect the battery.

Detach the Lucar connector from the thermo switch and unscrew the switch.

The switch is located next to the thermostat housing (Fig. 11-2).

Maintenance

The thermo switch should be suspended in a container of coolant or oil.

Do not allow the switch to contact the container (Fig. 11-4).

Heat the liquid and note the temperature at which the thermo switch closes. With the switch at this temperature, check that continuity exists between the switch-lead terminal and the body.

Continuity of the switch (ON) should occur at 90° +/– 2°C minimum.

As the switch cools, continuity should cease (OFF) between 3°C and 7°C below the temperature at which continuity occurred.

To Refit

Refitting is a reversal of the removal instructions.

SECTION 12

FUEL PUMP, FILTER AND CONNECTOR

To Remove

NO SMOKING OR NAKED LIGHTS.

Disconnect and remove the battery.

Remove the starter motor to improve access to the fuel pump, release the clips and remove the three fuel lines to the pump.

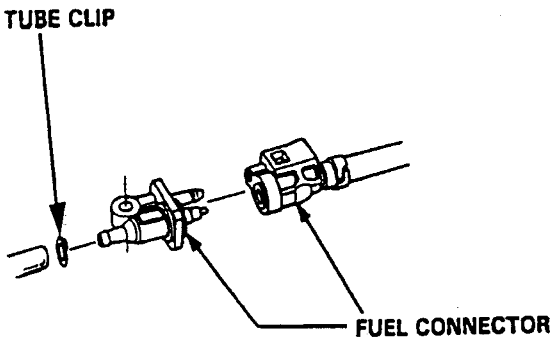


Fig. 12-1 Fuel line connector

INSTALLATION:
Note the installation direction.

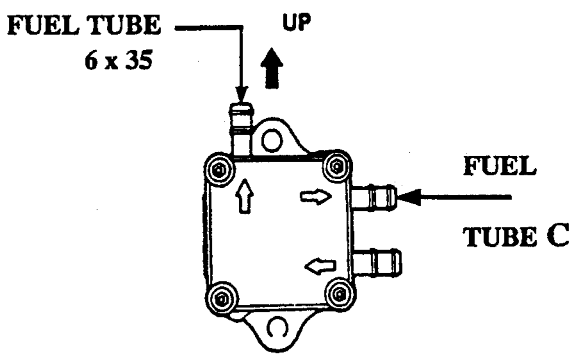


Fig. 12-2 Fuel pump orientation

Unscrew and remove the two 6 x 20mm screws securing the pump to the cylinder head and withdraw the pump.

The fuel filter is a sealed transparent unit. If excessive contamination is observed a new unit must be fitted. It is held in position in the fuel supply line by two clips.

The fuel connector is a two-piece assembly and is not serviceable. If any damage or leaks occur the complete assembly must be renewed.

To Refit

Refitting is a reversal of the removal instructions.

Ensure that the pump is refitted correctly (Fig. 12-2).

Tighten the 6 x 20mm screws to a torque of 10Nm.

Check the fuel lines for deterioration or damage before installation and renew if necessary

SECTION 13

AIR INTAKE SILENCER COVER

To Remove

Withdraw the breather tube from the hole in the silencer cover.
Unscrew the two 6 K 40mm bolts at the end of the intake silencer cover.
Recover the 6 x I 8mm washer from under the head of each bolt, the collars and the silencer cover nurs.

Maintenance

No maintenance is required but the components should be cleaned before refitting.

To Refit

Locate the 6 x 40mm bolts and washers in the holes of the silencer cover.
Position the collars on the bolts between the cover and its base and fit the cover onto the base.
Be careful to correctly locate the cover nuts (boomerang-shaped) below the base, enter and tighten the screws.

SECTION 14

CARBURETTORS

The variable-choke carburettors incorporating concentric floats are fitted to the intake manifold and an air-intake silencer is also provided.

All three carburettors are connected together by a throttle link rod and a choke link rod to provide synchronised control. A dashpot check valve and diaphragm arrangement is fitted to provide a smoother progression of the throttle-closing operation.

For reference purposes the standard carburettor is Number 3 carburettor, which is the lowest mounted one on the intake manifold. It also has the throttle-cam assembly fitted to it. The throttle is cable-controlled and the choke uses a control-rod arrangement.

To Remove

NO SMOKING OR NAKED FLAMES.

Disconnect and remove the battery.
Turn the fuel tap to the ‘OFF’ position.
Remove the air intake silencer cover. (see SECTION 13).

To remove the choke control linkage, pull the choke control fully out, hold the control rod and push the control fully in. The control rod will then be released from the control.

Disconnect the throttle-control cable link from the cam of Number 3 carburettor (Fig. 14-1).

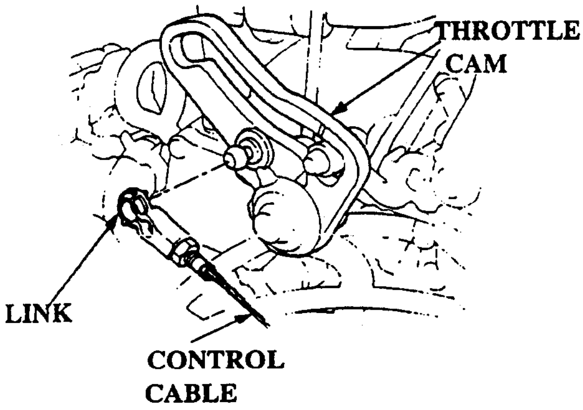


Fig. 14-1 Throttle cam and linkage

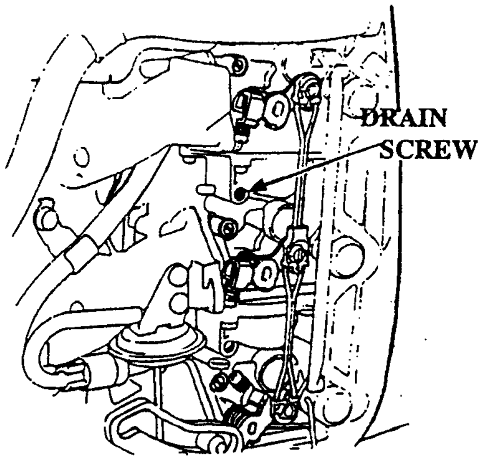


Fig. 14-2 Carburettor drain screws

WARNING: Remove the drain screw from the float chamber of each carburettor BEFORE attempting to remove OR dismantle the carburettors (Fig. 14-3).

Remove the 5,3 x 65mm fuel tube from the top connection on the fuel pump and the fuel tube 'C' from the upper of the two side connections on the fuel pump (Fig. 14-3).

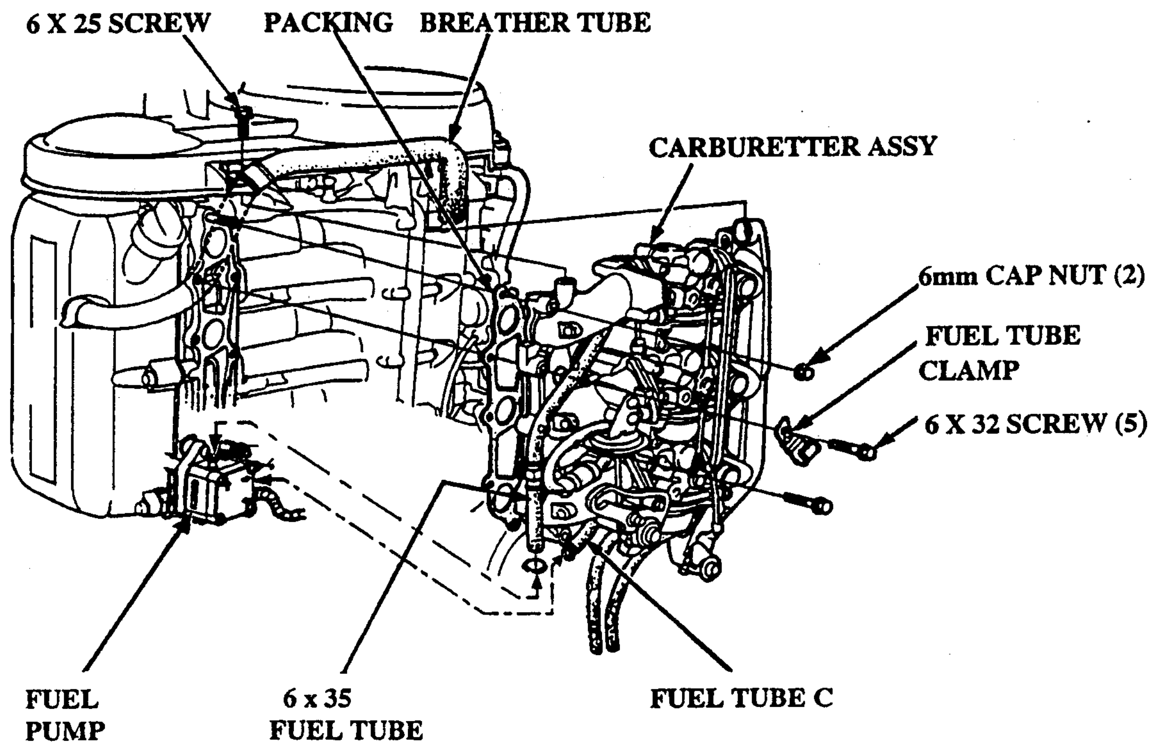


Fig. 14-3 Intake manifold, carburettors and fuel tubes

Unscrew the 6 x 25mm flange bolt, the five 6 x 32mm flange bolts and the two 6mm cap nuts securing the intake manifold to the cylinder head (Fig. 14-3).

Withdraw the complete intake manifold, carburettors and fuel-tubes assembly from the cylinder head with the remaining fuel tubes.

With the assembly on the bench, unclip the dashpot check valve and remove both fuel tube 'D' and the 3,5 x 60mm fuel tube connected to the install pipe (Fig. 14-4).

Unscrew the two 5 x 10mm screws securing the install pipe to the intake manifold.

Detach the three 3,5 x 45mm fuel tubes from the carburettors and then remove the assembly (Fig. 14-4).

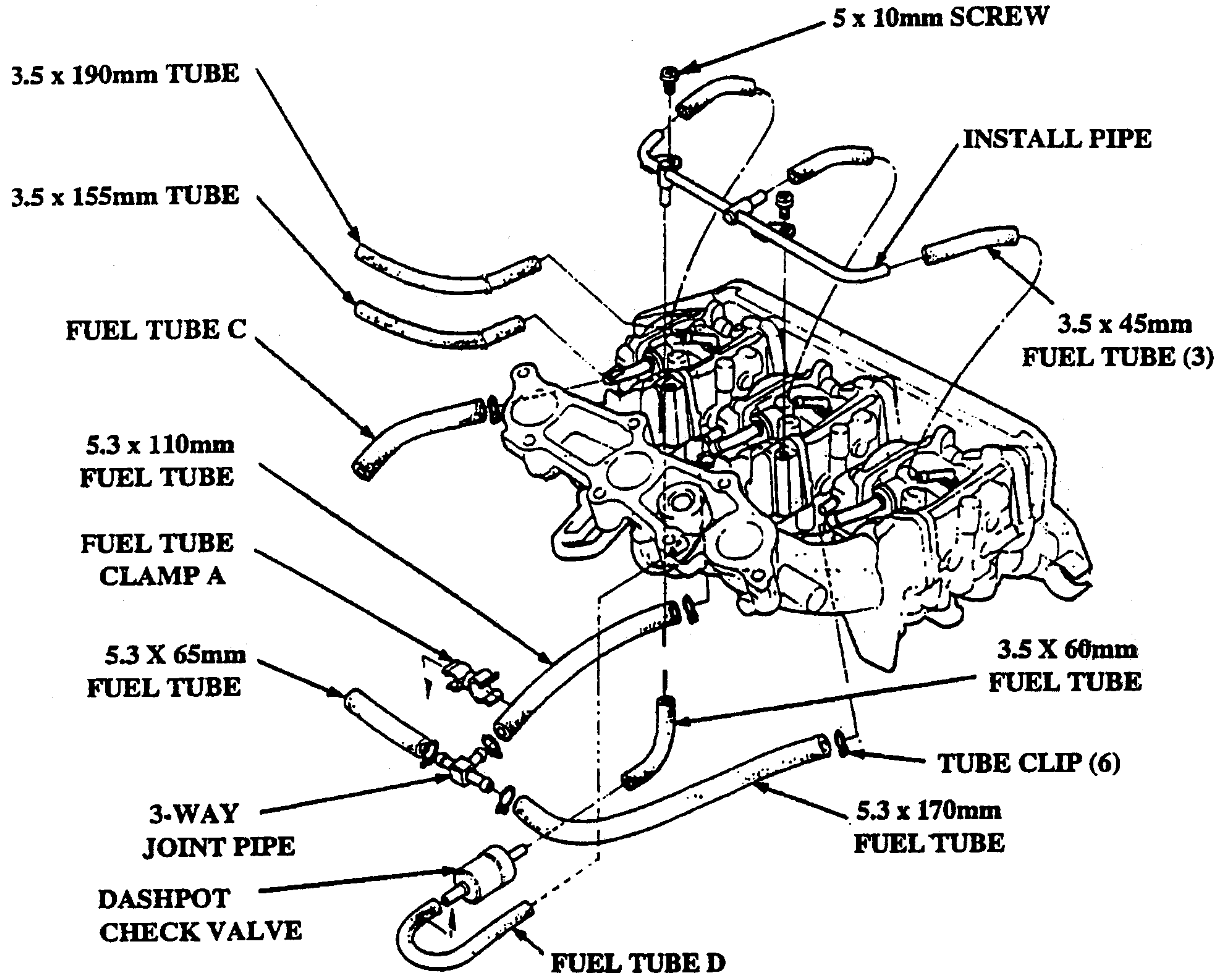


Fig. 14-4 Fuel tube location and identification

Prise the throttle-link rod (which connects the butterfly-throttle shafts of the three carburettors together) from its location, taking care NOT to bend it (Fig. 14-5).

Remove the choke link rod (which connects the chokes of the three carburettors together) taking care NOT to break it (Fig. 14-5).

Release the fuel tubes from the clamp. Then remove the tube clips and detach the 5,3 x 110mm and the 5,3 x 170mm fuel tubes from the carburettors.

If fuel tube 'C' has not already been detached, remove this also (Fig. 14-4).

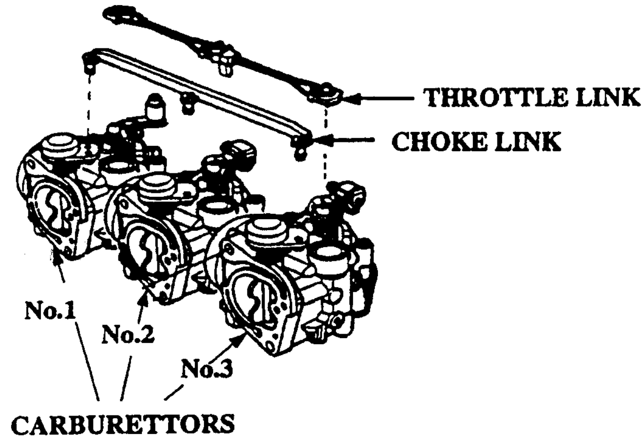


Fig. 14-5 Throttle and choke-link rods

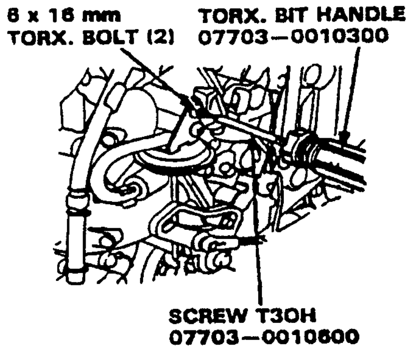


Fig. 14-6 Diaphragm bolts and tools

Using Special Tools T30H 07703 – 0010600 and 07703 – 0010300, remove the two Torx 6 x 16mm bolts securing the diaphragm unit to the intake manifold (Fig. 14-6).
Unscrew the 6 x 40mm bolt and remove the throttle-cam assembly taking care to DISCONNECT the interconnected link from the choke arm.

Unscrew the 6 x 28mm bolt and remove the choke-arm assembly.

Note: Try to keep the various assemblies in their groups to simplify reassembly and avoid losing component parts.

To separate the intake manifold, carburettors and silencer plate, unscrew the six 6 x 97mm bolts from the silencer plate which clamp the whole assembly together (Fig. 14-7).

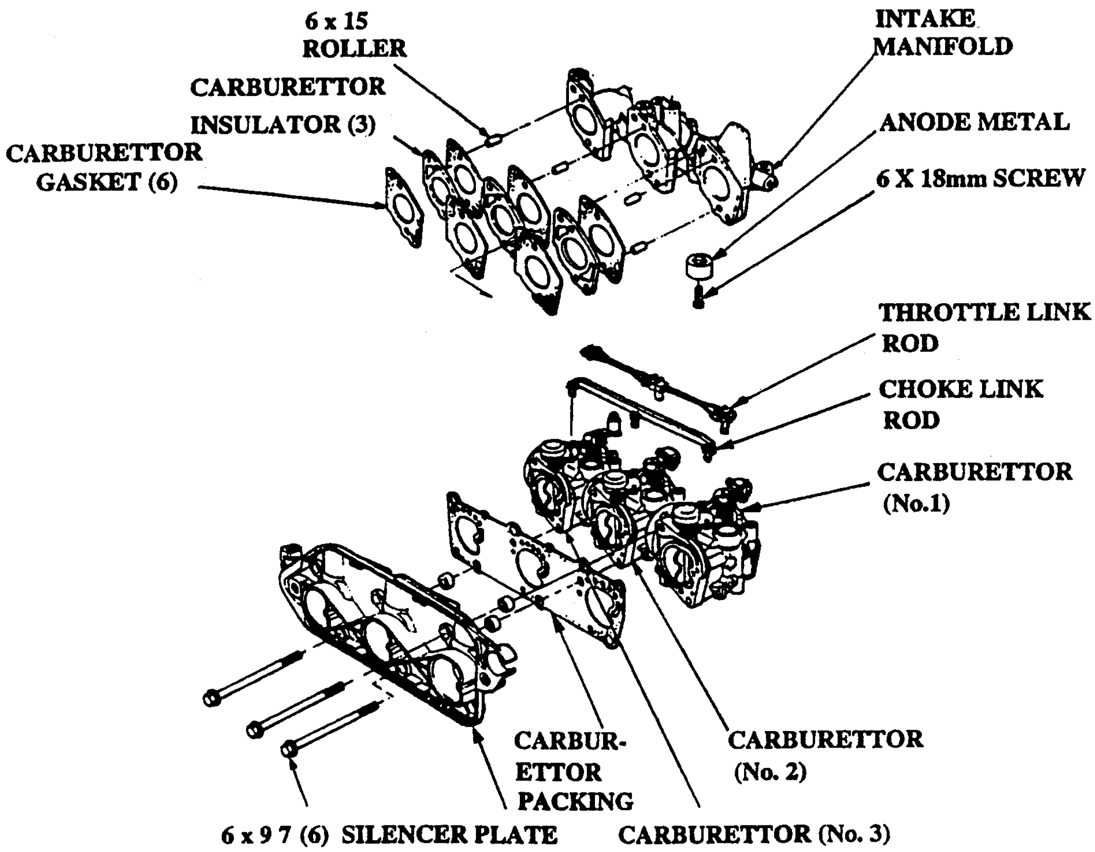


Fig. 14-7 Location of intake system components

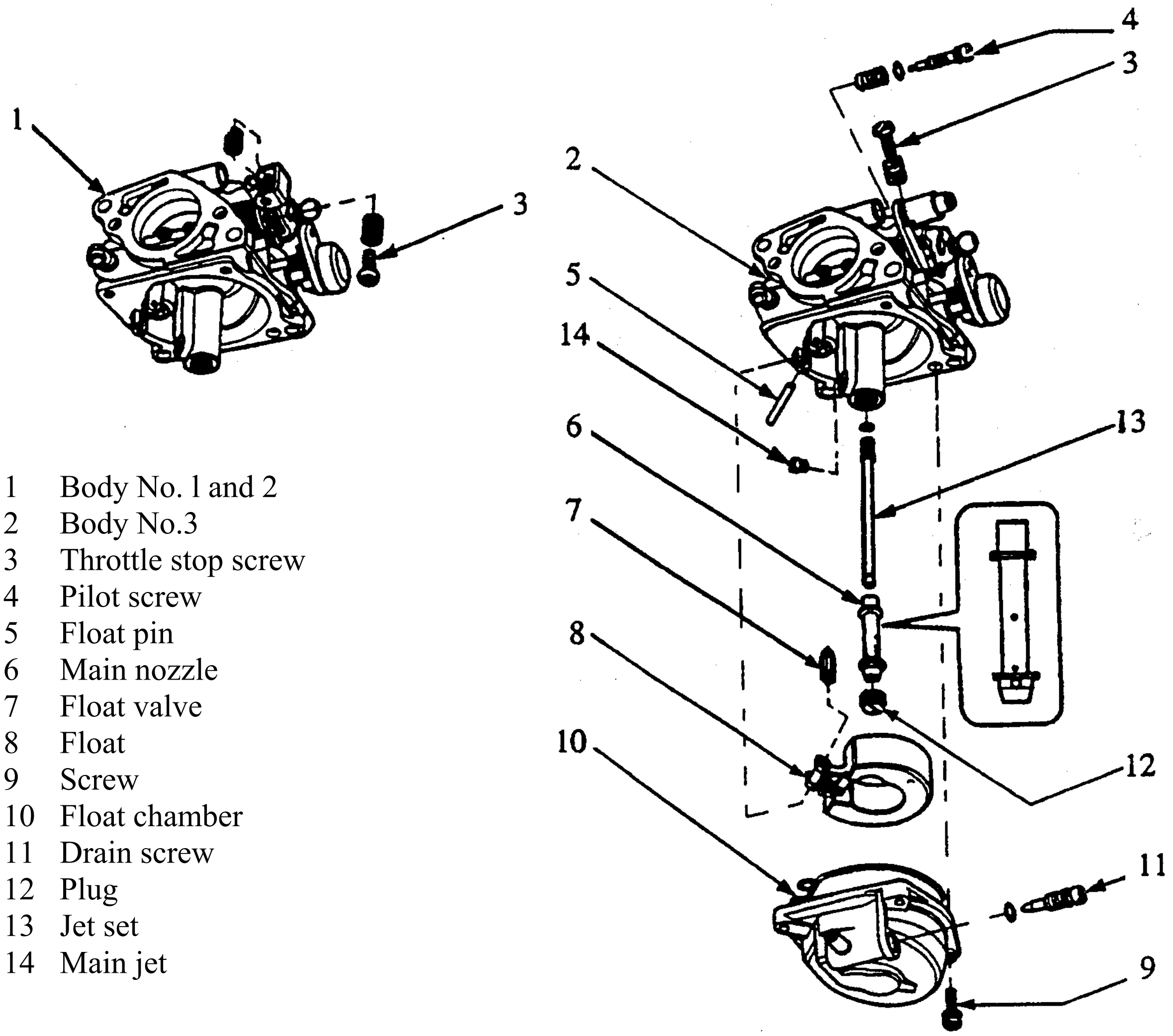
Recover the spacers, carburettor packing, carburettor insulators and gaskets from between the silencer plate and the carburettors.

Check that the six 6 x 15mm rollers are still located in the intake manifold.

The anode metal is fitted to the intake manifold by a 6 x18mm screw and may be removed if renewal is required.

Maintenance (Fig. 14-8)

Note: That Number One and Two carburettor assemblies are not the same as Number Three carburettor is described because this unit will have the throttle-control cam arrangement connected to it after refitting to the intake manifold.



1 Body No. l and 2
2 Body No.3
3 Throttle stop screw
4 Pilot screw
5 Float pin
6 Main nozzle
7 Float valve
8 Float
9 Screw
10 Float chamber
11 Drain screw
12 Plug
13 Jet set
14 Main jet

Fig. 14-8 Carburettor components

Unscrew the four screws (9) securing the float chamber (10) to the carburettor body. Remove the chamber and recover the joint washer.

Withdraw the float pin (5) from the body to release the float (8). This will enable the float valve (7) to be removed.

The main jet (14) may be unscrewed from the extension of the carburettor body.

Unscrew the pilot screw (4) and recover the spring and washer.

Check both choke and butterfly for smoothness of operation.

IMPORTANT: When using compressed air to clear any obstruction ensure that adequate EYE PROTECTION is correctly worn.

Use compressed air to clear any foreign matter from the drill-ways and passages of the body.

Clean the main nozzle (6) the jet set (13) and the main jet (14) with compressed air BEFORE refitting. **USE EYE PROTECTION.**

Inspect the pilot screw (4) for wear or damage before installing. Turn it fully-in (DO NOT FORCE IT) and then unscrew 2 1/8 turns.

Check the float valve (7) for wear and weak spring before refitting.

Locate the float (8) and float valve (7) and install the float pin (5). The components are shown assembled in Fig. 14-9.

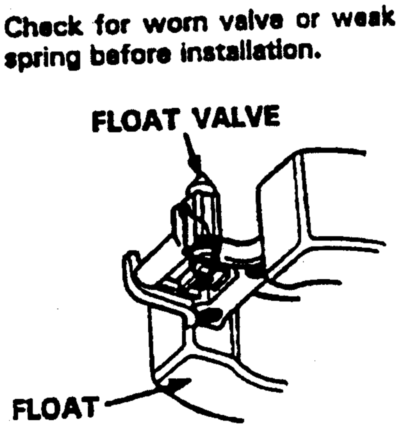


Fig. 14-9 Float and valve assembly

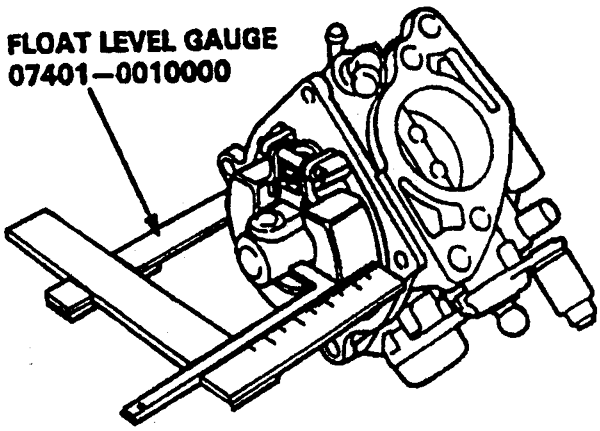


Fig. 14-10 Checking float level

Check for smooth operation after installation.

With the carburettor in an upright position, use the float-level gauge 07401 – 0010000 to measure the distance between the float top and the carburettor body when the float just contacts the float valve (Fig. 14-10). The standard measurement is 14mm. If incorrect, fit a new float and check its operation.

Use a new float chamber joint washer, refit the float chamber and tighten the four screws, ensuring that the drain-screw hole faces the pilot screw-side of the body. Refit the drain screw using a new ‘O’ ring.

To Refit

Refitting is a reversal of the removal instructions.

Check that the six 6 x 15mm rollers are fitted at the intake manifold and fit new gaskets each side of the carburettor insulator when refitting the carburettors (Fig. 14-11).

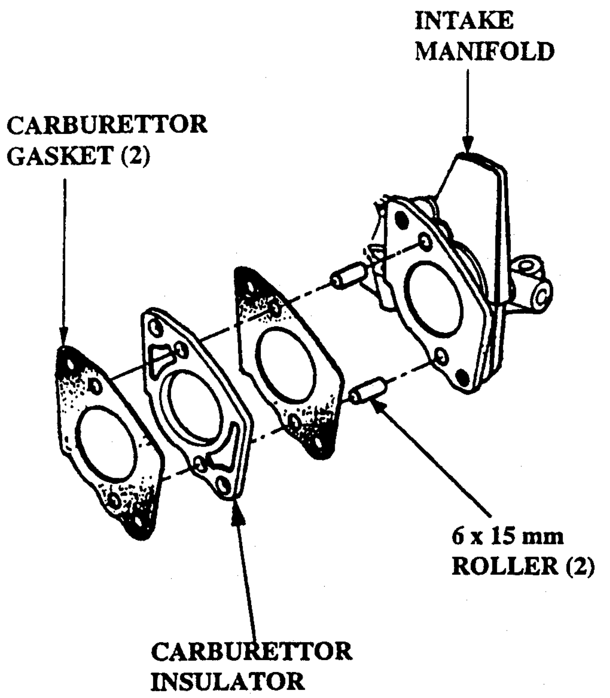


Fig. 14-11 Carburettor gasket arrangement

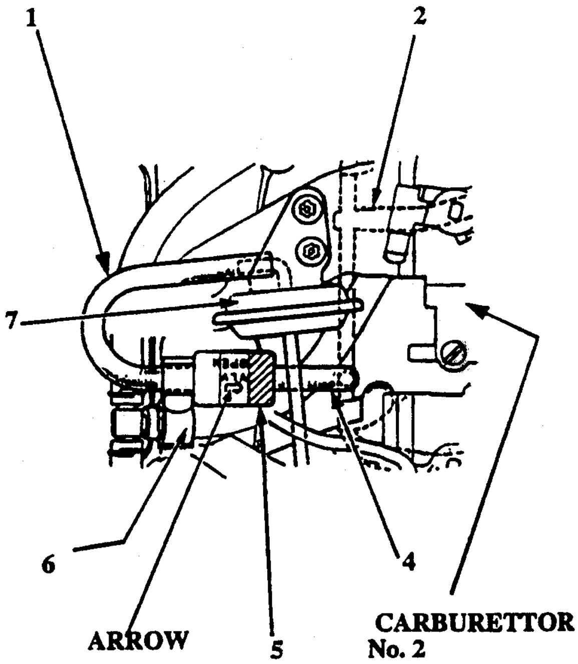


Fig. 14-12 Dashpot check-valve installation

Ensure gaskets and insulators are properly located on the rollers before fitting the carburettors.

Check all fuel tubes for damage and deterioration and renew if necessary.

Install diaphragm unit (7) dashpot check valve (5) fuel tube (1) fuel tube (4) fuel-tube clamp (6) and the install pipe (2) – Fig. 14-12 refers.

Ensure that: a) the dashpot check valve is fitted with the arrow pointing towards the carburettor-side and b) the fuel tubes are securely fitted into the clamp.

The order of assembly of the throttle-cam end-choke arm assemblies is shown in Fig. 14-13.

The 6 x 40mm flange bolt (1) should first have the 6mm plain washers (2) fitted.

The bore of the throttle cam (3) should be greased and fitted to the bolt followed by the assist spring (4) with its hook located on the cam projection (Fig. 14-14).

The throttle cam opener (5) should then be fitted and the assist spring point 'A' located in the groove of the throttle cam with the assist plate projection point 'A' against the throttle cam.

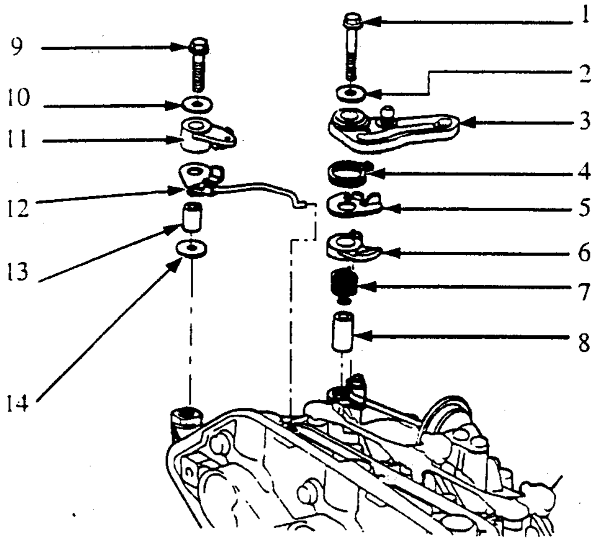


Fig. 14-13 Choke and throttle cam assemblies

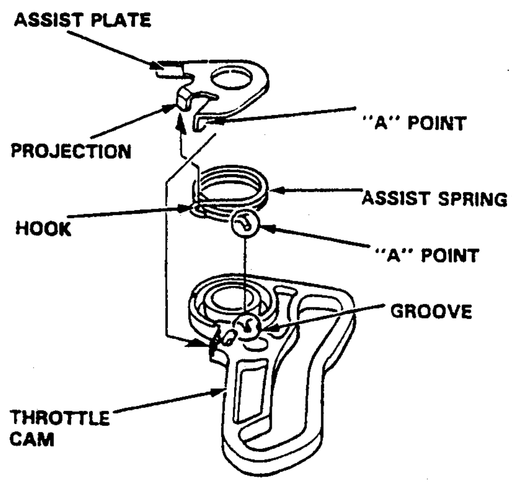


Fig. 14-14 Throttle-cam details

The throttle-opener cam (6) the opener-cam return spring (7) and the 6,7 x 12,5 x 24mm collar (8) should be assembled to the bolt.

The complete assembly should then be fitted to the intake manifold and the flange bolt tightened to a torque of 12 Nm.

Note: DO NOT FORGET to fit the control rod of the diaphragm unit to the hole in the throttle cam.

To reassemble the choke mechanism (Fig. 14-13 refers) proceed as follows:

1. Assemble the 6mm plain washer (10) to the 6 x 28mm bolt (9) followed by the choke arm.

2. The choke-control arm and choke-rod assembly (12) should then be fitted followed by the 6,5 x 10,5 x 16mm collar (13) and 6mm plain washer (14).

3. Insert the choke rod assembly on the hole in the choke link before positioning the choke mechanism on the intake manifold.

4. Tighten the 6 x 28rni bolt (9) to a torque of 12Nm.

5. Fit the throttle link rod to the carburettors with the 'UP' and arrow at the centre of the rod facing upwards (Fig. 14-15).

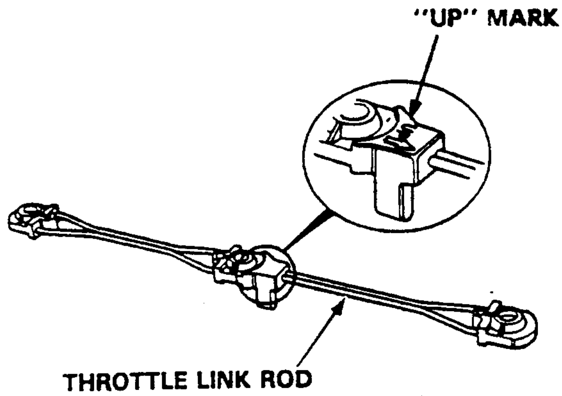


Fig. 14-15 Throttle-link marking

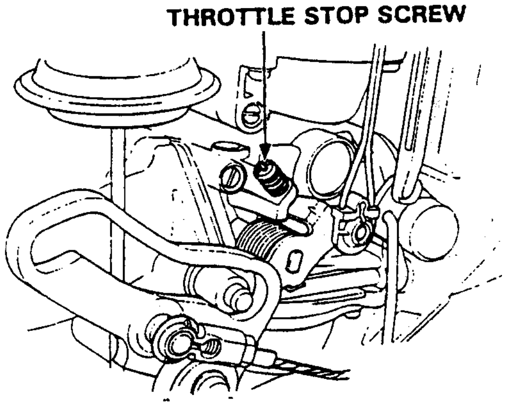


Fig. 14-16 Throttle-stop screw location.

Adjustments

Idle Speed

Idle-speed adjustment must be performed without any load imposed on the engine.

Start the engine and allow the engine speed to stabilise.

Turn the throttle-stop screw to achieve the correct idle speed of 950+/–50r.p.m. (Fig,14-16).
If the idle speed does not stabilise, carburettor synchronisation must be performed.

Synchronisation

Screw-in the pilot screw of each carburettor until it stops – DO NOT FORCE IT (Fig. 14-17).
Then turn each one out 2 1/8 turns.

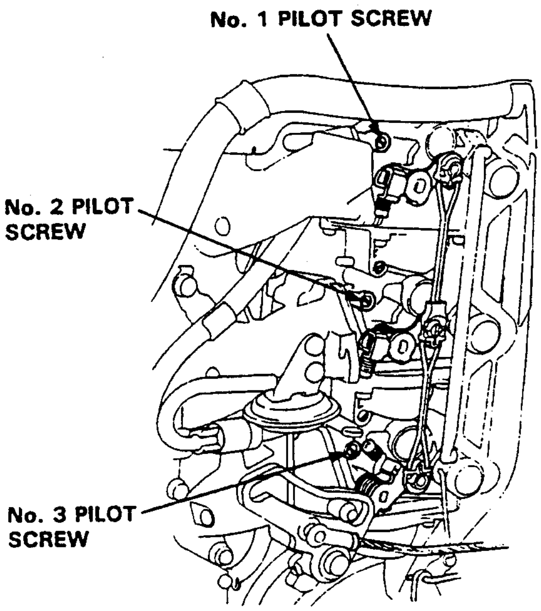


Fig. 14-17 Carburettor pilot screws

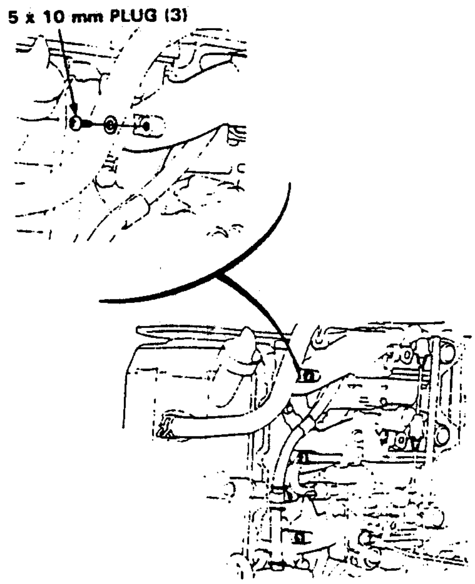


Fig. 14-18 Intake manifold plugs

Turn the throttle-stop screw to achieve 950+/– 50 r.p.m. idle speed with NO LOAD on the engine.

Turn the pilot screw of Number Three carburettor (the standard carburettor) 1/8 of a turn, in or out, until the highest idle speed is obtained.

Perform the same operation on Numbers I and Number 2 carburettors.

Lightly snap the throttle open several times and then adjust the throttle-stop screw to obtain an idle speed of 950+/–50 r.p.m. (Fig. 14-16).

Stop the engine and remove all three 5 x 10mm plugs from the intake manifold (Fig. 14-18).

Attach the vacuum gauge adaptors to each of the threaded holes and correctly connect the vacuum gauge tubes of the vacuum gauge unit 07404-0030001.

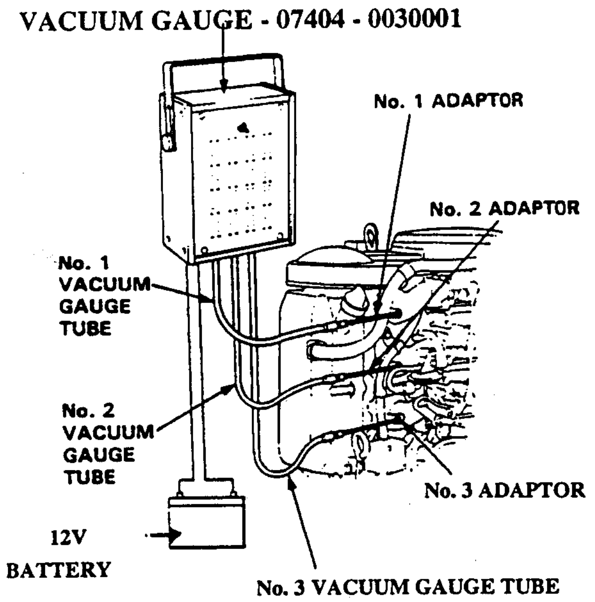


Fig. 14-19 Connecting vacuum gauge

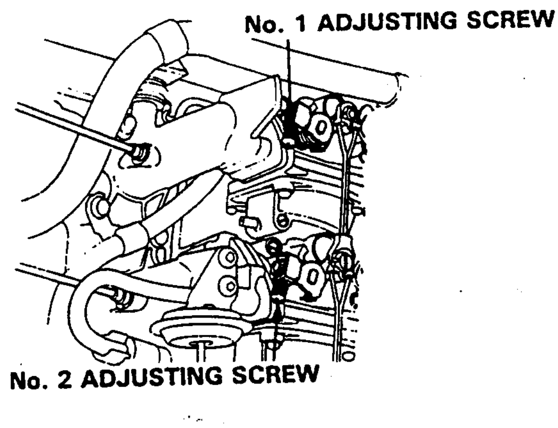


Fig. 14-20 Adjusting screws

Start the engine and with it running at normal temperature, recheck the idle speed and adjust if necessary.

Check that the difference in vacuum reading between the cylinders is 20mm Hg or less. If it is greater than 20mm HG, adjust as follows:

With the Number Three carburettor being the standard,, turn the adjusting screws on Number One and Number Two carburettor-adjusting screws, so that the vacuum-reading difference between Number One and Number Two carburettors is 20mm Hg or less.

Snap the throttle open several times and recheck that the vacuum readings of Number One and Two carburettors is the same as Number Three carburettor.

Note: The less the difference between the three readings, one for each carburettor, the more stable the idle speed.

Remove the vacuum gauge, tubes and adaptors from the intake manifold and refit the three 5 x 10mm plugs and washers (Fig.14-18).

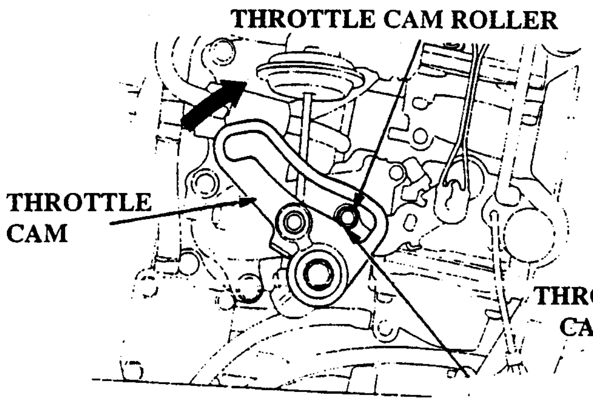
Recheck and, if necessary, readjust the idle speed by turning the Number Three throttle-stop screw to obtain an idle speed of 950+/–50 r.p.m. (Fig.14-16).

Diaphragm Adjustment

The diaphragm should only be adjusted AFTER the idle speed has been adjusted.

Loosen the two 6 x 16mm Torx bolts securing the unit using the screw T30H 07703 – 0010600 and handle 07703 – 0010300 (Fig.14-6).

Disconnect the throttle cable link from the throttle cam (Fig. 14-1).



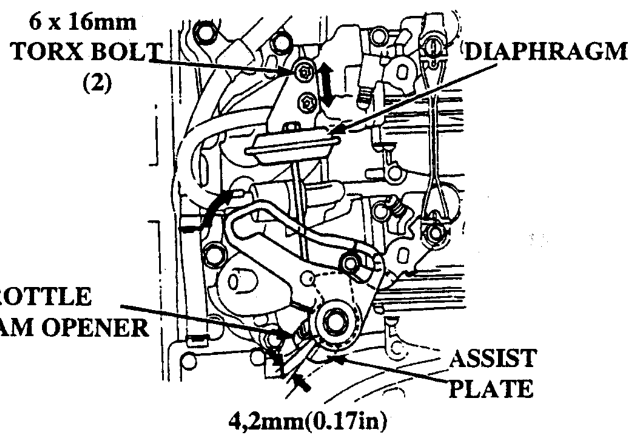


Fig. 14-21 Throttle-cam position Fig. 14-22 Assist-plate/throttle-opener clearance

Move the throttle cam in the direction of the arrow until it contacts the roller of the throttle arm (Fig. 14-21).

Slowly move the diaphragm up and down until the clearance between the assist plate and the throttle-opener cam is 4,2mm (Fig. 14-22).

Hold the diaphragm in this position and tighten the two 6 x 16mm Torx bolts.

Refit the throttle-cable link to the throttle cam and check that the full travel is available.

SECTION 15

ENGINE REMOVAL

To Remove

Disconnect and remove the battery.

Remove the fuel tank (See PART A–SECTION 14).

Drain the engine coolant.

Remove the header tank-and-heat exchanger assembly (See PART A–SECTION 11).

Disconnect the multi – pin plug of the wiring harness and two wires to the pressure gauge lamp.

Release the instrument panel by removing the screws securing it to the cradle.

Unscrew the union nut securing the compound gauge pipe at the volute.

Disconnect the throttle cable at the carburettor-end.

Disconnect the choke-control rod at the carburettor-end.

Unscrew the four pan-head screws and washers to release the floodlight mast-support panel from the cradle.

Remove the delivery valves to provide more space for manoeuvring the unit.

Remove the screws securing the silencer outer heat shield and remove it.

Release the primer control rod at the exhaust primer-end by removing the split pin and washer.

Unscrew the two union nuts of the priming pipe at the exhaust primer unit and priming valve and remove the pipe.

Unscrew the two union nuts securing the oil drain pipe between the adaptor housing and the engine oil sump and then remove the pipe.

Unscrew the two sleeve nuts and remove the thermal relief-valve pipe from the valve and the exhaust silencer (if fitted).

Remove the four nuts and washers and remove exhaust silencer – also releases inner heat shield.

Release the protective plate (skid-plate) from below the cradle by removing the securing screws.

Remove the four self-locking nuts and washers from the engine and pump flexible mountings.

Using suitable, approved lifting equipment, manoeuvre the engine and pump unit together from the cradle. The pump may then be separated from the engine.

SECTION 16

ELECTRICAL AND IGNITION SYSTEMS

Description

The engine is equipped with a capacitor-discharge ignition system (C.D.I.) which provides three independent circuits – one for each cylinder.

The system also incorporates electronic advancement of the spark, over-rev limiter, over-heating and oil-pressure alert and warning system.

No contact breakers, or other mechanical parts are used, so the system is maintenance-free and provides excellent sparking performance.

Electronic Advance C.D.I. System

Operation (Fig. 16-1 to 16-8)

As the flywheel rotates, the interaction of the flywheel magnets and the exciter coil generates electrical power. This is fed to the ignition condensor (dotted line on Fig. 16-1) which then becomes charged. At this point in the cycle the thyristor is ‘OFF’.

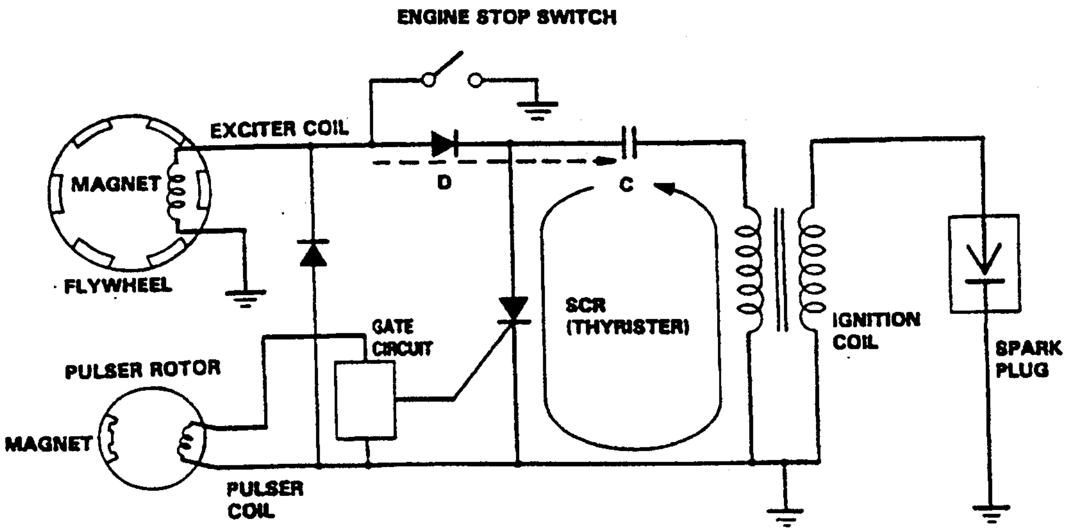


Fig. 16-1 Basic circuit diagram – single cylinder

When the magnet of the pulser rotor passes the pulser coil, the coil emits a signal by magnetic force. This signal passes the gate circuit, turns the thyristor ‘ON’ and the electrical charge is discharged from the condensor. The discharged current flows through the ignition coil primary circuit inducing a high-voltage charge in the secondary circuit which is then discharged across the electrodes of the spark plug (shown by a solid line in Fig. 16-1).

The electronic advance spark system advances the ignition timing when the gate circuit turns the thyristor ‘ON’ according to the engine speed to obtain high-speed power output.

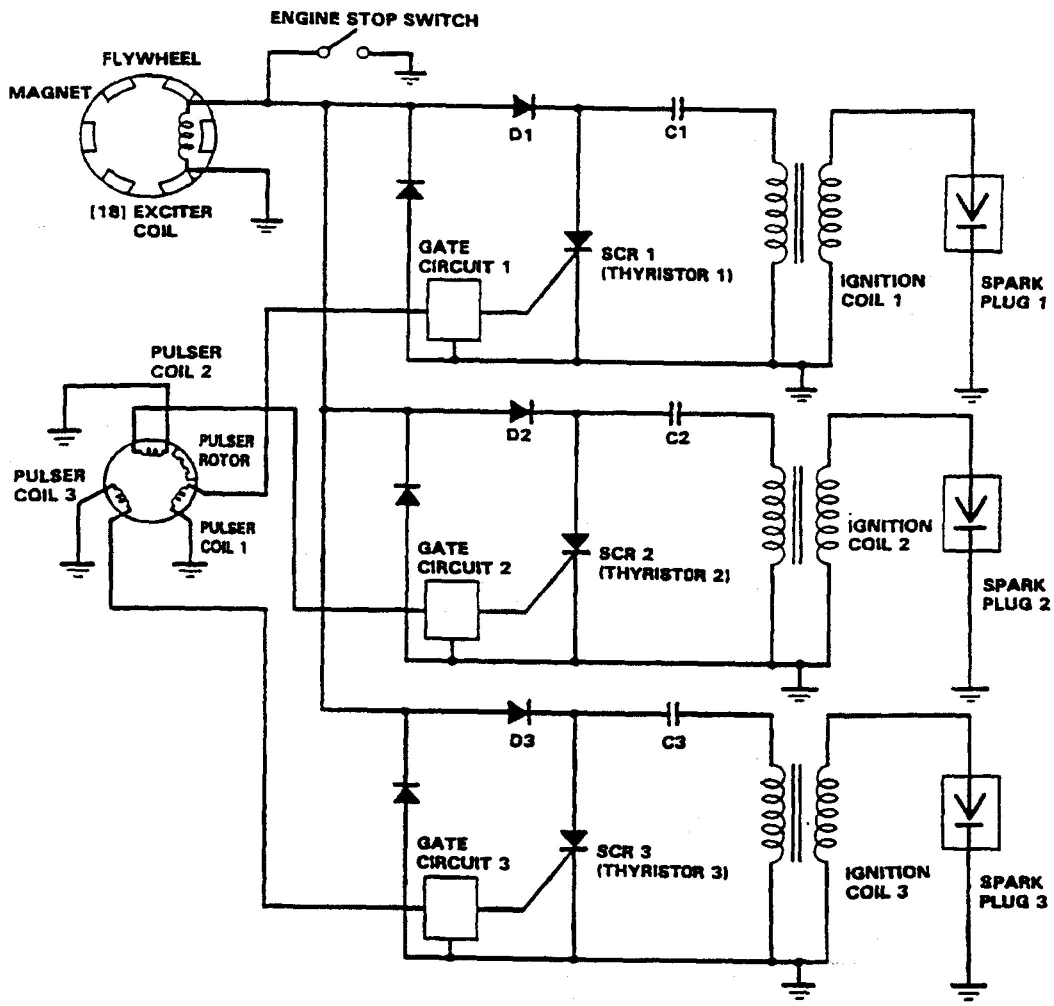


Fig. 16-2 Basic circuit diagram – three cylinders

The system is equipped with three ignition condensors and an independent system is provided for each of the three cylinders.

Over-rev Limiter

An over-rev limiter is provided in the C.D.I. unit to prevent the over-revving of the engine (Fig. 16-3). The speed limiter is set to 6600+/–200 r.p.m.

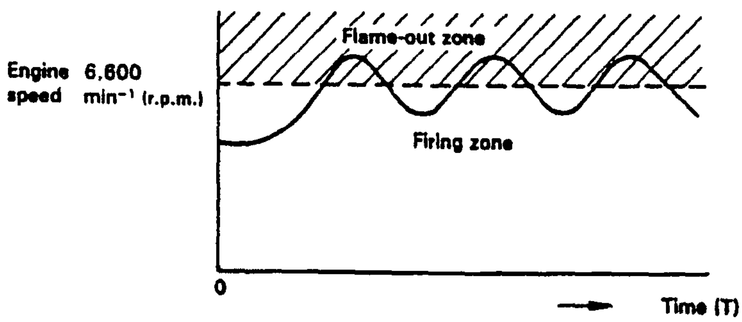


Fig. 16-3 Speed limiter firing and flame-out zones

Overheat/ Oil Pressure Alert

This system protects the engine by controlling its speed through the C.D.I. circuit if overheating or low engine-oil pressure occurs.

When trouble is detected, the system slows down the engine speed gradually as a sharp drop in the speed can be hazardous to the personnel operating at the discharge-end of the hose(s).

When the problem is solved the system gradually increases the engine speed once again up to the setting determined by the throttle opening.

Engine Speed Control

Firing and flaming-out is repeated electrically to control the engine speed.

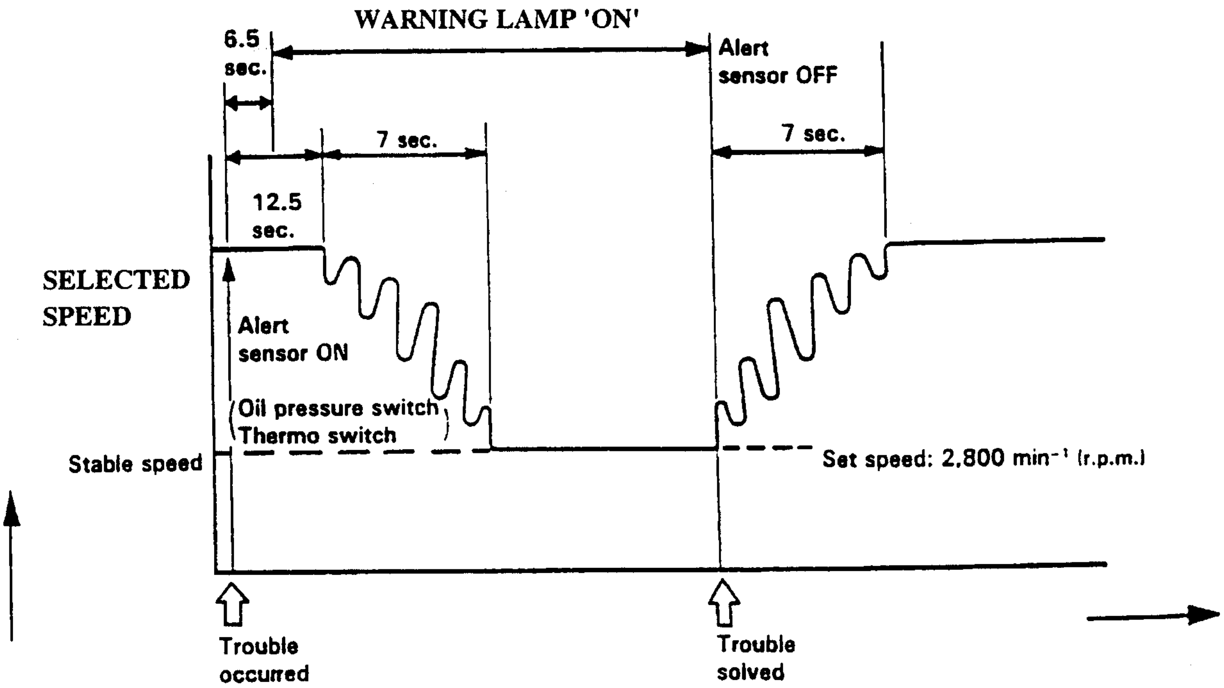


Fig. 16-5 Engine Speed Control

When the engine is below the stable speed (approximately 2800 r.p.m.) it is increased to the engine stable speed according to the throttle setting.

With the engine above the stable speed, it is slowed down gradually and stabilises at the stable speed (approximately 2800). The engine speed does not increase regardless of throttle opening,

Warning System

The warning system sets the time of the timer before the engine-speed control is started and alerts the operator to the oil pressure or thermal-switch operation with the warning lamps on the instrument panel.

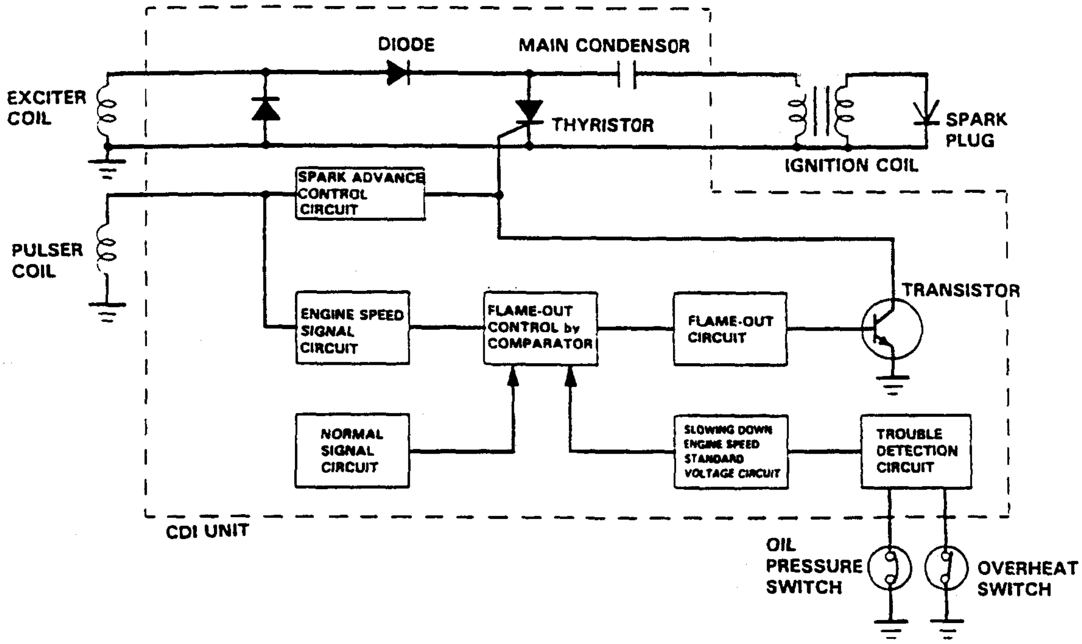


Fig. 16-6 Unit alert system – single cylinder

Item	Colour of the lamp	When faulty
Oil pressure switch	Red	ON
Thermo-switch	Red	ON

<Detection>	
Thermo switch:	ON when temperature is above the set temperature
Oil pressure switch:	ON when oil pressure is below the set pressure

When the oil-pressure switch or thermo-switch detects the 'trouble signal', the comparator circuit compares the condensor discharged-voltage curve of the slowing-down engine speed standard voltage circuit with the engine-speed voltage signal and detects whether the speed is above or below the specified speed.

Receiving the signal from the comparator, the flame-out circuit turns the transistor ON/OFF and controls the thyristor rate.

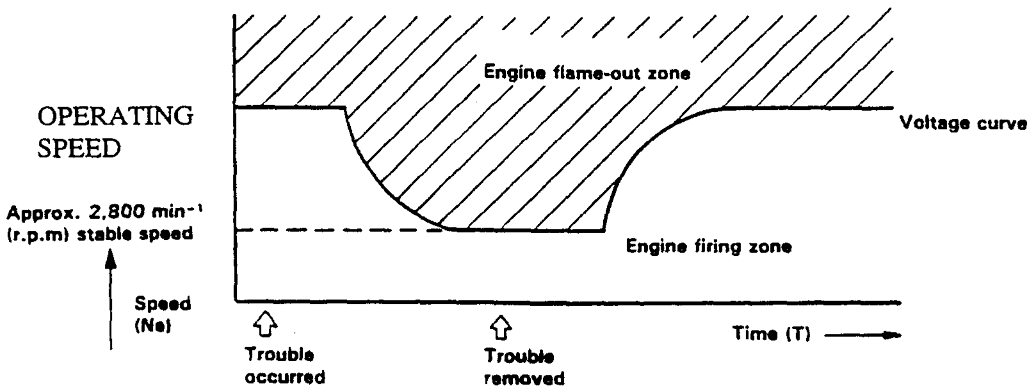


Fig. 16-7 Engine speed flame-out and firing zones

The slowing-down engine speed standard voltage stabilises at the pre-set stable engine speed. The flaming-out and firing are repeated at this stable engine speed.

When the oil-pressure switch or thermo-switch trouble is removed the 'trouble signal' stops and the alert system repeats the procedure.

Alert Indicator (Warning) Lamp Circuit (Fig. 16-8)

Direct current supplied by the charging coil and rectified to half-wave by the rectifier, flows to the thermo-lamp and oil lamp.

The thermo-switch turns ON when the temperature is above the set temperature and current flows through the lamp circuit. The alert ON signal is sent to the C.D.I. unit when the thermo switch is ON.

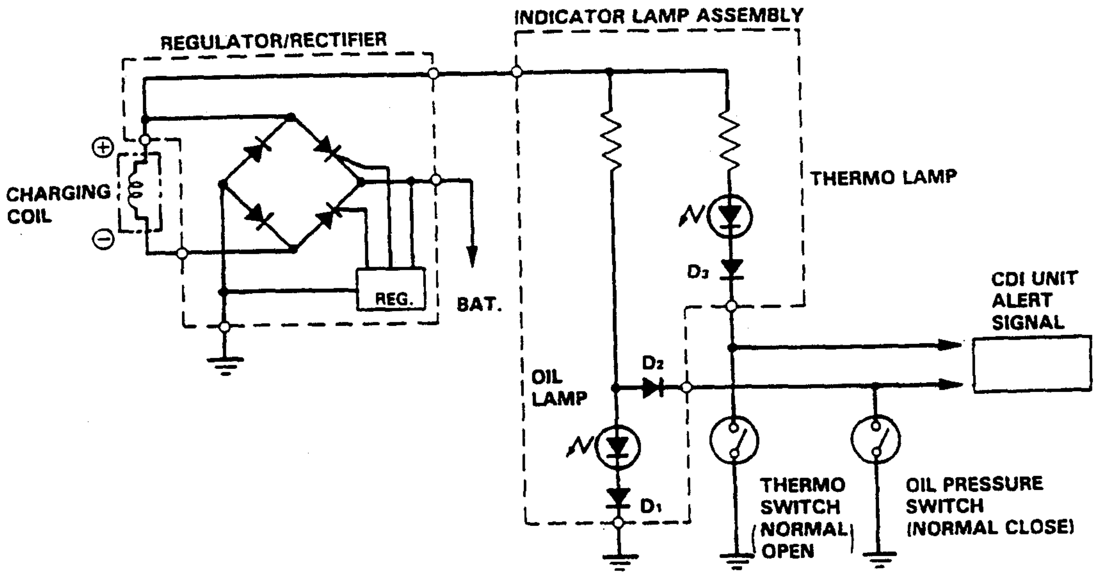


Fig. 16-8 Basic circuit diagram – Alert indicator lamps

The oil-pressure switch turns OFF and the current flows to the oil lamp when the oil pressure generated by the engine is above the pre-set limit.

When the oil pressure falls below the set pressure the switch turns ON, the current flows through diode D2 to the oil-pressure switch and the current to the oil lamp ceases and the lamp turns OFF.

The alert ON signal is sent to the C.D.I. unit when the switch is ON.

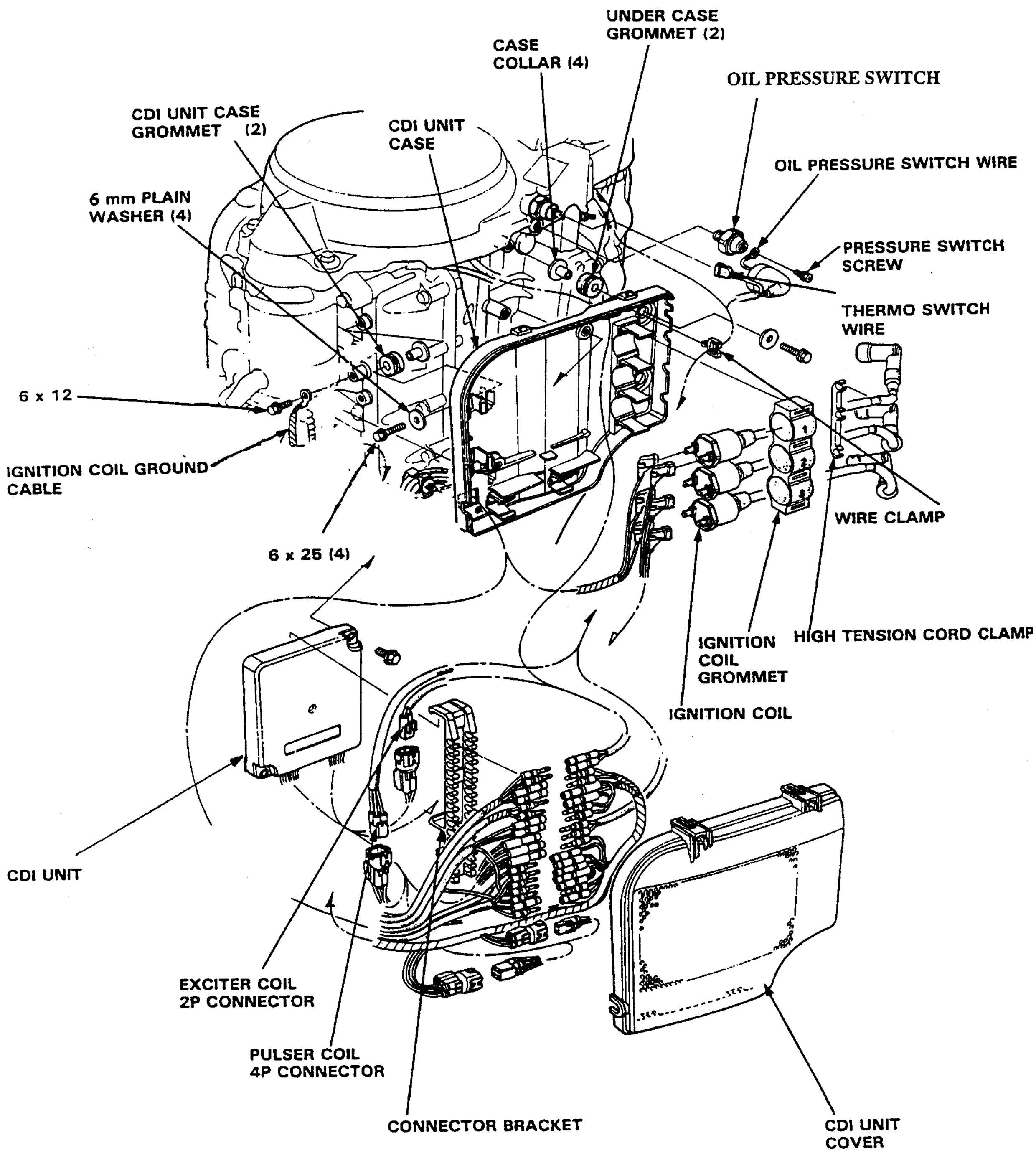


Fig. 16-9 Component identification

Oil Pressure Switch

Testing

Peel back the protective cover and unscrew the 4 x 8mm screw securing the wire to the switch.

Attach the test apparatus probes between the centre of the witch, previously occupied by the screw, and the switch body.

Check that there is continuity (Fig. 16-10). If no continuity exists, fit a new coil-pressure switch.

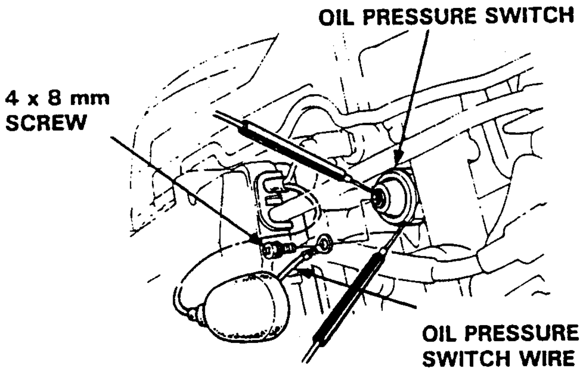


Fig. 16-10 Continuity test oil pressure switch

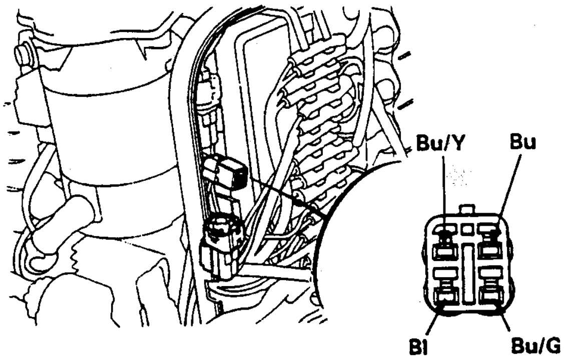


Fig. 16-11 Resistance test – pulser coil

Pulser Coil

Testing

It is not necessary to remove the coil to conduct these tests.

Disconnect the pulser coil-plug located under the C.D.I. – cover on the side of the engine.

Connect the probes of an ohmmeter to each terminal and measure the resistance between these terminals (Fig.16-11).

The readings should be as follows:

Reading

	PC1 (Bu)	PC2 (Bu/Y)	PC3 (Bu/G)
GND (Bl)	288–352 Ω	286–352 Ω	288–352 Ω

Colour code: Bl = Black Bu = Blue Bu/Y = Blue/Yellow Bu/G = Blue/Green

If it is necessary to fit a new pulser coil refer to SECTION 2.

Exciter Coil

Testing

There is no need to remove the Coil to conduct this test.

Measure the resistance between each terminal of the exciter coil connector (Fig. 16-12). The resistance should be 168–227 ohms. If not within this range, fit a new exciter coil (See SECTION 2).

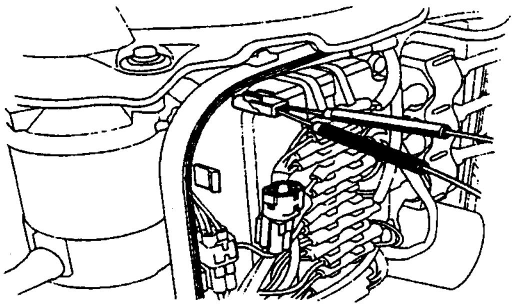


Fig. 16-12 Resistance test – exciter coil

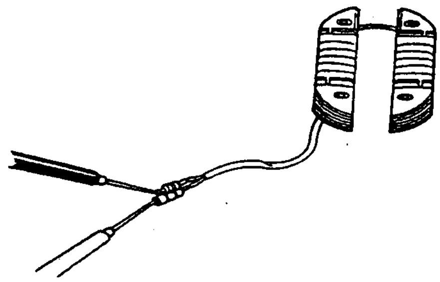


Fig 16-13 Resistance test – charging coils

Charging Coils

The charging coils are located inboard of the engine flywheel and have an output of 10 amps.

Disconnect the two connectors of the charging coil set under the C.D.I. cover.

Measure the resistance between the connectors of the charging coil set (Fig. 16-13). This should be 0.17 – 0.23 ohms. If the reading is outside these limits a new coil set must be installed (See SECTION 2).

Ignition Coils

Three independent ignition coils are fitted, one for each cylinder, located under the C.D.I. cover (Fig. 16-9).

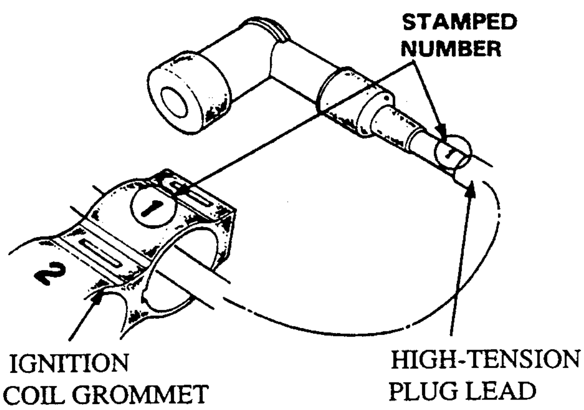


Fig. 16-14 Coil grommet and H.T. lead numbers

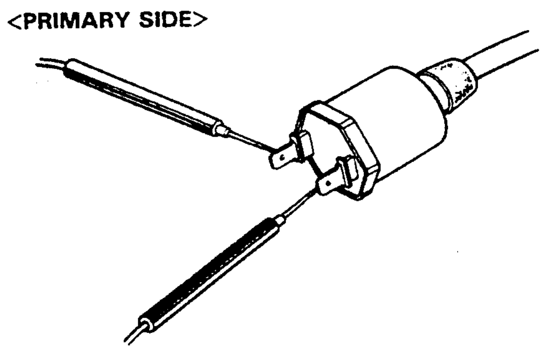


Fig. 16-15 Testing coil primary circuit

To Remove

Identify the coil(s) to be removed.

Detach all three plug (H.T.) leads from the spark plug(s).

Disconnect the two wires from the appropriate coil, release the H.T. plug lead from its clamp and remove the spark-plug cap.

Carefully withdraw the coil from its grommet.

Testing

Connect the probes of an ohmmeter as shown in Fig. 16-15 to test the coil primary circuit

The reading should be 0.19 – 0.23 ohms.

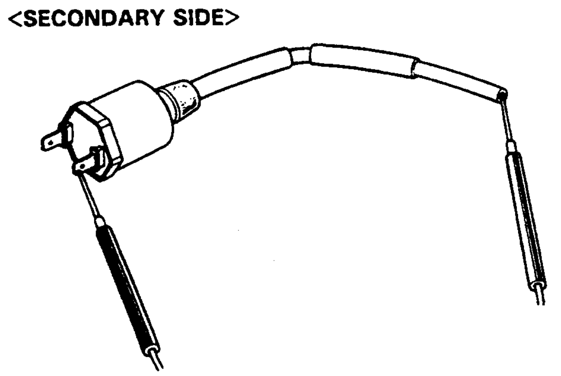


Fig. 16-16 Testing coil secondary circuit

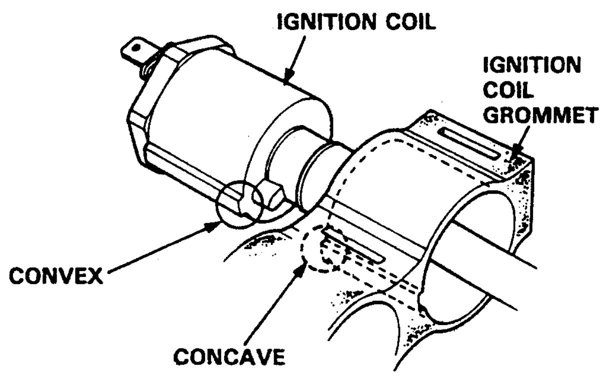


Fig. 16-17 Coil and mounting grommet.

To test the coil secondary circuit: connect the ohmmeter probes between the end of the plug (H.T.) lead and the green terminal of the coil (Fig. 16-16).

The reading should be 2.8 – 3.4ohms.

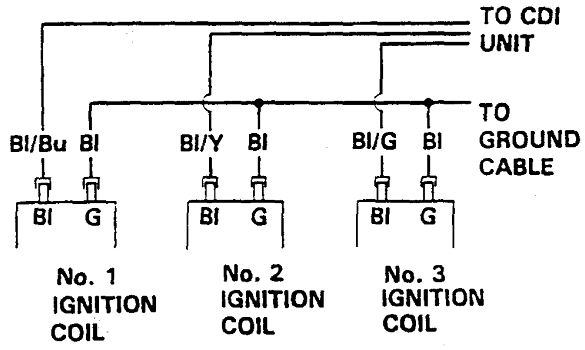
Note: A false reading will be obtained if the spark plug cap is not removed.

To Refit

If more than one coil has been removed, ensure that it is refitted in the appropriate mounting grommet.

Align the key (convex) of the ignition coil with the concave (slot) in the grommet mounting, and then feed the plug (H.T.) lead through the grommet and finally push the coil into position in the grommet.

Connect the wiring to the ignition coils as shown (Fig. 16-18). The black/blue lead connects to No.1 coil, the black/yellow lead to No.2 coil and the black/green lead to No.3 coil. All the black leads are common earth (ground) leads.



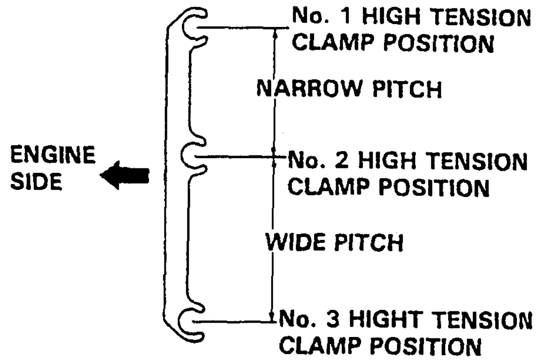


Fig. 16-18 Ignition coil connections Fig. 16-19 Spark plug (H.T.) lead clamps

Install the spark plug (H.T.) lead clamp with the narrow pitch-side uppermost and the flat side towards the engine. Insert the leads securely in the clamp (Fig. 16-19).

Spark Plug Gap

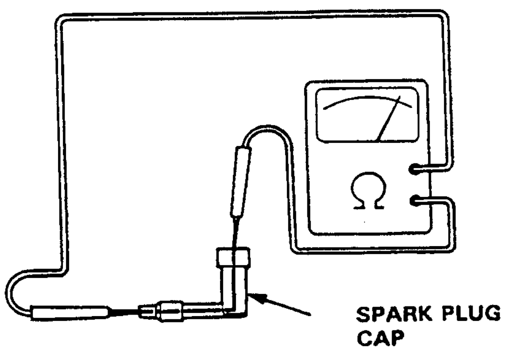
Testing

Remove the spark-plug cap from the plug (H.T.) lead.

Using a suitable test meter, connect one probe to the input-side of the cap and the other probe to the spark plug-end and measure the resistance (Fig. 16-20).

This should be 7.5 – 12.5 ohms.

If outside these readings, fit a new spark-plug cap.



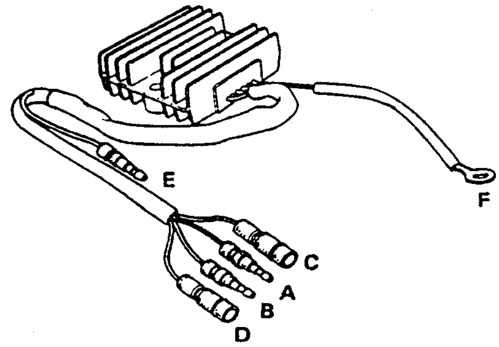


Fig. 16-20 Measuring plug-cap resistance Fig. 16-21 Regulator/ rectifer connections

Regulator/ Rectifier

Testing

Disconnect the unit at the connectors under the C.D.I. cover and measure the resistance between the connectors (Fig, 16-20).

If the measurements obtained are outside the readings in the table (Fig. 16-22) then a new unit must be fitted.

(Ω)

ESTER (+) / TESTER (–)		Gr	Gr	W/Bl, W	Bl
		A	B	D/E	F
Gr	A		∞	∞	∞
Gr	B	∞			∞
W/Bl, W	D/E	1k – 200k	1k – 200k		500 – 100k
Bl	F	500 – 50k	100 – 50k	∞	

Fig. 16-22 Regulator/rectifier resistance readings

Capacitor Discharge Ignition Unit

To Remove

Disconnect the battery.

Remove the coolant tank and heat exchanger as an assembly (See PART A – SECTION 11).

Release the four clips of the C.D.I. unit cover and withdraw it.

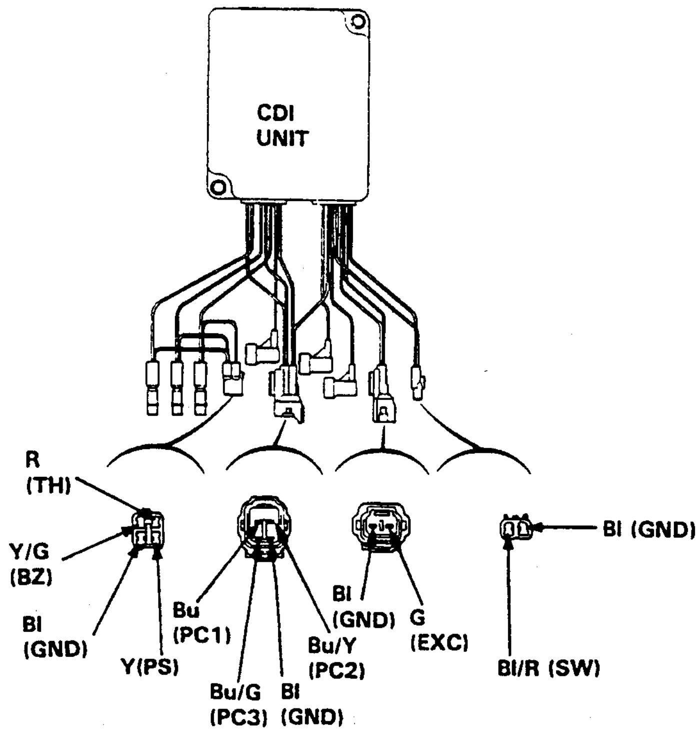
The wiring may be disconnected at the connectors on the connector bracket but their colours and positions should be carefully noted.

Unclip the connector bracket from the C.D.I. unit.

Unscrew the two 6 x 18mm screws securing the C.D.I. unit to the casing to allow it to be removed.

Testing

Measure the resistance between the C.D.I. unit terminals. The measurements must conform to the ranges shown in Fig. 16-23.



COLOUR CODE			
Bl	BLACK	BR	BROWN
Y	YELLOW	O	ORANGE
Bu	BLUE	Lb	LIGHT BLUE
G	GREEN	Lg	LIGHT GREEN
R	RED	P	PINK
W	WHITE	Gr	GRAY

COLOUR	Tester(–) / Tester(+)	PC1	PC2	PC3	EXC	SW	IG1	IG2	IG3	PS	TH	GND	BZ
Bu	PC1		10 – 500	10 – 500	10 – 500	∞	∞	∞	∞	∞	∞	3 – 300	∞
Bu/Y	PC2	10 – 500		10 – 500	10 – 500	∞	∞	∞	∞	∞	∞	3 – 300	∞
Bu/G	PC3	10 – 500	10 – 500		10 – 500	∞	∞	∞	∞	∞	∞	3 – 300	∞
G	EXC	10 – 500	10 – 500	10 – 500		∞	∞	∞	∞	∞	∞	0.5 – 50	∞
Bl/R	SW	20 – 500	20 – 500	20 – 500	0.5 – 50		∞	∞	∞	∞	∞	0.5 – 50	∞
Bl/L	IG1	∞	∞	∞	∞	∞		∞	∞	∞	∞	∞	∞
Bl/Y	IG2	∞	∞	∞	∞	∞	∞		∞	∞	∞	∞	∞
Bl/G	IG3	∞	∞	∞	∞	∞	∞	∞		∞	∞	∞	∞
Y	PS	10 – 500	10 – 500	10 – 500	10 – 500	∞	∞	∞	∞		∞	0.5 – 50	∞
R	TH	3 – 300	3 – 300	3 – 300	3 – 300	∞	∞	∞	∞	∞		0.5 – 50	∞
Bl	GND	3 – 300	3 – 300	3 – 300	3 – 300	∞	∞	∞	∞	∞	∞		∞
Y/G	BZ	10 – 500	10 – 500	10 – 500	10 – 500	∞	∞	∞	∞	∞	∞	0.5 – 500	

Tester(–) / Tester(+)	PC.E.	EXC.E.	IND.E.	SW.E.
GND	Continuity	Continuity	Continuity	Continuity

NOTE

- RECOMMENDED MULTITESTERS:
  TH – 5H (KOWA Analogue type)
  SP – 10D (SANWA Analogue type)
- Select the following range.
  Kowa: R x 100 Ω
  Sanwa: kΩ

Fig. 16-23 Test meter readings for C.D.I. unit

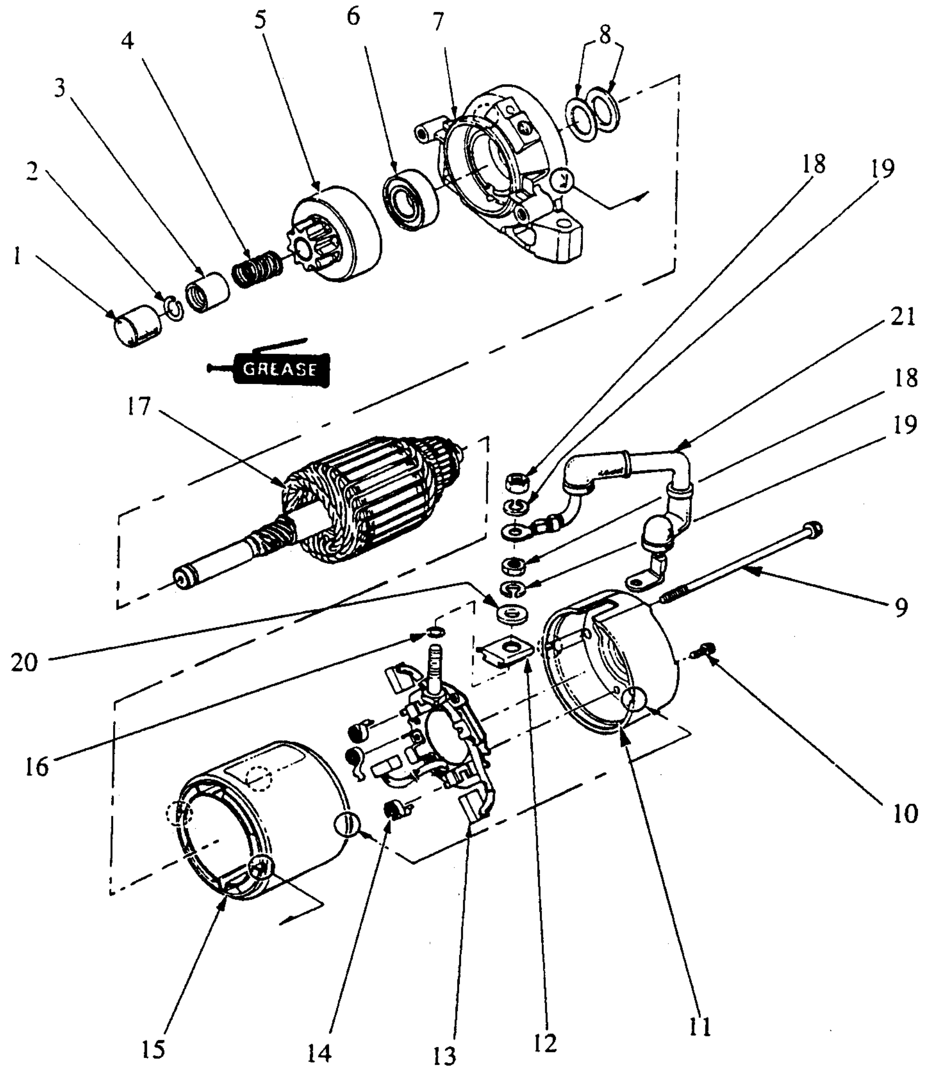
To Refit

Refitting is a reversal of the removal instructions.

Retighten the C.D.I. unit screws to a torque of 5 Nm.

Starter Motor

The starter motor is of the inertia-engagement type (0,9 kw rating) and also incorporates a uni-directional (over-run) clutch-and-pinion assembly. The solenoid (magnetic switch) is mounted separately to the starter motor and connected to it by heavy-duty cable. Both units are mounted on the crankcase.



1. Cover
2. Snap ring
3. Stopper collar
4. Spring
5. Uni-directional clutch
6. Ball race
7. Front cover
8. Washers
9. Belt
10. Screw
11. Rear cover
12. Bushing
13. Bush holder
14. Bush spring
15. Yoke
16. 'O' ring
17. Armature
18. Flange nut
19. Spring washer
20. Washer
21. Cable assembly

Fig. 16-24 Starter motor components

To Remove

Disconnect and remove the battery

Unscrew the 8 x 12mm flange bolt and detach the negative (–) cable from the starter motor body.

Peel back the protective cover of the positive (+) cable, unscrew the 8mm flange nut securing it to the starter-motor bushing and finally, recover the 8mm spring washer and cable (Fig. 16-25).

Remove the three flange bolts securing the starter motor to the crankcase and remove the starter motor.

Place the starter in an upright position (starter-pinion uppermost).

Position an off-set wrench over the stopper collar and push the collar down. This will expose a snap ring which should then be removed (Fig, 16-26).

The collar and uni-directional clutch can then be withdrawn from the armature shaft.

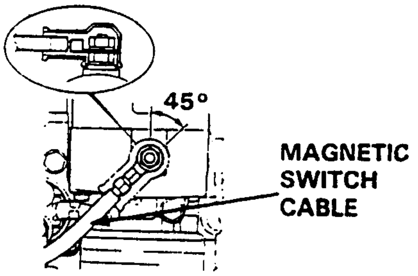


Fig.16-25 Magnetic switch cable

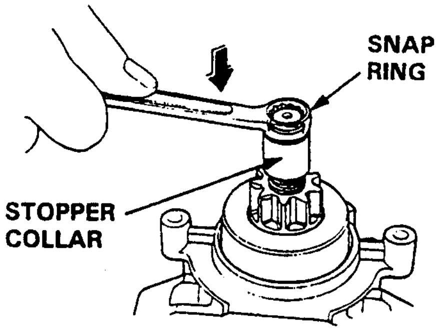


Fig. 16-26 Removing snap ring

Maintenance

To dismantle the starter motor refer to Fig 16-24 and proceed as follows:

Unscrew the two long bolts (9) clamping the rear cover (11) yoke (15) and front cover (7) together.

Remove the rear cover and brush-holder assembly and the yoke (15).

The armature (17) may then be withdrawn from the ball race (6) located in the front cover (7). Recover the washers (8).

Inspection and Testing

Brushes

Pull each brush spring away from the brush and withdraw the brush from its holder.

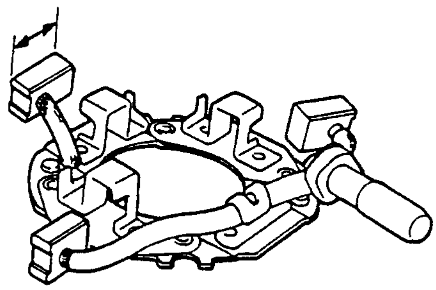


Fig. 16-27 Measuring brush length

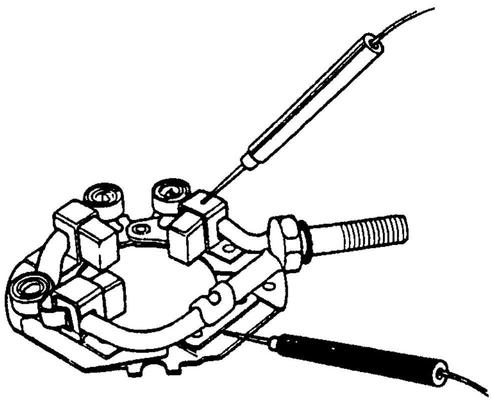


Fig. 16-28 Testing brush insulation

Measure the length of each brush (Fig. 16-27). The standard is 16mm and the service limit is 12mm. If less than the service limit, fit a new set of brushes.

With the brushes refitted to their holders, check for any continuity between the brushes (Fig. 16-28). Should continuity exist, fit a new brush-holder assembly. To do this, unscrew the nut (18) and two screws (10) securing it to the end cover (11) – See Fig. 16-24.

Mica Depth

Check the grooves between the commutator segments for depth which should not be less than 0,2mm (Fig. 16-29). If less than this figure or if clogged, recut the grooves using a hacksaw blade or suitable small file.

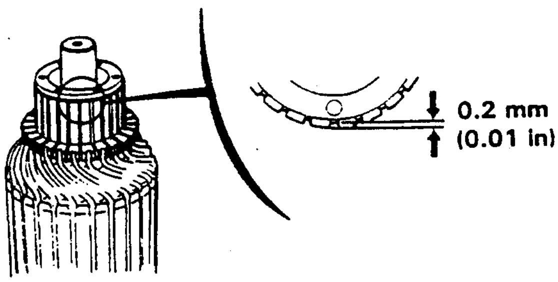


Fig. 16-29 Measuring mica depth

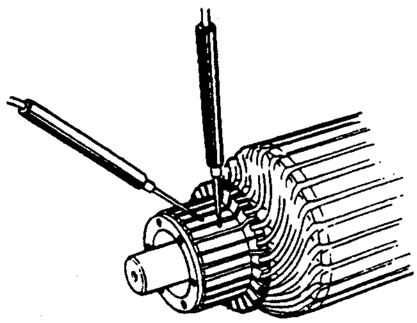


Fig. 16-30 Armature continuity check

Continuity Check

Check for continuity between the armature segments (Fig. 16-30). If no continuity exists (open-circuit) between the two segments, fit a new armature.

Short-Circuit Test, Core-to-Commutator

Check for continuity between the commutator and armature-coil core (Fig. 16-31). If continuity exists, fit a new armature.

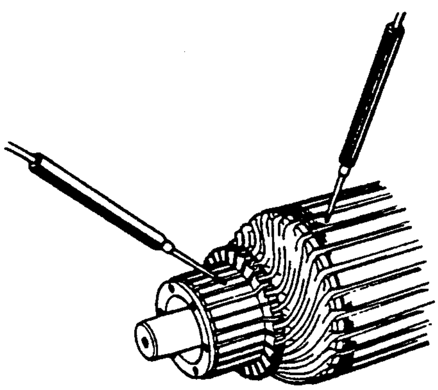


Fig. 16-31 Short-circuit test
core-to-commutator

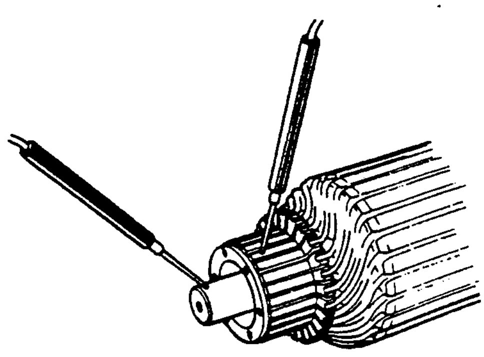


Fig. 16-32 Short-circuit test
shaft-to-commutator

Short-Circuit Test, Shaft-to-Commutator

Check for continuity between the commutator and armature shaft (Fig. 16-32). If continuity exists, fit a new armature.

Short-Circuit Test, Armature

Place the armature in an armature test unit, (this is commercially available). Hold a hacksaw blade or similar metal strip, close to – but not touching, the armature (Fig. 16-33).

If the blade vibrates, or is attracted to the core when the test unit is turned on, there is a short circuit in the armature. Fit a new armature if short-circuited.

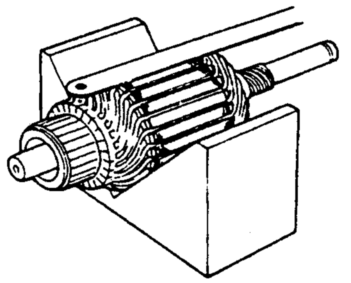


Fig. 16-33 Armature short-circuited

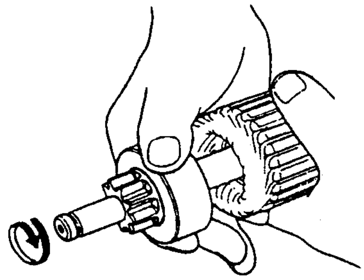


Fig. 16-34 Checking uni-directional clutch

Uni-directional Clutch

The clutch should first be checked for smooth axial movement. Oil should be applied but if still unsatisfactory, fit a new clutch unit (Fig. 16-34).

Check the operation of the clutch by holding the unit stationary and turning the armature (Fig. 16-35). The clutch should turn freely in the counter-clockwise direction, but should NOT turn clockwise.

Check the pinion teeth for wear or damage and if unsatisfactory, fit a new one. If this is necessary, check the flywheel teeth for excessive wear or damage. Renew if necessary.

Inspect the armature for dust, rust or any other damage. Wipe clean with a clean lint-free, cloth If rusted or damaged, dress with a fine emery cloth. Make sure that no metallic material is attached to the armature before refitting.

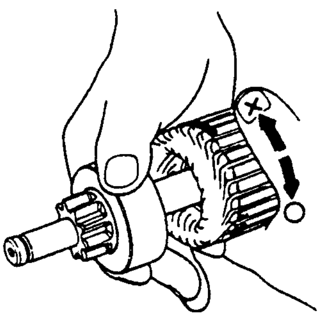


Fig. 16-35 Checking clutch operation

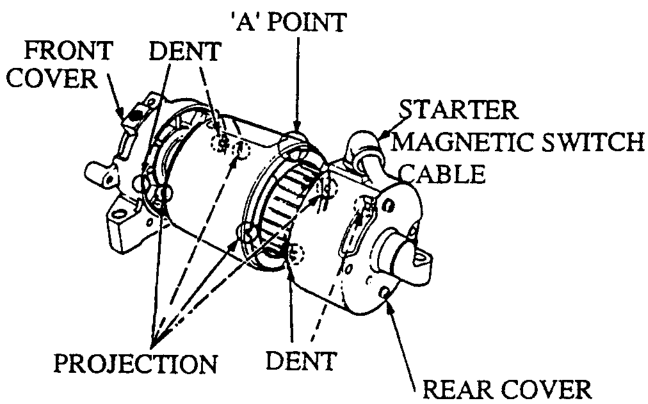


Fig. 16-36 Yoke and covers relationship

Check the front and rear bearings for excessive movement and renew if necessary.

When reassembling, align the projections on the yoke with the recesses in the rear cover ensuring that the ‘A’ Point on the yoke faces the starter magnetic switch cable (Fig. 16-36). The front cover recesses should be aligned with the projections on the yoke, in a similar manner.

Apply an adhesive compound (e.g. Cemedain 575 or equivalent) to the bushing to rear cover joint.

Magnetic Switch (Solenoid)

Testing

Ensure that the battery is in good condition and fully-charged before performing this test.

Connect the black/white wire of the switch to the positive (+) terminal of the battery and the black wire to the negative (–) terminal (Fig. 16-37).

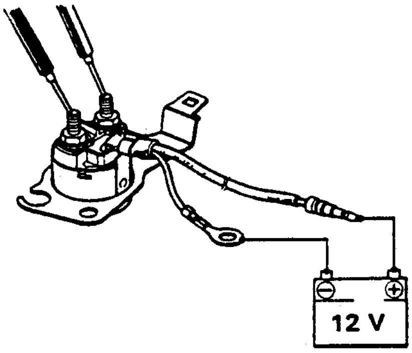


Fig. 16-37 Continuity test, solenoid

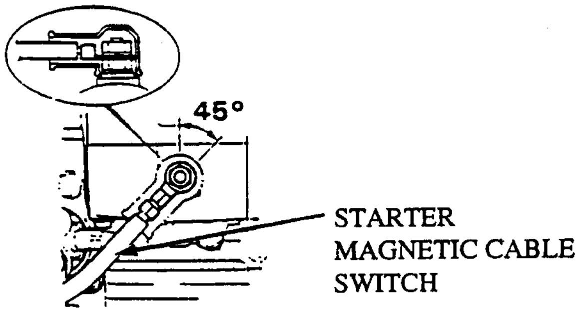


Fig. 16-38 Starter-cable installation

Connect the probes of the test apparatus, one to each solenoid terminal and check for continuity (Fig. 16-37). There should be continuity with the battery connected, but no continuity with the battery disconnected. If faulty, fit a new solenoid,

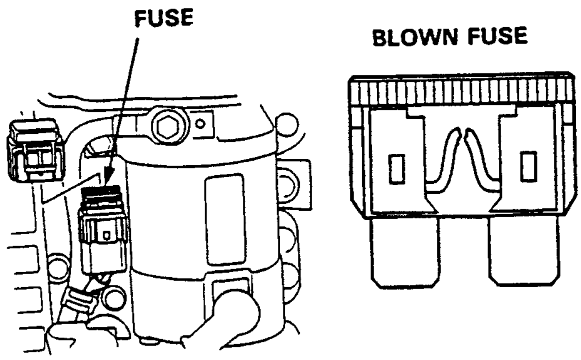


Fig. 16-39 Fuse location and condition

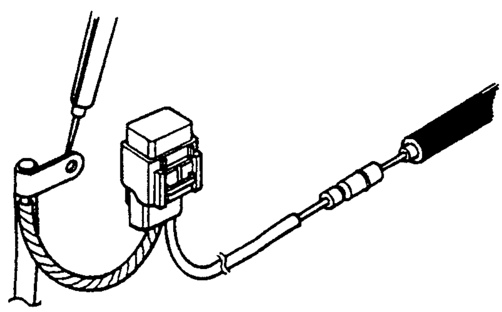


Fig. 16-40 Checking fuse continuity

Fuse and Fuse Case

The fuse case is located adjacent to the starter motor (Fig.16-39).

The fuse plugs into the top of the case and should be checked either visually or electrically to determine its condition (Fig. 16-39).

If ‘blown’, fit a new fuse.

Testing

Using a ‘known’ good fuse plugged into the fuse case, connect the probes of the test apparatus as shown (Fig. 16-40) and check the fuse case for continuity.

If no continuity, renew the fuse case.

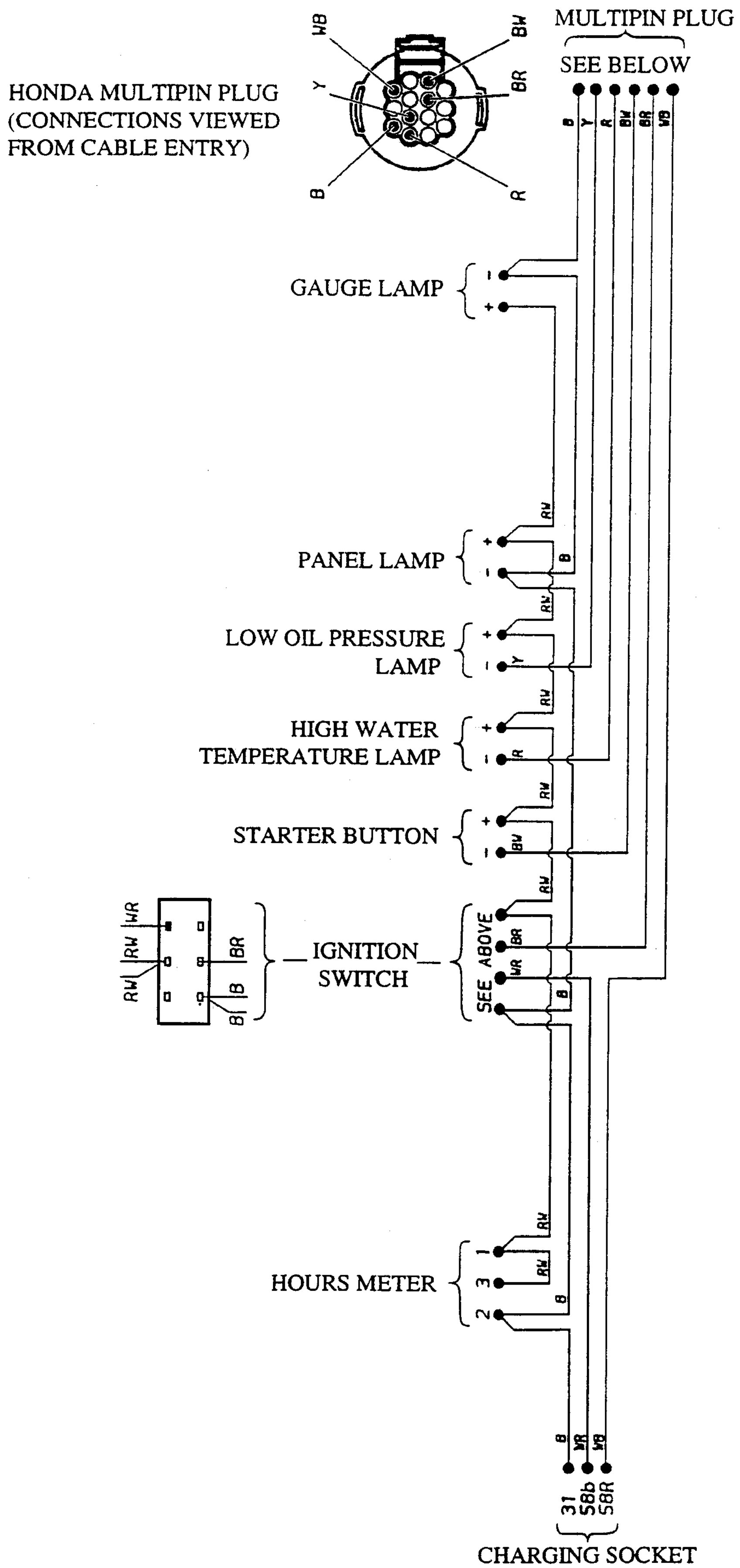
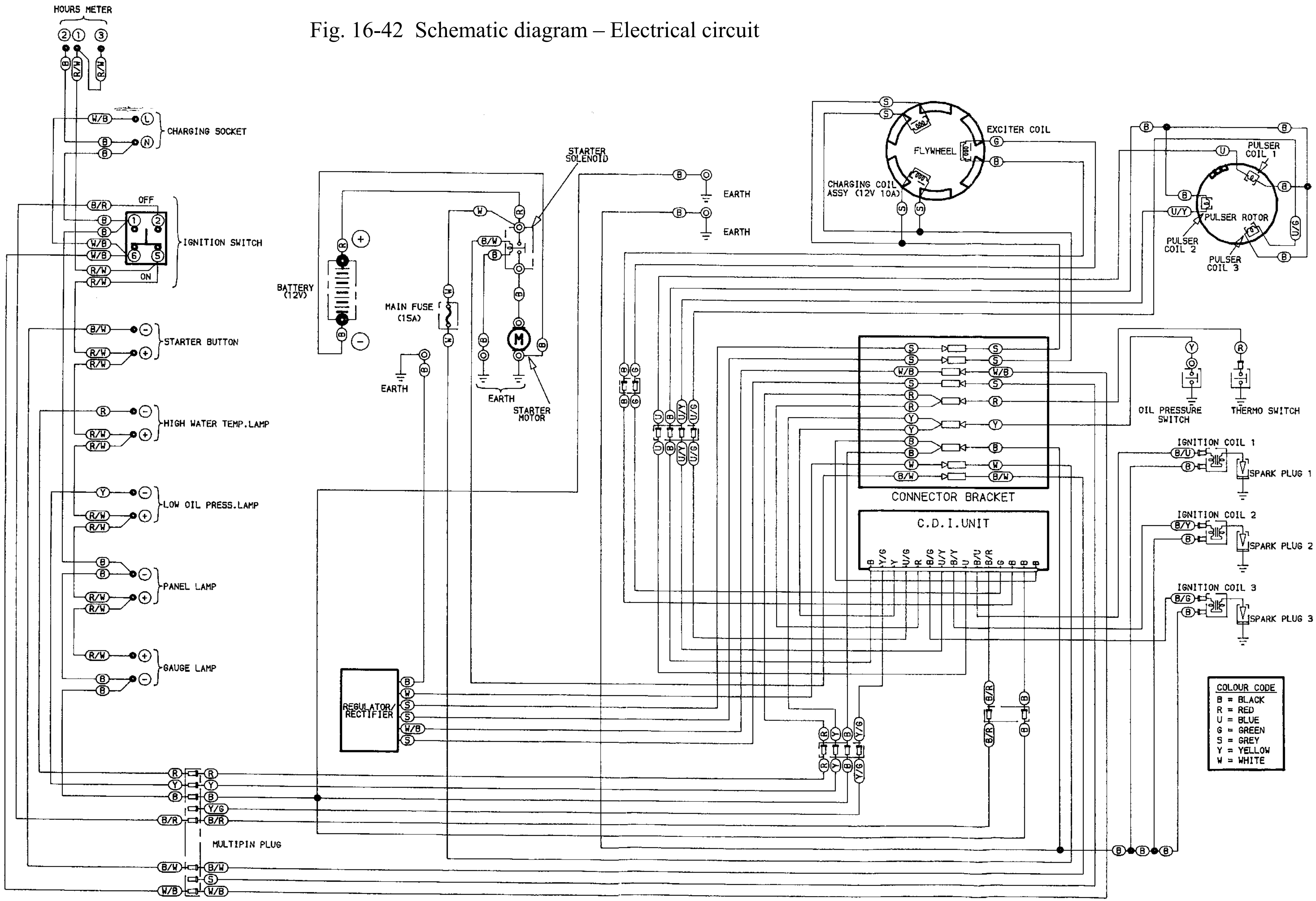


Fig. 16-41 Schematic Wiring Diagram – Godiva part

Fig. 16-42 Schematic diagram – Electrical circuit



SECTION 17

MAINTENANCE SCHEDULE

ITEM / REGULAR SERVICE PERIOD Perform at every indicated month or operating hour interval, whichever comes first.		EACH USE	FIRST MONTH OR 20 HRS	EVERY 6 MONTHS OR 100 HRS	EVERY YEAR OR 200 HRS	EVERY 2 YEARS OR 400 HRS	REFER TO SECTION
Engine oil	Check level	□					10
	Change		□		□		10
Engine oil filter	Change					□	10
Timing belt	Check-readjust				□		2
Carburettor linkage	Check		□	□			14
Idling	Readjust		□	□			14
Valve clearance	Check-readjust		□		□		4
Spark plugs	Check-clean		□		□		16
Fuel filter	Check			□			12
	Change					□	12
Thermostat	Check				□		11
Fuel	Check	□					–
	(Replace if necessary)					□	–
Battery fluid	Check-refilling	□					16
Cable connection	Check-tightness		□	□			16
Bolts and Nuts	Check-tightness		□	□			–

SECTION 18

TECHNICAL DATA

Unit: mm (in)

Part	Item		Standard	Service limit
Engine	Idle speed		950 +/– 50 min^{-1} (rpm)	—
	Cylinder compression		15 +/– 1kg/cm² (212 +/– 14 psi) at 500 min^{-1} (rpm)	—
Carburettor	Main jet		#125	—
	Pilot screw opening		2-1/8 turns out	—
	Float height		14 (0.6)	—
Spark plug	Gap		0.6–0.7 (0.024–0.028)	—
Valves	Valve clearance	IN	0.13–0.17 (0.005–0.007)	—
		EX	0.21–0.25 (0.008–0.0101)	—
	Stem O.D.	IN	5.480–5.490 (0.2157–0.2161)	5.45 (0.215)
		EX	5.460–5.470 (0.2150–0.2154)	5.42 (0.213)
	Guide I.D.	IN/EX	5.500–5.512 (0.2165–0.2170)	5.53 (0.218)
	Seat width	IN	1.25–1.55 (0.049–0.061)	2.0 (0.08)
		EX	1.25–1.55 (0.049–0.061)	2.0 (0.08)
	Spring free length	IN/EX	36.9 (1.45)	35.4 (1.39)
	Stem-to-guide	IN	0.010–0.032 (0.0004–0.0013)	0.06 (0.0024)
	clearance	EX	0.030–0.052 (0.0012–0.0020)	0.10 (0.004)
Rocker arm	Rocker arm I.D.		14.010–14.028 (0.5516–0.5523)	14.05 (0.553)
	Rocker arm shaft O.D.		13.976–13.994 (0.5502–0.5509)	13.95 (0.549)
	Rocker arm shaft-to-rocker arm clearance		0.016–0.052 (0.0006–0.0020)	0.07 (0.003)
Piston	Skirt O.D.		69.970–69.990 (2.7547–2.7555)	69.910 (2.7524)
	Piston-to-cylinder clearance		0.010–0.045 (0.0004–0.0018)	0.09 (0.0035)
	Pin hole I.D.		18.002–18.008 (0.7087–0.7090)	18.012 (0.709)
	Pin O.D.		17.994–18.000 (0.7084–0.7086)	17.954 (0.7068)
	Pin-to-pin hole clearance		0.002–0.014 (0.0001–0.0005)	0.04 (0.0016)
Piston ring	Ring side clearance	Top	0.040–0.065 (0.0016–0.0026)	0.1 (0.004)
		Second	0.015–0.045 (0.00059–0.0018)	0.1 (0.004)
		Oil	0.055–0.140 (0.0022–0.0055)	0.15 (0.006)
	Ring end gap	Top	0.15–0.3 (0.006–0.012)	0.8 (0.03)
		Second	0.3–0.45 (0.012–0.018)	0.95 (0.037)
		Oil	0.2–0.7 (0.0079–0.028)	1.0 (0.04)
	Ring width	Top	0.990–1.025 (0.0390–0.0404)	0.96 (0.038)
		Second	1.190–1.225 (0.0469–0.0482)	1.160 (0.0457)
Cylinder/ cylinder head	Cylinder sleeve I.D.		70.0–70.015 (2.7559–2.7565)	70.06 (2.758)
	Distortion of cylinder head		0.05 (0.0019)	0.1 (0.004)
	I.D. of camshaft journal		23.0–23.021 (0.9055–0.9063)	23.05 (0.908)

TECHNICAL DATA (Continued)

Unit: mm (in)

Part	Item		Standard	Service limit
Connecting rod	Small end I.D.		18.016–18.034 (0.7093–0.7100)	18.05 (0.711)
	Big end oil clearance		0.016–0.040 (0.0006–0.0016)	0.05 (0.0019)
	Big end axial clearance		0.05–0.2 (0.0019–0.0079)	0.3 (0.012)
	Connecting rod bearing oil clearance		0.020–0.038 (0.0008–0.0015)	0.08. (0.003)
Crankshaft	Journal O.D.	Main	39.982–40.006 (1.5741–1.5750)	39.95(1.572)
		Pin	37.976–38.0 (1.4951–1.4961)	37.94(1.494)
	Crankshaft main bearing oil clearance		0.020–0.038 (0.0006–0.0015)	0.05 (0.0019)
	Crankshaft side clearance		0.05–0.3 (0.0019–0.012)	0.45 (0.018)
Camshaft	Shaft axial clearance		0.03–0.11 (0.0012–0.0043)	0.3 (0.012)
	Shaft runout		0.03 (0.0012) Max.	0.05 (0.0019)
	Journal O.D.		22.959–22.960 (0.9039–0.9047)	22.93 (0.903)
	Cam height	IN	34.928–35.248 (1.3751 – 1.3877)	34.708 (1.3665)
		EX	34.973–35.293 (1.3769–1.3895)	34.753 (1.3682)
	Shaft oil clearance		0.020–0.065 (0.0008–0.0026)	0.08 (0.003)
Oil pump	Body I.D.		50.15–50.18 (1.974–1.975)	50.20 (1.976)
	Inner rotor-to-outer rotor clearance		0.15 (0.006) Max.	0.20 (0.0079)
	Outer rotor-to-body clearance		0.15–0.22 (0.006–0.009)	0.26 (0.0102)
	Outer rotor height		16.98–17.0 (0.6685–0.6693)	16.93 (0.667)
	Pump body depth		17.02–17.05 (0.670–0.671)	17.09 (0.673)
	Pump end clearance		0.02–0.07 (0.0008–0.0028)	0.1 (0.004)
Ignition coil	Resistance	Primary coil	0.19–0.23	—
		secondary coil	2.8–3.4 k	—
Charging coil	Resistance		0.20–0.26	—
Exciter coil	Resistance		168–227	—
Pulser coil	Resistance		288–352	—

SECTION 19

TIGHTENING TORQUES

Item	Thread Dia. (mm) and pitch (length)	Torque values		
		Nm	kgm	ft lb
ENGINE				
Crankcase bolt *	M8 x 1.25	28	2.8	20.2
	M6 x 1.0	11	1.1	8.0
Oil filter cartridge	M20 x 1.5	8	0.8	5.6
Water jacket cover bolt	M6x 1.0	12	1.2	8.7
Thermostat cover bolt	M6 x l .0	12	1.2	8.7
Cylinder head bolt *	M10 x 1.25	38	3.8	27.5
	M8 x 1.25	27	2.7	19.5
Cylinder head cover bolt	M6 x 1.0	12	1.2	8.7
Fuel pump bolt	M6 x l.0	10	1.0	7.2
Camshaft holder bolt	M6 x 1.0	14	1.4	10.1
	M6 x l.0	12	1.2	8.7
Throttle cam	M6 x l.0	12	1.2	8.7
Choke arm bolt	M6 x 1.0	12	1.2	8.7
Intake manifold bolt, nut	M6 x 1.0	12	1.2	8.1
Carburettor bolt	M6 x 1.0	10	1.0	7.2
Connecting rod nut	M8 x 0.75	28	2.8	20.2
Pump drive adaptor nut	M22 x 1.25	92	9.2	66.5
Valve adjusting nut	M7 x 0.75	23	2.3	16.6
Oil drtun bolt	M12 x 1.5	23	2.3	16.6
Exhaust pipe bolt	M6 x 1.0	10	1.0	7.2
	M8 xl.25	21	2.1	15.2
Oil pan bolt	M6 xl.0	10	1.0	7.2
Oil pump bolt	M6 xl.0	13	1.3	9.4
Timing pulley bolt	M48 x 1.5	130	13.0	94.0
Timing belt tensioner bolt	M10 x 1.25	45	4.5	32.5
Timing belt adjusting spring bolt	M6 x 1.0	12	1.2	8.7
Flywheel bolt	M10 x l.0	66	6.6	47.7
Pulser rotor bolt	M10 x 1.25	57	5.7	41.2
Oil pressure switch	PT 1/8	9	0.9	6.5
Thermo switch	M16 x 1.5	12	1.2	8.7
Starter solenoid (Switch side)	M6 x 1.0	5	0.5	3.6
(Starter motor side)	M8 x 1.25	7	0.7	5.1
CDI unit bolt	M6 x 1.0	5	0.5	3.6

* Tighten the crankcase bolts to 28 Nm (2.8 kg m. 20.2 ft lb) and the cylinder head bolts to 38Nm (3.8 kg m, 27.5 ft lb) first. then tighten them $90^{\circ +30}$ further.

STANDARD TORQUE VALUES

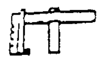
Item		Torque values		
	Thread Dia.	Nm	kg m	ft lb
Bolt and nut	5mm	5	0.5	3.6
	6mm	10	1.0	7.2
	8mm	21	2.1	15.2
	10mm	35	3.5	25.3
	12mm	55	5.5	40.0
Flange bolt and nut	6 mm (SH Flange bolt)	9	0.9	6.5
	6mm	12	1.2	8.7
	8mm	27	2.7	19.5
	10mm	35	3.5	25.3
	12mm	60	6.0	43.4
Screw	5mm	4	0.4	2.9
	6mm	9	0.9	6.5

SECTION 20

SPECIAL TOOLS

Item No.	Tool Name	Tool Number	Application
1	Float-level gauge	07401 – 0010000	Inspection for carburettor float level.
2	Vacuum 4ch tester set	07404 – 0030001	Carburettor vacuum pressure inspection.
3	Oil pressure gauge	007506 – 300000	Inspection for oil pressure
3-1	Attachment for Item 3	07406 – 0030000	
4	Torx bit handle	07703 – 0010300	For Torx bits
4-1	Screw T20H	07703 – 0010400	Fuel pump disassembly/ reassembly
4-2	Screw T30H	07703 – 0000100	Diaphragm adjustment
5	Valve guide driver 5,5mm	07742 – 0010100	Valve-guide removal/installation
6	Valve-spring compressor	07757 – 0010000	Valve cotter removal
7	Valve-seat cutter 45°29 dia.	07780 – 0010300	Valve-seat reconditioning EX
8	Valve-seat cutter 45°33 dia.	07780 – 0010800	Valve-seat reconditioning IN
9	Valve-seat cutter 32°30 dia.	07780 – 0012200	Valve-seat reconditioning EX
10	Valve-seat cutter 32°33 dia.	07780 – 0012900	Valve-seat reconditioning IN
11	Valve-seat cutter 60°30 dia.	07780 – 0014000	Valve-seat reconditioning EX
12	Valve-seat cutter 60°37.5 dia.	07780 – 0014100	Valve-seat reconditioning IN
13	Cutter holder 5,5mm	07781 – 001010f	Valve-seat reconditioning EX14
14	Valve-guide reamer	07984 – 2000001	Valve-guide reaming
15	Oil-filter wrench	07HAA – PJ70100	011-filter renewal
16	56mm lock-nut wrench	07LPA – ZV30200	Pulser rotor 45mm locknut removal/installation
17	Ring-gear holder	07LPB – ZV30100	Flwheel 22mm locknut removal/installation
18	Staking tool	53563	Staking 22mnt locknut securing pump
19	Pump adaptor puller	56566	Removing pump adaptor from crankshaft
20	Seal and seating tool	56571	Fitting silicon-carbide seal and seating to impeller

Special Tools (Continued)



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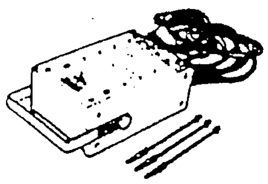

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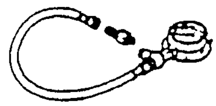

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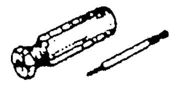

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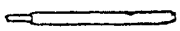

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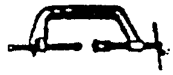

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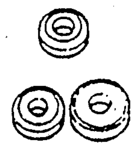

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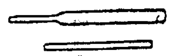

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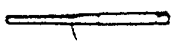

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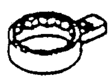

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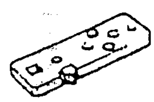

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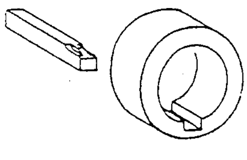

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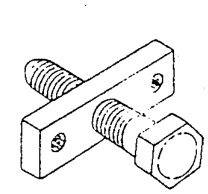

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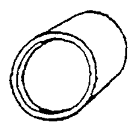

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SECTION 21

ENGINE FAULT-TRACING CHART

	POSSIBLE FAULT	REMEDY

ENGINE WILL NOT START

	POSSIBLE FAULT	REMEDY
1.	Fuel tank empty.	Refill tank.
2.	Fuel pump not functioning.	Fit new pump.
3.	In-line filter clogged.	Fit new filter.
4.	Water or impurities in fuel system.	Clean out fuel pump, carburettors, fuel tank and fuel pipelines. Refill tank with fresh fuel.
5.	Blockage in fuel pipeline.	Disconnect and clear.
6.	Carburettor setting faulty.	Adjust carburettor.
7.	Carburettor flooding –	
	a) Over-choked	Release choke, turn engine over with the throttle wide open.
	b) Needle-valve sticking	Remove and clean needle-valve.
8.	Carburettor air vent blocked.	Clean vent hole.
9.	Insufficient choke.	Check and correct.
10.	Throttle open too wide.	Check and close.
11.	Faulty spark plugs.	Fit new plugs.
12.	Plug leads loose, broken or badly-fitted.	Examine and if necessary, renew leads.
13.	Fuel pipe incorrectly-fitted.	Check and rectify.
14.	Fuel pipe twisted or trapped.	Release and re-position.
15.	Position of plug leads incorrect.	Refit leads correctly.
16.	Ignition not switched ON.	Switch ignition ON.

ENGINE MISSES AT LOW SPEEDS ONLY

	POSSIBLE FAULT	REMEDY
1.	Air leaks in system.	Check joints between: a) Cylinder head-and-intake manifold. b) Carburettor-and-intake manifold.
2.	Carburettor setting faulty.	Adjust carburettor.
3.	Valve not seating properly due to:	
	a) Incorrect valve clearance.	Check and adjust.
	b) Burnt or bent valve(s)	Remove cylinder head and renew parts.

ENGINE MISSES AT ALL SPEEDS

	POSSIBLE FAULT	REMEDY
1.	Carburettor flooding.	a) Remove and clean needle valve. b) Check float is not puntured or damaged.
2.	Faulty spark plugs.	Remove, clean and set plug points and, if necessary, fit new plugs.
3.	Plug lead(s) loose or damaged.	Examine and, if necessary, fit new plugs.
4.	Plug lead(s) insulation faulty.	Renew leads.
5.	Faulty valve operation due to:	
	a) Broken valve spring.	Examine and renew defective parts.
	b) Valve sticking in guide.	Check and clean valve guide.
	c) Incorrect valve clearance.	Check and adjust.
	d) Bent valve(s).	Remove cylinder head and fit new valve(s).
6.	Weak mixture due to: Fuel filter being partially-blocked.	 Renew filter.

ENGINE MISSES AT HIGH SPEEDS ONLY

	POSSIBLE FAULT	REMEDY
1.	Faulty spark plugs, or incorrect electrodes gap.	Remove, clean and set plug-electrodes gap and, if necessary, fit new plugs.
2.	Faulty	valve operation due to:
	a) Incorrect valve clearance.	Check and adjust.
	b) Valve sticking in guide.	Examine and renew defective parts.
	c) Bent or badly-fitting valve*.	
	* Defective valve(s) indicated by: popping or spitting in the carburettor – inlet; ‘banging’ in the silencer – exhaust.	Examine and renew defective parts.

ENGINE LACKS POWER

	POSSIBLE FAULT	REMEDY
1.	Carburettor setting faulty.	Adjust carburettor.
2.	Excessive carbon deposit.	Decarbonise engine.
3.	Faulty valve operation due to:	
	a) Incorrect tappet clearance.	Check and adjust.
	b) Valve sticking in guide.	Examine and renew defective parts.
	c) Bent or badly fitted valve.	Examine and renew defective parts.
4.	Incorrect valve timing.	Check and rectify
5.	Spark plug-electrode gaps incorrect.	Remove, clean and, if necessary, fit new plugs.

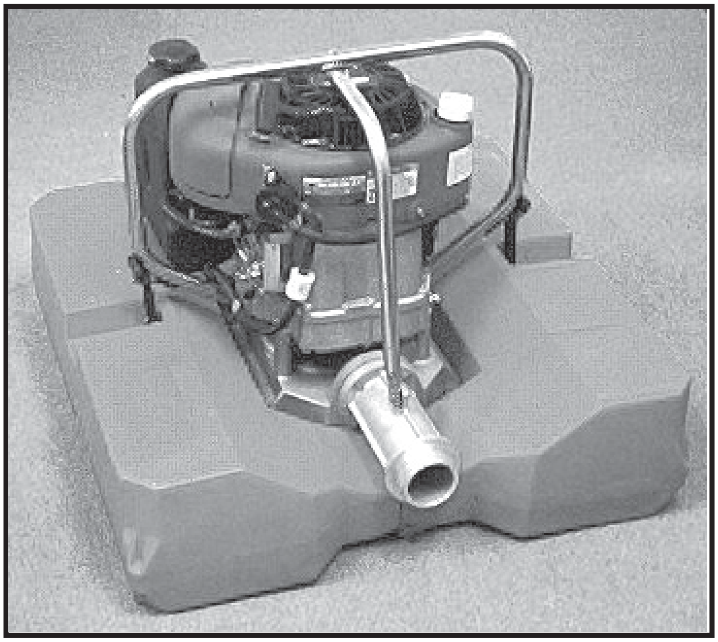
ENGINE LACKS POWER

	POSSIBLE FAULT	REMEDY
1.	Water supply low in engine cooling system.	Refill and check all coolant hoses and clips for safety.
2.	Air leaks in induction system.	Check the joints between: a) The cylinder head-and-intake manifold. b) The carburettor-and-intake manifold. If necessary, fit new joints/tighten nuts.
3.	Carburettor(s) setting faulty.	Adjust carburettor(s).
4.	Choke in rich position.	Return choke-control to correct position.
5.	Defective heat exchanger.	a) Clear blockage (back-flush). b) Fit new heat exchanger.
6.	Oil diluted or of incorrect grade.	Drain the oil system and refill with the correct grade of oil.
7.	Faulty thermostat.	Test thermostat – renew if necessary.

DIFFICULT STARTING

	POSSIBLE FAULT	REMEDY
1.	Weak spark due to: a) Faulty spark plugs. b) Wet or fouled spark plugs.	 Fit new spark plugs. Clean or renew.
2.	Low compression.	Check for: a) Correct valve clearance. b) Loose cylinder head. c) Blown cylinder-head gasket. d) Loose spark plug(s). e) Damaged or burnt valves. f) Worn piston rings. g) Worn cylinder bores.

Owner's Manual
THE CHIEF
11HP Gas Pump



CUSTOMER CHECK LIST:

Please do the following immediately upon receipt of your pump:

- Inspect pump for shipping damage.
  (Report any damage to freight company.)

- Check to see that any/all accessories that you ordered are included.

- Record the pump serial number. This can be found stamped on the top housing, and on the yellow sticker located on the side of the engine.

- Fill out and return warranty card.
  NOTE: **Warranty is validated upon the receipt of the completed Warrranty Registration Card.**

- Read all operating and maintenance instructions.

HALE
IDEX
IDEX CORPORATION

Hale Products Inc, A Unit of IDEX Corporation
700 Spring Mill Avenue
Conshohocken, PA 19428 USA
Phone (610) 825-6300 Fax (610) 825-6440

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Revised 2/24/04

INTRODUCTION

CONGRATULATIONS! You have just purchased the best pump on the market. At Otterbine®/Barebo, Inc. we are committed to quality products and service. If you have any problems or questions regarding your new pump, please contact your qualified Otterbine distributor or call us at 800-237-8837.

Your new pump is a rugged, well-tested tool, but it requires some routine care and maintenance. Please read this manual before operation.

WARRANTY

The Otterbine® pump is covered by a one-year limited warranty. The engine is warranted by Briggs & Stratton. Both warranties are enclosed, see inside and outside back cover. **The enclosed warranty card must be filled out and returned for your warranty to be valid.**

NOTICE: **Pump is shipped with no oil in the engine. Fill with oil before first use. (See Page 3, Step 1 for more details)**

CAUTION: **The 1/8" diameter weep hole in the endcap must be kept clear for proper priming and operation. During normal operation, there will be a stream of water coming out of this weep hole.**

Hale Model #545-4091-07-0 (National Hose Thread Discharge)
Hale Model #545-4091-08-0 (ISO Thread Discharge)

Pump Operation

1. **Important:** **Fill crankcase with oil *(There is no oil in the crankcase when you receive the pump).***
   Approx. 1.5 quarts/1.4 liters (verify oil level with the oil dipstick)
   - Summer: use SAE 30 Oil.
   - Winter (under 40^{o}F or 4^{o}C): use SAE 5W-20 Oil.

2. **Fill gas tank.** Briggs & Stratton recommends using a lead-free gasoline (minimum of 85 octane). Allow 1/4" or 6 mm of tank space for fuel expansion.

3. To Start Engine

A. Open fuel line valve. Turn fuel line valve to "ON" position. It is located above the throttle control.

B. Move throttle control to "**FAST**" position. The throttle control is located on the side of the engine. Move the throttle lever to the full right position.

C. Grasp rope handle and pull slowly until resistance is felt. Then pull cord rapidly to overcome compression, prevent kickback and start engine. Repeat if necessary.

D. After engine is warmed up, adjust throttle as needed FAST or SLOW.

NOTE: Minor adjustments to the carburetor and governor may be necessary to get pump running to specs. Please refer to Briggs & Stratton engine Owner's Manual which was enclosed with this document.

4. Place pump in water and start for fastest prime.

A. Pump may fail to prime properly if started in fast idle position on shore first.

5. To Stop Engine

A. Move throttle control to "**SLOW**" position (throttle lever to full left position)

Operating Notes:

- **Do not submerse the muffler in water.** May cause damage to the engine.
- **Use a 3" dia. discharge hose.** Chief pumps are low pressure/high volume. Anything less than 3" dia. will restrict flow and reduce GPM output.

ENGINE MAINTENANCE

CAUTION: Always remove spark plug first. (This prevents accidental starting during servicing.)

MAINTENANCE SCHEDULE	
TIME	**ACTION**
After first 5 hours	•Change Oil
After every 5 hours	•Check Oil Level •Remove dirt & debris from air cleaner with a cloth or brush. Cleaning with a forceful spray is not recommended as water can contaminate the fuel system
Every 25 hours/3 months	• Clean air cleaner filter
Every 50 hours/ Each season:	• Change oil
Every 100 hours/yearly	• Remove blower housing & clear debris from cooling system. • Spark plug - clean & reset gap at .03" • Replace IN-LINE fuel filter.

Change Oil: Drain oil from bottom of the engine. Change oil while engine is warm, after first 5 hours & every 50 hours/season thereafter. Change every 25 hours if operated under heavy load, or in high ambient temperatures.

Clean air cleaner filter:
(Every 25hours/3 months)
1. Lift handle on air cleaner cover and remove.

2. Clean or replace air cleaner filter as necessary.

3. Reinstall air cleaner filter. Reinstall air cleaner cover and secure into place with the handle.

SALT WATER MAINTENANCE

Otterbine floating pumps may be used in salt water applications providing the pump is immediately flushed with fresh water after use for **7-10 minutes at full throttle.** The exterior hardware must be rinsed and wiped dry.

STORAGE INSTRUCTIONS

If the Otterbine pump is to be stored for 30+days, do the following:

1. To prevent dirt or gum deposits in the fuel system, drain engine of fuel. Run the engine until it stops from lack of fuel.
2. Float assembly should be removed for easier maintenence. To remove the float assembly, disengage the hold-down straps (see parts breakdown pages 8 - 10) and lift engine/pump assembly up and away from the float.
3. While engine is still warm, drain oil from crankcase. Refill with oil.
4. Remove spark plug. Pour approximately .5 ounce/15ml of engine oil into cylinder and crank slowly to distribute oil. Replace spark plug.
5. Clean dirt and chaff from cylinder, blower housing, rotating screen, and muffler area.
6. Store the pump in a clean and dry area.

Important Warnings and Safeguards

WARNING: **Do Not Touch Hot Muffler:** Contact may cause burns.

CAUTION: **Do Not Submerse Engine and/or Muffler:** This may allow water to enter to engine and damage the pump.

CAUTION: **Do Not Fill Fuel Tank While The Engine is Hot:** Potential fire Hazard.

WARNING: **Engine Exhaust From This Product Contains Chemicals Known, In Certain Quantities, To Cause;** cancer, birth defects, or other reproductive harm.

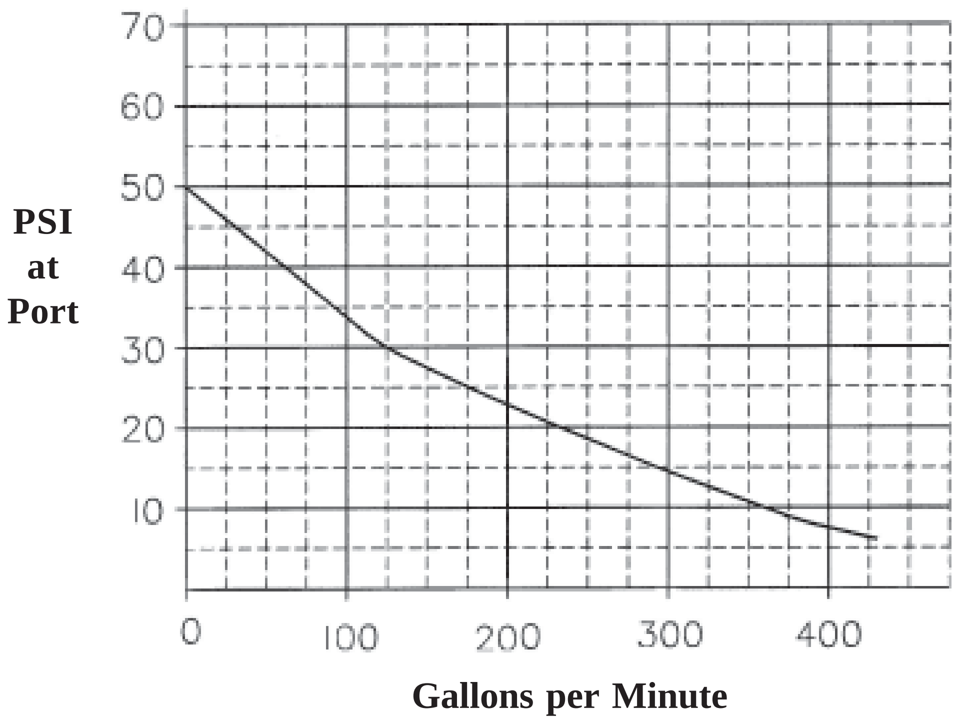
TROUBLESHOOTING

Symptom	Systematic order of Repair
Pump will not prime:	a. Check the weep hole in the endcap. It must be kept clear. b. Check that hose is not kinked c. Hose may have some flat, compressed areas. Squeeze these areas to open the hose and alleviate back pressure.
Unit will not pump properly:	a. Check the weep hole in the endcap. It must be kept clear. b. Check the intake for debris. c. Check oil; if there is water in the oil, change it. d. Using hose smaller than 2.5" (63mm) diameter will reduce output. Verify hose diameter. e. If starting pump on shore, make sure idle is set low when placed in water. f. If pump does not prime while starting on shore, place pump in water prior to starting engine. g. Check engine speed. Throttle should be fully open. Engine speed should be 3600 rpm at no load.
Pump will not start:	a. Check spark plug wire. b. Check gas level and fuel line valve is open.
Too much oil or grey colored oil:	a. Drain oil. Refill and run engine for about 5 min. Drain oil and refill. Continue procedure until oil is no longer discolored. b. Next time pump is operated, check oil for greyish color, if this persists, take pump to an authorized Briggs & Stratton repair center to have engine seal changed.
Pump no longer achieves manufactureres performance spec.s	a. Remove discharge flanges and or end plug. Remove bottom housing bolts and seperate bottom housing from top housing. (you will need to pry apart silicone seal) b. Inspect impeller, bottom and top housing for wear or damage. Replace as needed. **Note:** Be sure to inspect top housing if impeller has significant wear.

Chief 11HP Pump Specifications

UNIT SIZE	30" x 30" x 23" (76cm x 76cm x 58.5cm)
Shipping Weight	In box fully assembled: 131 lbs (59.4 Kilograms)
Net Weight	118 lbs (53.5 Kilograms) Pump: 86 lbs (39.0 Kilograms) Float: 32 lbs (14.5 Kilograms)
Engine Capacities	Gas tank 3 Quarts / 2.8 Liters Oil 1.5 Quarts / 1.4 Liters
Engine Specifications	Briggs & Stratton Intek Series 11HP, 3600 RPM @ no load 21 cubic inch / 344 cc Single cylinder Overhead Valve (OHV) Design Advanced Anti-Vibration System (AVS™)
Pump Body	.5" / 1.2cm cast aluminum alloy. Built-in suction guard and skids
Discharge	2.5" NST male / ISO 228/1-G21/2A Parallel Pipe 3" / 8mm hose diameter recommended for full output. 2.5"/6.5mm minimum.
Float	High density polyethylene shell filled with closed-cell polyurethane foam.
Pump Performance	Chief - 1 Discharge (See Page 7 for Pump Curve) Max head pressure 50 psi (3.4 Bars) Max. head 115 feet (35 meters) Max. output 425 GPM (1609 LPM) @ 7 psi
Lubricant and Fuel	Above 40°F / 4°C SAE 30 Below 40°F / 4°C SAE 5W-30, 10W-30 Lead-free, minimum of 85 Octane **Note: Use detergent oil classified for service, SC, SC, SE, SF, SG.**

Chief 11HP Pump Curve



Optional Accesories		
#	**Description**	**Part #**
1	Intake screen for stopping small debris: 1/8" dia. openings in screen	12-0025
2	25', (7.62 m), Hose assembly	F-203-H25
3	50', (15.24 m), Hose assembly	F-203-H50
4	100', (30.48 m), Hose assembly	F-203-H100
5	2.5" NST x 3" NPSH Adaptor	46-0021

Standard engine has a one (1) year limited warranty on entire engine.

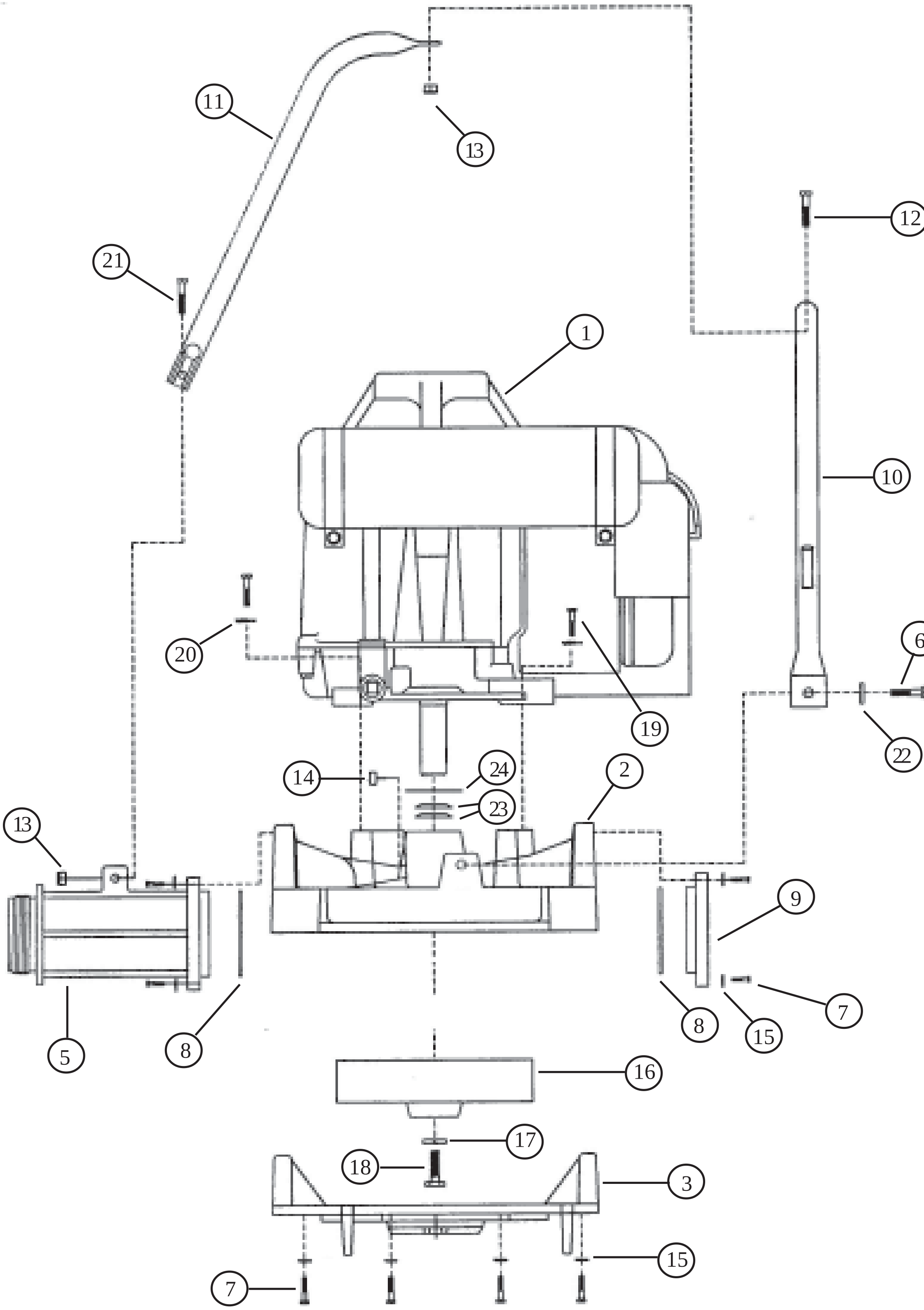
See back page for Briggs & Stratton warranties

OTTERBINE® CHIEF 11HP PORTABLE FLOATING PUMP
REPLACEMENT PARTS LIST

DIAGRAM NUMBER	PART DESCRIPTION	QTY	OTTERBINE PART NUMBER
1	Engine, Briggs & Stratton, 11HP	1	30-0026-011
2	Upper Housing	1	41-0007
3	Lower Housing	1	41-0008
5	Discharge Flange	1	41-0009
6	Hex Bolt, S/S, 5/16"-18 x 1"	2	MP2008
7	Hex Bolt, S/S, 1/4"-20 x 1"	16	EP5100
8	Discharge/Plug Gasket	2	EP2503
9	End Cap/Plug	1	41-0010-001
10	Handle, (with keepers)	1	60-0009
11	Handle Brace	1	60-0010
12	Hex Bolt, S/S, 1/4"-20 x 1.25"	1	101-001
13	Nylon Lock Nut, S/S, 1/4"-20	2	C2-112
14	Square Nut, S/S, 5/16"-18	2	26-0002
15	Internal Star Washer, S/S, 1/4"	16	927-001
16	Impeller, 10.5HP High Volume	1	41-0135
17	Lock Washer, S/S, 7/16"	1	EP6401
18	Hex Bolt, S/S, 7/16"-20 x 1.5"	1	22-0030
19	Hex Bolt, Plated, 5/16"-18 x 1.25"	4	EP5001
20	Internal Star Washer, S/S, 5/16"	4	927-005
21	Hex Bolt, S/S, 1/4"-20 x 7/8"	1	101-016
22	Fender Washer, S/S, 5/16"	2	28-0008
23	Lip Seal, Self-Adjusting	2	49-0025
24	Engine Gasket	1	49-0029
25	Silicone Grease (not shown) - applied between lip seals	---	48-0014

Chief 11HP Parts Breakdown

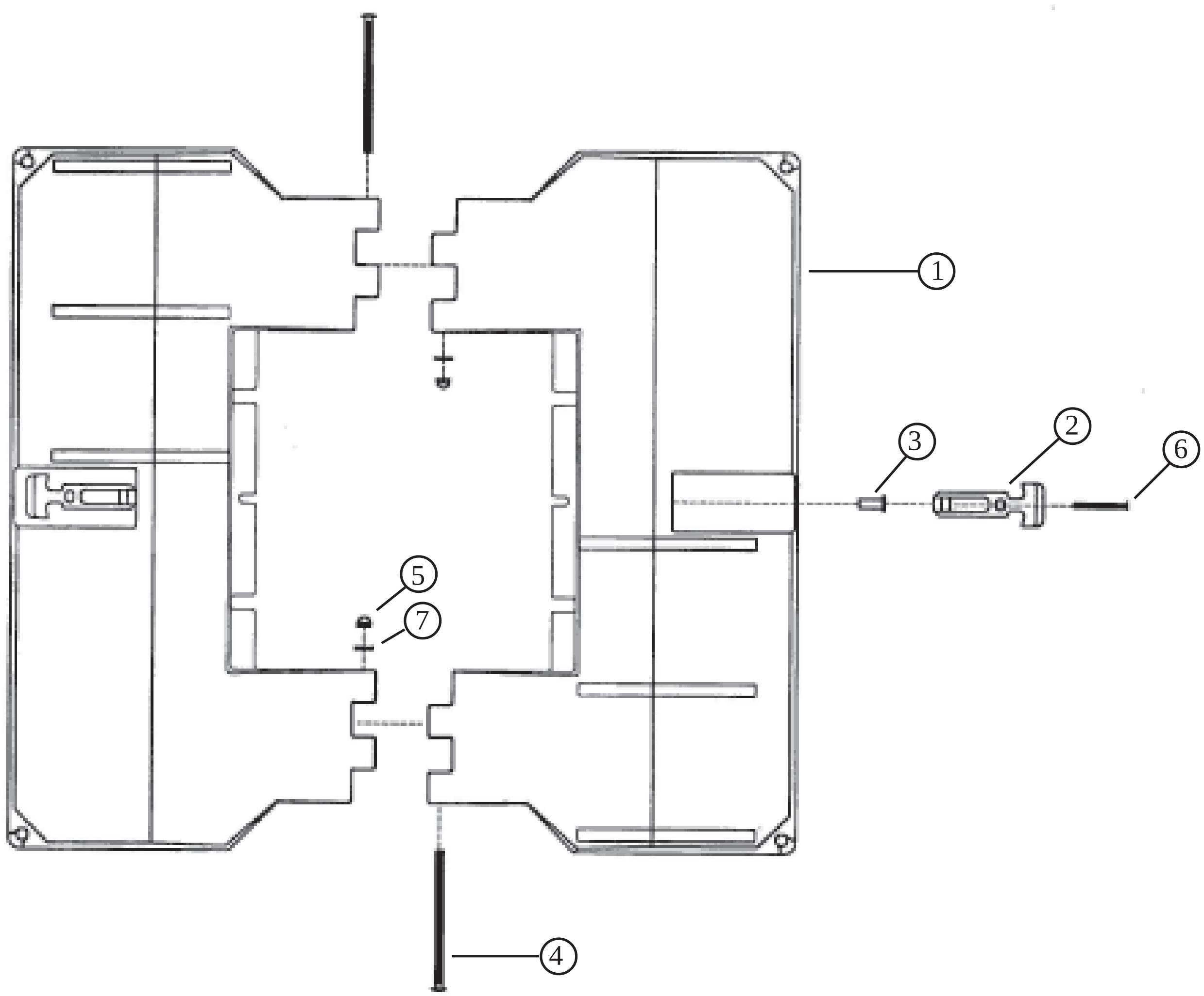
Pumping Assembly



Chief Parts Breakdown

Float Assembly (P/N 01-0002-002)

Item Number	Description	Qty	Part Number
1	Float, 2 sections	2	42-0035
2	Flex Draw Latch	2	46-0015
3	Well Nut, 10 - 32	4	21-0010
4	Carriage Bolt, S/S, 5/16" - 18 x 5 3/4"	2	22-0008
5	Cap Nut, Brass, 5/16" - 18	2	BP2811
6	Phillips Screw, S/S, 10 - 32 x 3/4"	4	24-0003
7	Flat Washer, S/S, 5/16"	2	28-0018



BRIGGS & STRATTON ENGINE OWNER WARRANTY POLICY
effective July 1, 2001

Replaces all undated Warranties and all Warranties dated before July 1, 2001

LIMITED WARRANTY

Briggs & Stratton Corporation will repair or replace, free of charge, any part, or parts of the engine that are defective in material or workmanship or both. Transportation charges on parts submitted for repair or replacement under this Warranty must be borne by purchaser. This warranty is effective for the time periods and subject to the conditions stated herein. For warranty service, find the nearest Authorized Service Dealer in our dealer locator map at www.briggsandstratton.com or as listed in the "Yellow Pages™" under "Engines, Gasoline," "Gasoline Engines," "Lawn Mowers" or similar category.

THERE IS NO OTHER EXPRESS WARRANTY. IMPLIED WARRANTIES, INCLUDING THOSE OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED TO ONE YEAR FROM PURCHASE, OR TO THE EXTENT PERMITTED BY LAW ANY AND ALL IMPLIED WARRANTIES ARE EXCLUDED. LIABILITY FOR CONSEQUENTIAL DAMAGES UNDER ANY AND ALL WARRANTIES ARE EXCLUDED TO THE EXTENT EXCLUSION IS PERMITTED BY LAW. Some countries or states do not allow limitations on how long an implied warranty lasts, and some countries or states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation and exclusion may not apply to you. This warranty gives you specific legal rights and you may also have other rights which vary from country to country and state to state.

WARRANTY PERIOD*

PRODUCTS	WITHIN U.S.A. AND CANADA		OUTSIDE U.S.A. AND CANADA	
	CONSUMER USE	COMMERCIAL USE	CONSUMER USE	COMMERCIAL USE
Vanguard™ engines.	2 years			
Diamond Plus®, Industrial Plus™, I/C®, ELS™ and Sleeve Bore Intek™ engines	2 years	1 year	2 years	1 year
Quantum®, Diamond Power®, Power Built™ OHV and Kool Bore Intek™ engines	2 years	90 days	2 years	90 days
Standard engines installed on lawn mowers, riders, edgers, chippers, shredders, string trimmers, tillers and Sno/Gard engines	2 years	90 days	1 year	90 days
Classic™ engines and all other standard engines and products	1 year	90 days	1 year	90 days
Etek™ electric motors	1 year			

Note the following special warranty periods: 5 years for consumer use, 90 days for commercial use of Touch-N-Mow™ starter on Quantum® and Intek™ engines; 2 years for emission control systems on engines certified by EPA and CARB; 1 year for consumer use of all engines and products in India, commercial use of Vanguard™ engines in India, and consumer use of Quantum Diamond Power® and Kool Bore Intek™ engines in Australia, New Zealand, the Middle East, and Africa.

The warranty period begins on the date of purchase by the first retail consumer or commercial end user, and continues for the period of time stated in the table above. "Consumer use" means personal residential household use by a retail consumer. "Commercial use" means all other uses, including use for commercial, income producing or rental purposes. Once an engine has experienced commercial use, it shall thereafter be considered as a commercial use engine for purposes of this warranty. ***Engines used in competitive racing or on commercial or rental tracks are not warranted.***

NO WARRANTY REGISTRATION IS NECESSARY TO OBTAIN WARRANTY ON BRIGGS & STRATTON PRODUCTS. SAVE YOUR PROOF OF PURCHASE RECEIPT. IF YOU DO NOT PROVIDE PROOF OF THE INITIAL PURCHASE DATE AT THE TIME WARRANTY SERVICE IS REQUESTED, THE MANUFACTURING DATE OF THE PRODUCT WILL BE USED TO DETERMINE THE WARRANTY PERIOD.

NOTE: This is a reprint of Briggs & Stratton Corporation printed warranty. The engine installed on this pump is warranted by Briggs & Stratton Corporation.

OTTERBINE® PORTABLE PUMP LIMITED ONE YEAR WARRANTY

Otterbine Portable Pump Serial #______________________________

Please note that this limited one year warranty applies to all components of the OTTERBINE PORTABLE PUMP except for the gasoline engine, which is warranted separately and exclusively by the manufacturer, Briggs & Stratton Company. See accompanying warranty information provided by Briggs & Stratton.

WARRANTY: BAREBO, INC. located at 3840 Main Road East, Emmaus, PA 18049 USA, hereby warrants, subject to the conditions hereinbelow set forth, that should this OTTERBINE PORTABLE PUMP prove defective by reason of improper workmanship or materials at any time during one (1) year of date of delivery to the Purchaser at retail only that BAREBO will repair or replace the said OTTERBINE PORTABLE PUMP as may be necessary to restore it to satisfactory operating condition, without any charge for materials or labor necessarily incident to such repair or replacement, provided that:

(a) The enclosed Warranty Registration Card must be mailed to BAREBO within fifteen (15) days of original receipt by the Purchaser at retail.

(b) The OTTERBINE PORTABLE PUMP must be delivered or shipped, prepaid, in its original container or a container offering an equal degree of protection, to BAREBO or a facility authorized by BAREBO to render the said repair or replacement services, or, if purchased from an authorized OTTERBINE dealer, to such dealer:

(c) The OTTERBINE PORTABLE PUMP must not have been altered, repaired, or serviced, by anyone other than BAREBO, a service facility authorized by BAREBO to render such service, or by an authorized OTTERBINE dealer, and the serial number of the OTTERBINE PORTABLE PUMP must not have been removed or altered; and

(d) The OTTERBINE PORTABLE PUMP must not have been subjected to lightning strikes, vandalism, freezing-in, accident, misuse or abuse, and also installed, operated, and maintained in accordance with guidelines in the Owner's Manual shipped with this OTTERBINE PORTABLE PUMP.

No implied warranties of any kind by BAREBO in connection with this OTTERBINE PORTABLE PUMP and no other warranties, whether expressed or implied, including implied warranties of merchantability and fitness for a particular purpose, shall apply to this OTTERBINE PORTABLE PUMP.

Should this OTTERBINE PORTABLE PUMP prove defective in workmanship or material, the retail Purchaser's sole remedy shall be repair or replacement as is hereinabove expressly provided and, under no circumstances, shall BAREBO be liable for any loss, damage or injury, direct or consequential, arising out of the use of, or inability to use, this OTTERBINE PORTABLE PUMP, including but not limited to retail Purchaser's cost, loss of profits, goodwill, damages due to loss of product or interruption of service, or personal injuries to Purchaser or any person.

HALE

06/14/96

FYR-FLOTE

MODEL # ______________________

SERIAL # ______________________

OPERATION and MAINTENANCE MANUAL

All Hale products are quality components: ruggedly designed, accurately machined, precision inspected, carefully assembled and thoroughly tested. In order to maintain the high quality of your unit, 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 unit. ALWAYS INCLUDE THE UNIT SERIAL NUMBER IN CORRESPONDENCE.

HALE PRODUCTS, INC. • A Unit of IDEX Corporation • 700 Spring Mill Avenue • Conshohocken, PA 19428 • TEL: 610-825-6300 • FAX: 610-825-6440

P/N 029-0020-34-0 REV. A

IDEX CORPORATION

HALE PRODUCTS INC.
ISO 9001
Certificate A4025

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LIMITED WARRANTY

Hale Products Inc., here in referred to as "Hale," warrants products of its manufacture to be free from defects in material and workmanship, under normal use and service, for a period of one year or 2000 hours of usage, whichever comes first. Products used for rental or contracting purposes are warranted for a period of six months or 2000 hours of usage, whichever comes first. This limited warranty is effective only if the equipment or apparatus is used as directed, is not subjected to misuse, negligence or accident, and is not altered, treated or repaired by someone other than Hale or its designee. Items not manufactured by Hale shall bear only the limited warranties offered by their respective manufacturers.

The exclusive remedy for breach of this warranty shall be to give Hale written notice thereof and to request a Returned Goods Authorization. Upon receipt of the Returned Goods Authorization, the buyer will return the non-conforming material to Hale F.O.B. its plant within thirty days after the buyer has received the Returned Goods Authorization. Thereupon Hale at its own election shall repair or replace the same or repay the price thereof. No proximate, incidental, consequential or other damages shall be recoverable.

Hale shall not be liable for consequential damages or contingent liabilities including; but not limited to, loss of life, personal injury, loss of crops, loss due to fire or water property damage, and consequential trade or other commercial loss arising out of the failure of Manufacturer's product.

HALE MAKES NO WARRANTIES OF FREEDOM FROM PATENT INFRINGEMENT, OF MERCHANTABILITY, OF FITNESS FOR A PARTICULAR PURPOSE OR ARISING FROM A COURSE OF DEALING OR USAGE OF TRADE OR OTHER LIKE OR DIFFERENT EXPRESS OR IMPLIED WARRANTIES EXCEPT AS MADE ABOVE.

Hale Products Inc.
A Unit of IDEX Corp.
Conshohocken, Pa. 19428
1996

NOTE: The Hale Fyr-Flote is equipped with a United States Motor Power Inc., Power Bee Engine. The engine is warranted by the manufacturer (See page 17). Information on the engine should be referred to the manufacturer or an authorized service center (See page 32).

WARNING LABEL IDENTIFICATION

The equipment described in this manual contains one or more of the following warning labels. The following chart identifies the label and provides an explanation of the hazard associated with the label.


HEARING PROTECTION REQUIRED WHEN OPERATING EQUIPMENT


EYE PROTECTION REQUIRED WHEN OPERATING EQUIPMENT


EQUIPMENT CONTAINS FLAMABLE FUEL

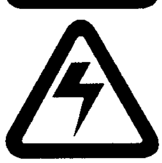

CORROSIVE HAZARD


ROTATING COMPONENTS


HOT SURFACES


DANGER OF CARBON MONOXIDE POISINING WHEN EQUIPMENT IS OPERATING


OPERATING EQUIPMENT PRESENTS A DRAW-IN HAZARD


ELECTRICAL SHOCK HAZARD

SAFETY PRECAUTIONS

Failure to follow the operating, maintenance and lubrication requirements set forth In this operating and Instruction manual may result in serious personnel injury and/or damage to equipment. These "WARNING" statements indicate potentially hazardous conditions for operator or equipment. TAKE NECESSARY STEPS TO PROTECT PERSONNEL AND EQUIPMENT.

1 Carefully read "Engine Operating Instructions," (page 23) before attempting to operate, service, or disassemble the engine or any of its parts.

2 Warning - Gasoline is a highly combustible fuel. The Improper use, handling, or storage of gasoline can be dangerous. Prevent accidents by following these safety rules:

A Use gasoline only as a fuel, never as a cleaning fluid.

B Use only an approved container to hold or store gasoline. Never store gasoline in familiar containers such as milk containers or soda pop bottles.

C Store gasoline in a cool location, out of the reach of children. Never store gasoline near heat or an open flame.

D Do not refuel with the engine running. Add fuel to a cool engine only. Spilled fuel on a hot engine or muffler may cause a fire or an explosion. Fill fuel tank out-of-doors and wipe up any spills.

E Make sure all fuel lines and connectors are secure.

F Provide a fire extinguisher nearby when working with gasoline. Be sure extinguisher Is In operating condition; chock the pressure gauge or indicator. Be familiar with its proper use. Consult local fire department for the correct type of extinguisher for your application. Extinguishers rated ABC by the NATIONAL FIRE PROTECTION ASSOCIATION are appropriate for most applications.

G POSITIVELY NO SMOKING!!

3 DO NOT RUN THE ENGINE IN AN ENCLOSED AREA!! Exhaust fumes contain carbon monoxide that is an odorless poisonous gas. If equipment is located in an enclosed area with an exhaust line to the outside, regularly check the exhaust system for leaks. Be sure the area is well ventilated.

4 Do not operate equipment when mentally or physically fatigued.

5 Stay away from moving parts, avoid wearing loose jackets, shirts and ties.

6 Keep the equipment and surrounding area clean. Cluttered areas invite accidents. Remove all oil deposits from equipment and surrounding area. Accumulations of grease and oil may present a hazard.

7 All visitors should be kept at a safe distance from work area. Keep children away from equipment and discharge hose. Do not allow children to hold discharge hose.

8 Be careful not to touch the exterior of a hot engine, especially the muffler and the surrounding area. The engine is hot enough to be painful or cause injury.

9 Keep power shields and guards in place. Do not make adjustments and repairs while engine is running, unless specified for in repairs. Use extreme caution around hot manifolds and moving parts.

10 Prevent accidental starting by always removing spark plug or b y disconnecting and grounding spark plug wire before working on engine or the equipment driven by engine.

11 Maximum speed of the engine is set. Do not tamper with the controls to adjust to run at higher speeds. Excessive speed increases the hazard of personal injury and reduces engine life

12 Familiarize yourself with all controls, learn how to stop engine quickly In a emergency.

13 When shutting off a gasoline engine, be sure It is completely stopped before leaving the work area.

14 Close fuel tank cap vent when storing or transporting.

15 Do not store vertical with fuel in tank.

16 Open fuel tank cap vent when pumping.

17 Check engine fuel level before Initial start-up each day.

18 Do not run pump more than two minutes without placing in water. After engine has been started and is operating smoothly, place pump in at least 4 inches (100 mm.) of water.

19 During freezing weather, drain the pump, throttle actuator tubing, and discharge lines after each use.

20 •Flush pump with fresh, clear water if pump has been used to pump salt water or water containing sand.

OPERATION AND INSTRUCTION MANUAL FOR ENGINE DRIVEN, FLOATABLE, SELF-PRIMING CENTRIFUGAL PUMPING UNIT

INTRODUCTION

PURPOSE

This operation and instruction manual is published to guide and assist in the installation, operation, lubrication, maintenance, and repair of the Hale FYR-FLOTE pumping unit. The installer and operator should understand this manual before attempting to install or operate the unit.

IDENTIFICATION

Whenever a question arises regarding your pumping unit, contact your Hale Dealer for the latest available information. This dealer will also be able to advise you of the nearest authorized engine dealer or refer to the supplied list of engine distributors who can provide service for the engine in your pumping unit. Finally, if additional help is needed, contact the Service Department of Hale Products Inc.

Please supply the complete pump model and serial numbers when requesting information or ordering parts. The pump model and serial numbers are stamped (not cast) on the Hale nameplate or on top of the pump head. For your convenience, fill in the information on the Hale nameplate below.

IDENTIFICATION PLATE

Also always mention both the model number and serial number of your engine when ordering engine parts. These numbers are found on the engine identification plate attached to the engine.

To help identify the pump parts used in your FYR-FLOTE, a pump parts catalog is included toward the back of this manual. To identify the engine parts used in your pumping unit refer to the engine manufacturer's parts catalog.

DESCRIPTION

GENERAL

The FYR-FLOTE is a portable, floatable, self-priming pumping unit. It consists of a Hale Type20FP or 20FV single stage, centrifugal pump close coupled to an air-cooled, 2-cycle, single cylinder, gasoline engine. The unit includes an automatic rewind starter, a 6-quart (5.7 L) fuel tank, an exhaust muffler, and other necessary controls all mounted on a floatable carrying base. The unit is intended for use in ponds, streams, lakes, swimming pools, or any source of water at least 4 inches (100 mm) deep. The FYR-FLOTE is offered in two versions: one a 20FP pressure model, the other a 20FV volume model.

The 20FP pressure model will deliver discharge pressures (measured at the pump outlet) to 220 PSIG (1515 kPa) and flow rates to 75 GPM (280 L/min.).

The 20FV volume model will deliver discharge pressures to 135 PSIG (930 kPa) and flow rates to 140 GPM (530 L/min.).

The FYR-FLOTE pumping unit consists of four major sub-assemblies: the float; the engine; the throttle control/overspeed control; and the pump.

FLOAT

The float assembly is a molded high-density polyethylene shell, this material is very abrasion resistant. The float may appear to scuff but little structural damage is done by abrasion. Further, the bottom area is molded thicker to allow for wear. The shell is filled with polyurethane closed cell foam, which provides structural rigidity and buoyancy. Molded into either side is a handle for carrying and positioning the unit. The float also serves as the mounting base for the fuel tank and the pump/engine assembly.

ENGINE

The lightweight engine is a single cylinder, two cycle, air-cooled version producing 8 hp (6 kW) from its 8.2 cu. inch (134 cc) displacement using a gasoline/oil fuel mixture. The engine is equipped with water resistant solid state ignition, a pressure carburetor with built-in fuel pump, and an on/off ignition toggle switch.

The engine's interior is protected from impurities by the use of a 75 micron in-line fuel filler, and an integral fuel strainer built into the fuel pump.

THROTTLE CONTROL

The engine speed is increased and decreased by use of a manual throttle control lever. The lever is located on the side of the engine near the carburetor. Move the lever down to increase the engine speed and up to decrease it.

OVERSPEED CONTROL

The overspeed control assembly is an added safeguard against overspeeding of the engine. The overspeed switch is mounted to the side of the engine, below the throttle lever, and near the fuel tank. Attached to the front of the overspeed switch is a flexible transparent hose that is connected to the nozzle plate (riveted to the engine fan housing). Connected to the back of the overspeed switch are two wires: one goes to the engine's ignition coil, the other goes to ground (engine). The switch senses the air pressure generated by the engine's cooling fan. When the engine reaches a speed in excess of that which would normally occur the fan air pressure generated will be sufficient to cause the switch to close thereby grounding the solid state ignition. The engine speed will then decrease until the air pressure reaches a lower trip point, reactivating the ignition system and the engine will accelerate. The engine will decelerate and accelerate alternately until the operating conditions are returned to their normal mode.

PUMP

The engine crankshaft extension serves as the pump shaft with an enclosed type bronze impeller mounted directly on the shaft. The shaft is protected against corrosion by a bronze sleeve, an "O"-ring, and a mechanical type, self-lubricating and adjusting seal. The impeller is hydraulically sealed by a replaceable, patented floating, bronze clearance ring located in the suction of the aluminum volute body. The volute body is attached to the cast aluminum pump head by four mounting screws. The pump head serves as the mounting bracket for the pump/engine assembly to the float. The pump/engine assembly is protected against vibration and shock by the use of rubber mounting bushings. Water enters the pump through small diameter holes in the suction screen and exits through the hard-anodized aluminum alloy discharge tube. The discharge tube has a threaded male connection to accept an 1-½ NST (NH) National Standard fire hose coupling and is located at the rear of the unit.

ATTENTION: Do not attach regular pipe threaded (NPSH/NPT) fittings, they will permanently damage the male fire threads.

PREPARATION

INSPECTION OF NEW UNIT

When unpacking unit do not discard cushioning materials, carton, or case until you are certain everything is correct. Inspect carefully, perfect condition of the outside shipping container does not guarantee undamaged contents. Check for loose, missing, or damaged parts. Also, check the packing slip for any additional parts. After inspection proves satisfactory, discard all shipping material in a proper manner.

> **ATTENTION:** The FYR-FLOTE has been shipped with the engine, carburetor, air filler, and fuel systems drained and tagged. Before using, fill with proper quantities and grades of fuel oil, refer to "Fuel and Lubricant Specifications" page 10.

The idle speed, idle and main fuel mixture adjustment screws have been factory set. However, the idle and main fuel mixture adjustment screws may require readjustment, especially for cold weather or high altitudes (see "Engine Operating Instructions," page 30, for adjustment procedure).

IDENTIFICATION OF CONTROLS

Air Intake: Compressed aluminum element type. Dirty air enters through the sides of air cleaner. Cleaner air then enters the carburetor through the.

Carburetor Fuel Strainer: Provides secondary fuel filtering for engine.

Carrying Handle(s): Two are molded into either side of float.

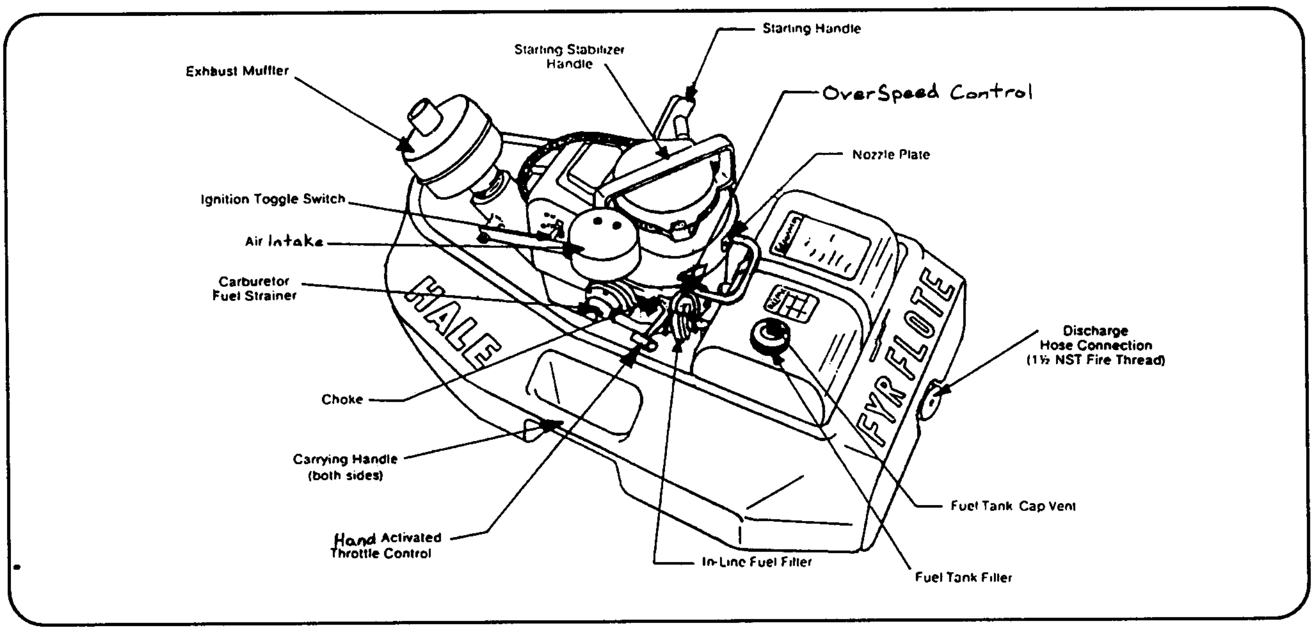
Choke: Reduces the amount of air entering the engine during cold weather start-up.

Discharge Hose Connection: Located at the rear of float for connecting a 1-½ NST hose fitting.

Exhaust muffler: Reduces the amount of combustion noise emitted by The engine.

Flexible Transparent Hose: Connected between the nozzle plate and the overspeed switch control. Allows for visual inspection of dirt and water which may clog hose and reduce amount of pressure reaching switch. Check regularly, be sure hose is not cracked, crimped, or kinked.

Fuel Tank Cap Vent: Prevents fuel from spilling from cap during storage and transportation and allows tank to vent



during operation. Turn vent knob clockwise to close; counter-clockwise to open.

Fuel Tank Filler: Turn clockwise to close; counter-clockwise to open. Refer to "Lubrication and Maintenance-Fuel Specifications," page 6 for correct amount and type of gasoline and oil.

Ignition Toggle Switch: When flipped to the "ON" position, opens circuit to ground allowing the magneto to develop a spark for the ignition of combustion. Flipped to the "OFF" position closes the circuit to ground magneto.

In-Line Fuel Filter: Provides primary fuel filtering for engine.

Nozzle Plate: Riveted to the engine fan housing, directs air pressure to flexible, transparent hose and overspeed control.

Overspeed Control: For description refer to "Description - Overspeed Control," page 5.

Throttle Control: For description refer to "Description - Throttle Control," page 5.

Starting Handle: Pull to start.

Starting Stabilizer Handle: Used as a convenient surface to place other hand when pulling starting handle.

TRANSPORTING

The FYR-FLOTE has two molded handles, one on each side, allowing it to be moved or positioned by one or two people. Care should be taken not to drop or strike the pump, engine, or float; damage may occur rendering the unit inoperable.

Care should also be taken when the FYR-FLOTE is being transported by motor vehicle; it should be securely fastened down. If the fuel tank is filled the pumping unit must be stored in a horizontal position (be sure to leave room for expansion of the fuel in the tank). ONLY WHEN the fuel tank is EMPTY could the pumping unit be stored in a vertical position. When storing, keep the pumping unit away from sources of heat or flame. The storage area should have adequate ventilation to prevent the accumulation of fuel vapors. Take care not to store the unit against sharp edges as these may cause damage.

> **WARNING:** CLOSE the fuel tank cap vent for storage and transportation. Allow the pumping unit to cool before transporting or storing; hot engine parts present a hazard.

INSTALLATION

A suitable location should be chosen to allow the pumping unit to be placed in and out of the water with ease. The water should be as free as possible from leaves, sand or debris; it should be at least 4 inches (100 mm) deep and as calm as possible. A tether rope should be attached to the FYR-FLOTE to prevent the current or wind from swinging it back toward shallow or trash filled water. Use care when attaching the tether rope, a hot engine or exhaust may burn or melt it.

Discharge hose should be of a size, type, and layout to avoid excessive friction loss. The volume and pressure of liquid to be pumped, the length of line, the number of elbows and fittings should be considered when selecting the proper size hose. By using a friction table, all fittings can be converted to the equivalent of straight pipe and the overall friction loss readily established. The discharge tube has a threaded male connection to accept a 1-½ NST (NH) National Standard fire hose coupling and is located at the rear of the unit.

> **CAUTION:** Do not attach regular pipe threaded (NPSH/NPT) fittings, they will permanently damage the male fire threads.

OPERATION

STARTING PROCEDURE

WARNING: DO NOT RUN THE ENGINE IN AN ENCLOSED AREA! Exhaust fumes contain carbon monoxide which is an odorless and poisonous gas. Be sure the area is well ventilated.

1. Make sure there is a FRESH mixture of gasoline and oil in the tank. Refer to "Fuel Specifications," page 10, for proper amounts and type.

   WARNING: Do not refuel the FYR-FLOTE with the engine running. Add fuel to a cool engine only. Spilled fuel on a hot engine or muffler may cause a fire or explosion. Fill fuel tank out-of-doors and wipe up any spills.

2. Choose a suitable location in which to float the pump. Remove any nearby debris from the water.
3. Connect the discharge hose to the pump and lay hose out so that it is free of kinks, twists, and knots.
4. Close discharge nozzle.
5. Open fuel tank cap vent.
6. Close choke.

   NOTE: A warm engine requires less choking than a cold engine.

7. Move ignition switch to "ON" position.
8. Move throttle control up to idle position.
9. Grasp the handle on top of engine with one hand. With the other hand pull starting handle slowly to bleed off some compression; then, pull with quick short strokes.
10. When engine starts, slowly open choke.
11. When the engine is running smoothly (about 20 to 30 seconds depending on air temperature) slowly and carefully place the unit level in water.

    WARNING: Avoid possible damage, do not run the FYR-FLOTE more than 2 minutes without placing in water. The pump's mechanical seal and clearance ring requires water for cooling and lubrication.

12. The pump should prime itself automatically within 5 seconds. The engine may stall during priming it the engine is still too cold or the idle mixture incorrect (see "Engine Operating Instructions," page 30, for idle mixture setting).
13. After priming, move the throttle down to increase the engine speed and bring pump to desired pressure.
14. The pump is now ready for use. Discharge conditions at the nozzle will be determined by length and type of hose, elbows, and fittings. If necessary, increase throttle setting and/or reduce nozzle size to compensate for pressure losses.

STOPPING PROCEDURE

1. Close discharge nozzle.
2. Using the discharge hose or tether rope, pull FYR-FLOTE near shore.
3. Move throttle to idle position.
4. Move ignition switch to "OFF" position.
5. Close fuel tank cap vent.
6. Remove pumping unit from water.

   NOTE: Engine should be shut down immediately after idle down.

   CAUTION: Be careful not to touch the exterior of the engine, especially the muffler and the surrounding area. The engine is hot enough to cause injury.

7. Disconnect the discharge hose and drain pump. Remove any debris from suction screen. Refer to "Maintenance - Seasonal or As Required; "item 3," Pump - to clean."

OPERATING TECHNIQUES

Priming: The pump will prime itself automatically, usually within 5 seconds. During priming a mixture of air and water will be seen discharging from the air vent in the pump head. After the pump has primed, a check valve will close and the discharge from the air vent will stop. The engine may stall during priming it the engine is still too cold or the idle mixture incorrect (see "Engine Operating Instructions," page 30, for idle mixture setting).

Idle Settings: The idle speed, idle and main fuel mixture adjustment screws have been factory set. However, the idle and main fuel mixture adjustment screws may require readjustment especially for cold weather or high altitudes. (See "Engine Operating Instructions," page 30, for adjustment procedure.)

Overspeed control: It there is no load on the engine (loss of prime, clogged suction screen) and the throttle is help open, the engine will accelerate and decelerate alternately until the operating conditions are returned to their normal mode. Or the discharge pressure drops low enough to deactivate the pressure throttle control returning the engine to idle speed.

Should the pump be operating normally and the engine begins to turn off and on, the overspeed switch may be tripping at too low an engine speed, if this consistently occurs, the overspeed switch will have to be replaced. The unit may still be operated, but at lower discharge pressures and/or throttle speed until a replacement is obtained.

PREPARATION FOR STORAGE

WARNING: Prevent accidental starting by always removing spark plug or by disconnecting and grounding spark plug wire before working on engine or pump.

NOTE: Replace the spark plug or wire only after all preparation is completed on both pump and engine.

1. **Fuel System:** If the FYR-FLOTE is to be secured for short periods of time, keep the fuel tank full and change fuel at regular intervals. If the unit is to be stored for any length of time. drain the fuel system.

2. **Engine:** See "Engine Operating Instructions," page 30, for storage instructions.

3. **Pump:**

   a. Follow the procedure under "Maintenance - Seasons: or As Required" item 3, "Pump - to clean."

   b. Drain water from pump thoroughly. After the flow has ceased, pump should be turned over a few revolutions so all water will drain from impeller.

   c. While turning the pump over using the engine's starting handle, spray into the pump discharge tube using either a white lithium or silicone type lubricant. Also extend the nozzle of the spray lubricant down through the suction screen and spray into and around the suction bore of the pump volute.

   This treatment coats the inside of the pump and tends to prevent the clearance ring and impeller hub from sticking due to corrosion.

   d. Spray the threads of the discharge tube with either a while lithium or silicone type lubricant.

LUBRICATION AND MAINTENANCE

FUEL AND LUBRICANT SPECIFICATIONS:

Gasoline: Use clean, fresh, "regular grade unleaded" or "low lead" type. Oil must be mixed with the gasoline, refer to fuel mixture below. High test Ethyl gasoline is not recommended.

Oil: Use a good quality Outboard motor oil or equivalent. The oil should meet the NMMA classification type TC-W. Gasoline must be mixed with the oil, refer to the fuel mixture below.

FUEL MIXTURE:

The engine used in the FYR-FLOTE requires that oil be mixed with the gasoline. For ease of starting, it is desirable to have a fresh mixture of fuel; therefore, mix only an amount of fuel you anticipate using in the near future. As a guide, the engine consumes approximately one gallon (3.8 L) per hour at full throttle (depending on load), less at partial throttle.

To mix fuel, add oil to a small amount of gasoline in a clean container, then add the rest of the gasoline and shake well.

> **NOTE:** Do not mix oil and gasoline in the FYR-FLOTE fuel tank, it will be difficult to get good mixing.

Also if the fuel container has been still for an extended period, shake container before filling fuel tank.

The correct ratio of oil to gasoline is one (1) part oil to 24 parts gasoline (1:24). Table 1 shows various quantities of fuel mixture and the amount of oil and gasoline required.

Approximate Quantity of Fuel Desired	**Oil**	**Gasoline**
One FYR-FLOTE Tank Full (5% Clearance)	7 oz. (207 ml.)	5qt. (4.7 L.)
One Gallon (plus) (3.9 Liters)	5 oz. (158 ml.)	1 Gallon (3.8 L.)
Three Gallons (plus) (11.8 Liters)	16 oz. (473 ml.)	3 Gallons (11.4 L.)
Five Gallons (plus) (19.7 Liters)	27 oz. (789 ml.)	5 Gallons (18.9 L.)

TABLE 1

MAINTENANCE SCHEDULE

SAFETY PRECAUTIONS:

1. DO NOT RUN THE ENGINE IN AN ENCLOSED AREA!! Be sure the area is well ventilated.

2. Stay away from moving parts. Avoid wearing loose jackets, shirts, and lies.

3. Keep the equipment and surrounding area clean. Cluttered areas invite accidents.

4. Keep power shields and guards in place. Do not make adjustments and repairs while the engine is running, unless specified for in repairs.

5. Do not run the pump more than two minutes without placing in water.

6. Be careful not to touch the exterior of a hot engine, especially the muffler and the surrounding area.

7. Prevent accidental starting by always removing spark plug or by disconnecting and grounding spark plug wire before working on engine or pump.

8. When working on any part of the fuel system be sure the unit is cool. Remove

any sources of heat or flame.

ABSOLUTELY NO SMOKING!

DAILY OR EVERY 8 HOURS:

1. **Leaks - (gaskets, fuel, seals, washers, and water):** Check for any leaks before operating unit. These leaks must be repaired before operating.

2. **Suction Screen:** Before operating unit, check screen and remove any dirt, leaves, grass, etc. Screen may require more or less service depending on operating conditions.

MONTHLY OR EVERY 25 HOURS:

1. **Throttle actuating rod:** Put one or two drops of SAE 30 motor oil on rod and let it run down shaft into actuator housing.

2. **Air cleaner:** Clean as follows:
   Note: Service air cleaner more often under dusty conditions.

   a. Remove 2 screws, washers and cover.

   b. Remove element by lifting it from the bottom plate.

   c. Wash element in kerosene or liquid detergent and water.

   d. Dry by shaking or using compressed air.

   e. Install element on carburetor. Reassemble cover, washers, and screws.

3. **Spark Plug:** Clean and regap at .030 inch (.8 mm). Spark plug type is champion #RL 86C, NGK #BR5HS, AC #R46FF, Motorcraft #AER6, and Fram-Autolite #426.

   CAUTION: Do not blast clean spark plug. Blasting material could lodge in recesses of plug and eventually work loose, permanently damaging aluminum bore. Spark plug should be cleaned by scraping or wire brushing and washing with a commercial solvent.

4. **Fuel Filters:**

   WARNING: When working on any part of the fuel system be sure the unit is cool. Remove any sources of heat or flame.

   GENERAL:

   a. Place the unit in a horizontal position.

   b. Open fuel tank cap vent.

   c. Place a rag under the carburetor and fuel line to catch any fuel spillage.

   d. Refer to filter maintenance below.

   e. Re-tighten the fuel tank cap vent.

   f. Wipe up any additional fuel spillage and discard rag in an approved safety container.

   In-Line Fuel Filter:

   a. Remove the two clamps from both sides of filter and pull hoses using a slight twisting motion.

   b. Observe hoses for any signs of cracking or deterioration and replace if necessary.

   c. Install a new filter with the word "IN" toward fuel tank. Replace clamps.

   Carburetor Fuel Strainer:

   a. Remove the screw holding the plastic cover in place (where the fuel line connects to carburetor). Gently remove the cover, gasket. and strainer screen.

   b. Clean screen in a non-flammable solvent, blow dry.

   c. Replace strainer screen, gasket, cover and screw.

5. **Hoses, Fittings and Tubes:** Clean and check all hoses, fittings and tubes for signs of cracks, kinks, deterioration, etc.

They should have uniform bends; if any are kinked or collapsed they should be replaced. Fittings and clamps should be tight. but not overtight.

SEASONAL OR AS REQUIRED:

1. **Float:** The float requires very little maintenance. To clean the float use a mild, non-abrasive detergent and warm water.

2. **Engine Cooling System:** Clean the starter screen, flywheel (fan), and engine cooling fins. Foreign matter may clog cooling system after prolonged service. Continued operation with a clogged cooling system causes severe overheating and possible engine damage.

   a. Remove the four screws that fasten the fan housing to the support plate and remove the two screws that fasten the fan housing to the sheet metal cylinder cover.

   b. Remove the flexible transparent hose from nozzle plate and the spark plug wire from spark plug.

   c. Carefully lift the fan housing from engine, push the spark plug and overspeed switch wires' rubber grommet from housing. Reach inside of housing and disconnect the magneto wire from ignition switch. The fan housing can now be completely removed and cleaned.

   d. Remove the four screws that fasten the sheet metal cylinder cover to engine; be careful, the lower two holes have small spacers between the cover and engine.

   e. To reassemble engine; reverse above procedures.

3. **Pump:** Except for draining the casing during freezing weather, the pump requires only an occasional cleaning.

To clean:
a. If debris has collected on the inside of the suction screen, remove the two screws that retain the discharge tube foam sealer. Carefully remove the foam sealer.

b. If more room is needed to clean the screen. it will have to be removed. Refer to item 4, "Removal of Pump/Engine Assembly."

4. **Removal of Pump/Engine Assembly:**

WARNING: When working on any part of the fuel system, be sure the unit is cool. Remove any sources of heat or flame.

ABSOLUTELY NO SMOKING!

a. Place the unit in a horizontal position and open fuel tank cap vent.

b. Place a rag under fuel line to catch any fuel spillage. Disconnect the fuel line from carburetor.

c. Remove the screw and nut from the fuel tank strap and remove the fuel tank. Be careful not to spill fuel and wipe up any spillage. Place the tank in a well ventilated area away from sources of heat.

d. Turn the unit on its side and remove the two screws and washers that retain the discharge tube foam sealer in place.

e. Place unit on two pieces of wood (2 x 4's). Remove the four screws and lock nuts that fasten the suction screen and the pump/engine assembly to float.

f. Lift the pump/engine assembly from float.

Assembly of pump/engine to float:
a. Insert the eight rubber mounting bushings (048-0800-00) in the recess bores of float (047-0190-00). Inspect the rubber mounting bushing; replace them

if they are cracked or deteriorated.

ATTENTION: Failure to use all eight mounting bushings may result in a permanently damaged float.

b. Insert the four $^5/_{16}$-18 x 5-½ lg. screws through suction screen (010-0330-00) and slide one spacer (159-0620-00) on each screw. Next place one $^5/_{16}$ flat brass washer (097-0810-00) on each screw. Mount this assembly on float.

c. Mount the pump/engine assembly, piloting on the four screws, to float. install the four $^5/_{16}$-18 lock nuts (110-1406-02) and tighten only until two threads extend beyond nuts.

d. If previously removed, install the fuel tank mounting bracket (019-0880-00) using two ¼-20 x ¼ lg. screws. Install fuel tank mounting strap. Carefully install fuel tank and secure mounting strap using one ¼-20 x 1-$^3/_8$ lg. screw and lock nut.

e. Reconnect fuel line to carburetor and close fuel tank cap vent.

f. Install discharge tube foam sealer and secure with two #12 x 1" lg. round head self tapping screws and lockwashers.

5. **Repair or Replacement of any Component in Pump:** (replacing pump mechanical seal)
a. Remove pump/engine assembly from float. Refer to Item 4, "Removal of Pump/Engine Assembly."

b. Remove the four screws that fasten the volute body to the pump head. Remove the volute body.

c. Remove the impeller retaining screw and washer.

ATTENTION: The impeller screw is left hand thread.

NOTE: To prevent the engine from rotating, when removing the impeller screw, place a long $^3/_8$ screw or $^3/_8$ diameter bar through one of the pump head mounting holes and a flat bar in one of the impeller cavities.

d. Remove impeller by putting hardwood wedges on each side of impeller, between impeller and pump head. The wedges should bear against impeller disc directly behind impeller vanes to prevent damaging the impeller; refer to figure 4. Tap end of engine shaft with a Soft (rawhide, rubber) headed mallet, while maintaining pressure with wedges until impeller comes off.

e. With impeller removed, remove the impeller key.

f. Remove the spring and carbon section (sealing washer) of mechanical seal from engine crankshaft sleeve. Observe the ceramic seal seat and carbon sealing washer. If they are scored or lip on the sealing washer is worn or cracked, replace complete assembly.

g. If further disassembly is required beyond mechanical seal replacement, remove the four $^5/_{16}$-18 x 2-½ Lg. screws and $^5/_{16}$ flat brass washers that fasten pump head to engine.

h. if mechanical seal ceramic seal was not removed previously, remove from head. If air vent check ball needs replacing lap the retaining pin out and remove ball.

i. Pull engine crankshaft projection sleeve from shaft.

j. There is a replaceable clearance or wear ring used in this pump. inspect impeller hub and clearance ring bore, replace if any of these surfaces are scored or worn excessively.

Reassembly Note:
Before reassembly, visually inspect parts. See that parts are clean and all sealing surfaces are free of corrosion and nicks. Remove any metal chips from casting cavities and tapped holes. Also inspect for any damaged or excessively worn parts which should be replaced.

Refer to " Parts Catalog" Plate No. 675 B for component parts location and orientation.

Assembly of pump to engine:

a. Coat the engine crankshaft with a thin layer of gasket sealer, such as, Loctite Gasket Eliminator 504

b. Lubricate the groove in the pump shaft sleeve (048-0770-00) using a multi-purpose grease and install "O"-ring (040-0180-00) in groove. Slide this assembly on engine crankshaft.

c. Insert air vent check ball (039-0200-00) into bore in pump head (002-0510-00) and install retaining pin (064-0310-12).

d. Position pump head on engine and align holes. If original screws are in good condition, reuse, but apply a thread locking adhesive, such as Locktite Threadlocker 242 or equal to threads. If original screws were damaged, or corroded, replace with four new $^5/_{16}$-18 x 2-½ lg. plated nylok screws P/N: 018-1424-07. When installing screws use a new $^5/_{16}$ flat brass washer (097-0810-00) under the head of each screw.

Note: Hale has available small tubes of Loctite Threadlocker 242 adhesive (0.5 cc). Hale P/N: 029-0010-01.

e. Coat rubber cup of mechanical seal ceramic seat with oil and press into pump head with ceramic surface toward you.

f. Coat rubber on inside of mechanical seat carbon sealing washer With oil and using a turning motion, push onto shaft sleeve until carbon lip comes into contact with ceramic surface.

CAUTION: Keep the ceramic seal seat and carbon sealing washer surfaces clean. Be careful not to crack or chip ceramic surface or carbon wearing lip.

g. Line up keyway of impeller with keyway of shaft. Push impeller on shaft. Insert impeller key (017-0060-01) until flush with face of impeller

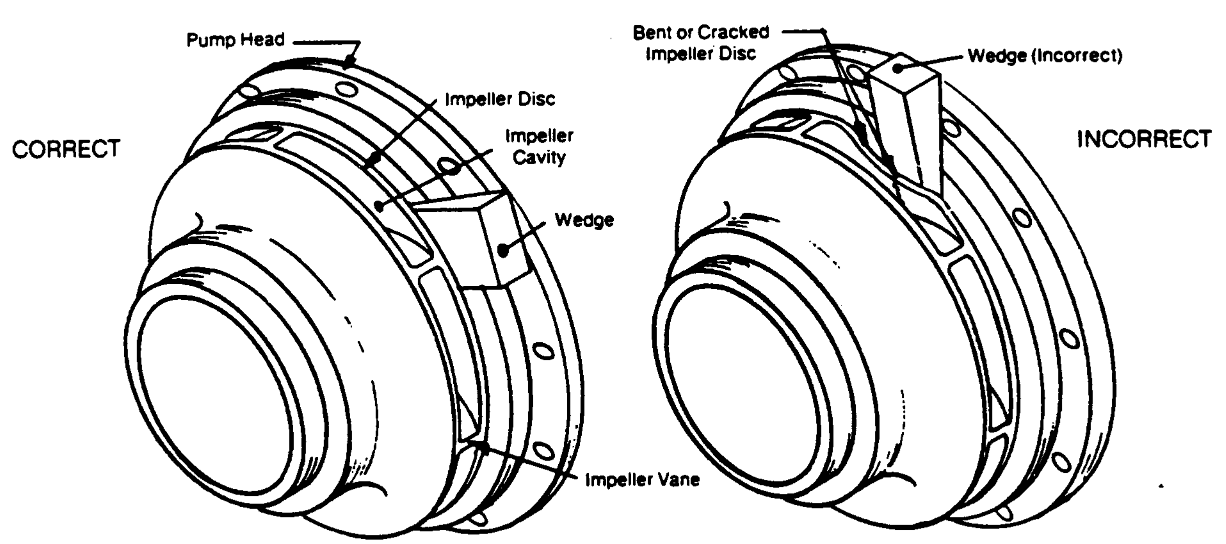


Figure 4.

h. Coat end of shaft and impeller with a thin layer of gasket sealer.

i. Coat threads of a new impeller screw (018-9350-00) with a thread locking adhesive (Loctite 242 or equal).

J. Mount impeller washer (097-0381-00) and impeller screw. Torque impeller screw to 10 ft. lbs.

ATTENTION: The impeller screw is left hand thread. If impeller clearance ring requires replacement proceed with the following steps. However, if impeller clearance ring is in good condition proceed to step n.

k. With the clearance ring removed from volute body, inspect clearance ring pins (064-0310-12). If these are damaged replace.

l. Apply a thin coat of oil to groove of impeller clearance ring (321-0121-00) and install O-ring (040-2320-00) into groove. Coat the outside of clearance ring and O-ring with oil.

m. Aligning the holes in impeller clearance ring with pins in volute body, press clearance ring into volute body.

n. Coat the inside of clearance ring bore and outside of impeller hub with oil.

o. install o-ring (040-1590-00) on pump head pilot and coat 0-ring and pump head pilot diameter with either oil or a multi-purpose grease.

p. Mount volute body with clearance ring to pump head aligning holes and bolt volute body to pump head using four 3/8-16 x 7/8 lg. stainless screws (018-1607-12) and four 3/8 plated lock washers.

q. If the discharge tube (007-0300-00) was removed or a new one is being installed, apply a general purpose retaining compound (Loctite RC/35 or RC/601 or equal) to PIPE THREADS ONLY and tighten in volute body.

Note: Hale has available small tubes of Loctite retaining compound RC/601 (0.5 cc), Hale P/N: 029-0010-00.

r. Install the pump/engine assembly to float. Refer to Item 4, "Assembly pump/ engine to float."

OPERATING INSTRUCTIONS AND PARTS CATALOG

MODEL 82034 "L" Series ENGINE
8.20 CU. IN. DISPLACEMENT (134 c.c.)
BORE AND STROKE 2.531 x 1.62

Always mention both the Model Number and Serial Number of your engine when ordering parts.

These numbers are found on the identification plate attached to the engine.

MOTOR US POWER
UNITED STATES
MOTOR POWER, INC.
2675 EAST MAIN
EAST TROY, WI
53120-0873 U S A
414-642-7969
A Wisconsin Oven Corporation Company

United States Motor Power, Inc.
STATEMENT OF LIMITED WARRANTY

United States Motor Power, Inc., at East Troy, Wisconsin 53120, herein called USMP, issues the following warranty to the first purchaser, for use and not resale (herein called consumer).

COVERAGE

Subject to the conditions, limitations and exclusions set forth below, this warranty covers defects in material and workmanship under normal use and service for ninety(90) days from the date of purchase by the consumer.

REMEDIES

USMP will repair or replace, without charge for parts or labor, any part it supplies which it deems defective pursuant to the coverage described above, at any authorized Power Bee Central Service Distributor, Service Distributor, or Service Dealer. To obtain this repair or replacement, the consumer must return the Power Bee Engine to one of the above service outlets.

EXCLUSION

This warranty does not cover parts or accessories not sold by US Marine or damage incurred through the use of such parts and accessories. This warranty shall not apply to any Power Bee Engine used in equipment in a manner that USMP regards as an unusual or not approved installation.

In addition, this warranty shall not apply to any Power Bee Engine that was:

1) Operated without oil or with improper fuel mixture, or with any oil other than a BIA certified TCW oil.
2) Modified or altered, including but not limited to, modifications resulting in increased revolutions.
3) Damaged by overheating due to excessive dirt in cooling fins, or improperly serviced air cleaner, or by dirt entering the engine.
4) Merely requiring normal tune-up or adjustment of carburetor, breaker points, or spark plugs.
5) Improperly repaired in a manner which affected the quality or reliability of the Power Bee 2 cycle industrial engine.
6) Subjected to more than normal usage. This relates to circumstances where an examination of the engine indicates that the malfunction is the result of normal wear of a part or parts operating under adverse conditions where a shorter service life could be expected. Warranty coverage is not applicable to engines where normal use has exhausted the service life of a part.
7) The result of failure of the owner to observe operating instruction.

This is the only warranty, expressed or implied, made by USMP applicable to its Power Bee Engines; and USMP does not authorize any person, firm, corporation or representative to make any warranty or to assume for USMP any other liability.

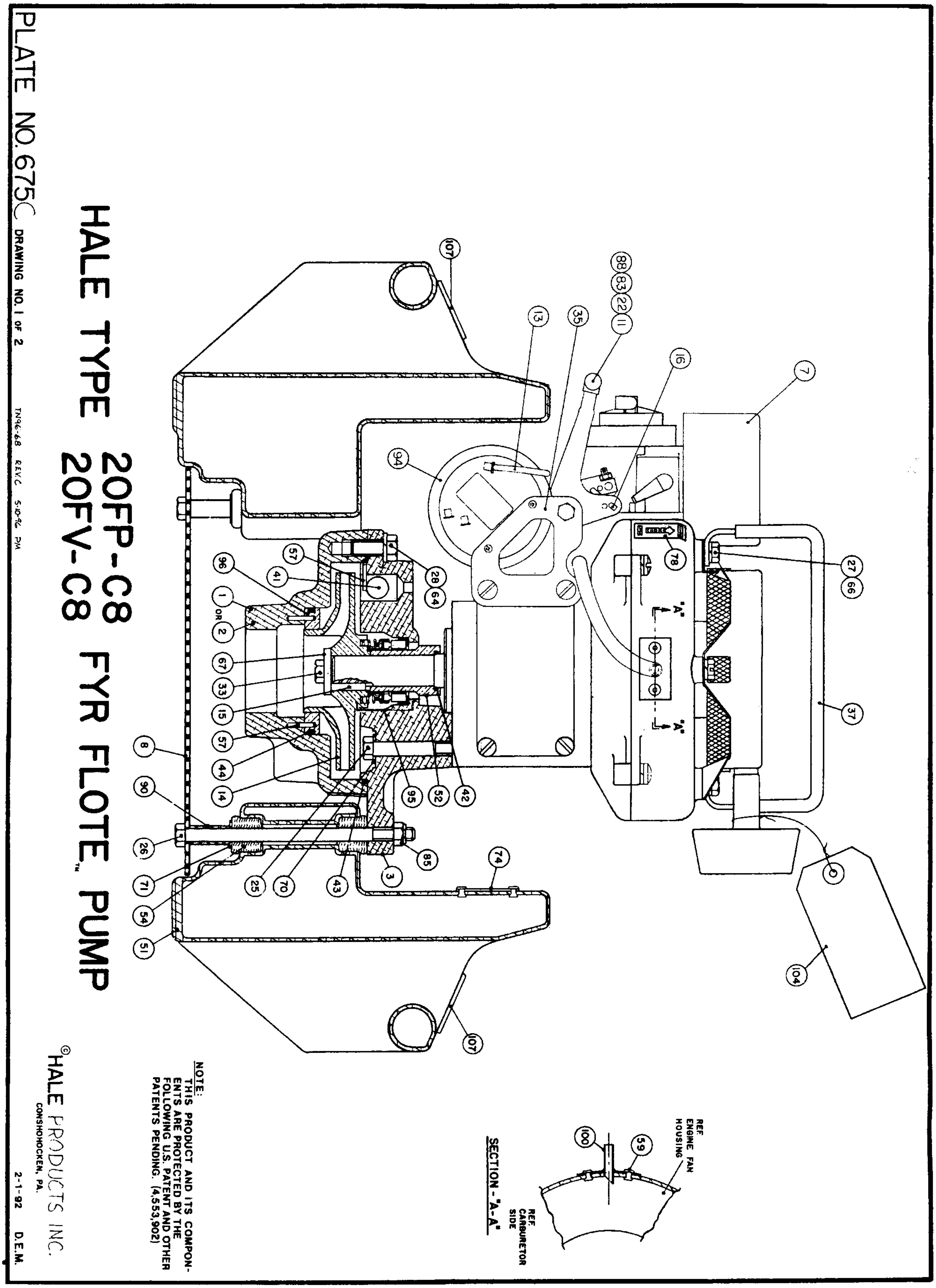
UNITED STATES MOTOR POWER, INC. CAN NOT ASSUME RESPONSIBILITY FOR CONSEQUENTIAL DAMAGES SUCH AS: LOSS OF USE OF THE PRODUCT, LOSS OF TIME, INCONVENIENCE, EXPENSE FOR GASOLINE, TELEPHONE, TRAVEL, TRANSPORTATION OR LODGING, LOSS OR DAMAGE TO PERSONAL PROPERTY, OR LOSS OF REVENUE. SOME STATES DO NOT ALLOW THE EXCLUSIONS OR LIMITATION OR INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATIONS OR EXCLUSIONS MAY NOT APPLY TO YOU.

This warranty gives you specific, legal rights, and you may also have other rights which vary from state to state.

PARTS CATALOG

NO.	PART NO.	QTY	DESCRIPTION
1	001-0220-00	1	BODY-20FP PUMP
2	001-0220-02	1	BODY-20FV PUMP
3	002-0510-00	1	HEAD-PUMP
5	007-0300-00	1	TUBE-DISCHARGE
7	010-0320-02	1	FILTER-AIR ASSEMBLY
8	010-0330-00	1	SCREEN - SUCTION
9	010-0330-01	1	SEALER - DISCHARGE TUBE FOAM
10	010-0340-00	1	FILLER - FUEL
11	012-0770-00	1	THROTTLE LEVER ASSEMBLY (INCLUDES PLASTIC WASHER)
12	013-1090-00	1	TERMINAL - 1/4 FEMALE STRAIGHT SLIDE-"SS" INSULATED
13	013-0931-00	1	WIRE - OVERSPEED SWITCH GROUND L 4.5 - 14B
14	016-0261-00	1	IMPELLER
15	017-0060-01	1	KEY - IMPELLER
16	012-0850-00	1	THROTTLE LINKAGE
20	018-1104-45	1	SCREW - #10-32 X 1/2 LG. SLOTTED RD. HD-ZINC PL. STL. MACH.
21	018-1204-07	3	SCREW - 1/4-20 X 1/2 LG. HEX HD.ZINC PL. STL. NYLON LOCKING
22	018-1210-02	3	SCREW - 1/4-20 X 1 LG. HEX. HD.ZINC PL. STL.
23	018-1213-45	1	SCREW - 1/4-20 X 1 1/3 LG. SLOTTEDRD. HD. ZINC PL. STL. MACH.
24	018-1407-02	4	SCREW - 5/16-18 X 7/8 LG. HEX HD. ZINC PL. STL.
25	018-1424-07	4	SCREW - 5/16-18 X 21/2 LG. HEX HD ZINC PL. STL. NYLON LOCKING
26	018-1454-02	4	SCREW - 5/16-18 X 51/2 LG. HEX HD. ZINC PL. ST.
27	018-1205-02	2	SCREW - 1/4-20 X 5/8 LG. HEX HD. ZINC PT. STL.
28	018-1607-12	4	SCREW - 3/8-16 X 7/8 HEX HD. STAINLESS STL.
29	018-5009-00	2	SCREW - #12 X 1 LG. SLOTTED RD. HD. TYPE "B" SELF TAPPING ZINC PL. STL.
30	2718863	1	SCREW RD HD - #10-32 X 2 1/4 LG. ZINC PL. STL.
31	018-8180-00	2	STUD - EXHAUST PIPE
33	018-9350-00	1	SCREW-5/16-24 X 1 LG. HEX HD. STAINLESS STL. LEFT HAND THREAD
34	019-0880-00	1	BRACKET - FUEL TANK MOUNTING
35	019-1380-30	1	OVERSPEED/THROTTLE BRACKET
36	019-0900-00	2	BRACKET - EXHAUST PIPE
37	019-0911-01	1	HANDLE
39	024-0320-00	1	PIPE EXHAUST
40	024-0330-00	1	MUFFLER - EXHAUST W/PLUG
41	039-0200-00	1	BALL - CHECK VALVE
42	040-0180-00	1	RING - PUMP SHAFT SLEEVE SEAL
43	040-1590-00	1	RING - VOLUTE BODY SEAL
44	040-2320-00	1	RING - CLEARANCE RING SEAL
50	045-0430-00	1	ENGINE - PUMP
51	047-0190-00	1	FLOAT - PUMP & ENGINE
52	048-0770-00	1	SLEEVE - PUMP SHAFT
54	048-0800-00	8	BUSHING - MOUNTING
57	064-0309-12	3	PIN - CLEARANCE RING & CHECK VALVE
59	064-7100-00	6	RIVET - 1/8 DIA. X 1/8 GRIP ALUM. "POP"
62	082-0118-02	1	ELBOW - 1/8 NPT X 1/4 ID HOSE
64	097-0140-01	4	WASHER - 3/8 ZINC PL. STEEL LOCK
65	097-0160-01	3	WASHER, - #10 ZINC PL. STEEL LOCK

NO.	PART NO.	QTY	DESCRIPTION
66	097-0300-01	2	WASHER - 3/4 ZINC PL. STEEL LOCK
67	097-0381-00	1	WASHER - IMPELLER
69	097-0560-01	4	WASHER - 5/16 ZINC PL. STEEL LOCK
70	097-0810-00	4	WASHER - 5/16 BRASS FLAT
71	097-0810-01	8	WASHER - 5/16 ZINC. PL. STEEL FLAT
73	097-1080-00	2	WASHER - #12 ZINC PL. STEEL LOCK
74	101-0500-00	1	PLATE - NAME
75	101-0611-00	1	DECAL - UNIT WARNING
76	101-0620-00	1	DECAL - ON/OFF
77	101-0640-00	1	DECAL - FUEL MIXTURE
78	101-0650-00	1	DECAL-CHOKE
79	108-0011-05	1	FUEL TANK & CAP ASSEMBLY
82	110-1100-02	1	NUT - #10-32 ZINC. PL. STL. HEX
83	110-1206-02	1	NUT - 1/4-20 ZINC PL. STL. LOCK
85	110-1406-02	6	NUT - 5/16-18 ZINC PL. STL. HEX LOCK
88	159-0760-00	1	1/4 INCH PLASTIC THROTTLE SPACER
89	142-0590-00	2	SHIELD - HEAT
90	159-0620-00	4	SPACER - SUCTION SCREEN
91	200-0721-00	1	SWITCH - OVERSPEED PRESSURE (WITH SCREWS)
92	217-0201-01	4	PLUG - 1/4 NPT BRASS CAD. PL. (20FP PUMP)
93	242-0150-01	1	STRAP - FUEL TANK
94	242-0520-00	4	CLAMP - FUEL HOSE
95	296-5240-00	1	SEAL - MECHANICAL
96	321-0121-00	1	RING - IMPELLER CLEARANCE
97	340-0060-02	15"	HOSE - 1/4 ID FUEL (FOR GASOLINE)
98	340-0171-03	1	LOOM - WIRE
99	340-0380-01	9	HOSE - 3/16 ID X 3/8 OD CLEAR PVC
100	505-0070-00	1	NOZZLE - OVERSPEED SWITCH (ASSY.)
104	101-0750-00	1	TAG - WARNING
105	217-3000-10	1	PLUG - FLOAT
106	101-0720-00	1	DECAL - SOLID STATE IGNITION
107	101-0690-01	2	DECAL - SMALL HALE
108	029-0090-00	2	CUSHION - FUEL TANK
116	008-0590-00	1	CAP FUEL TANK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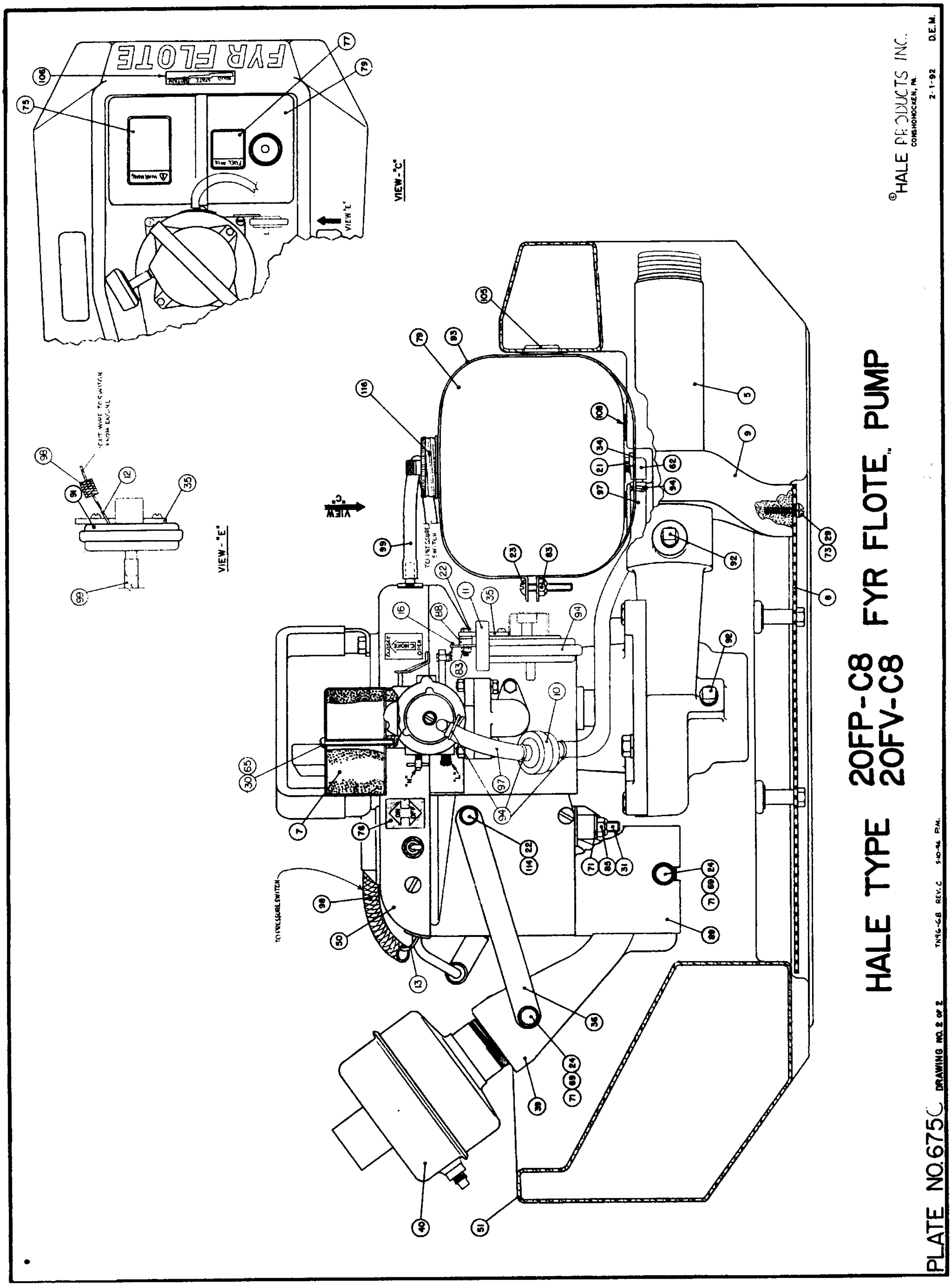
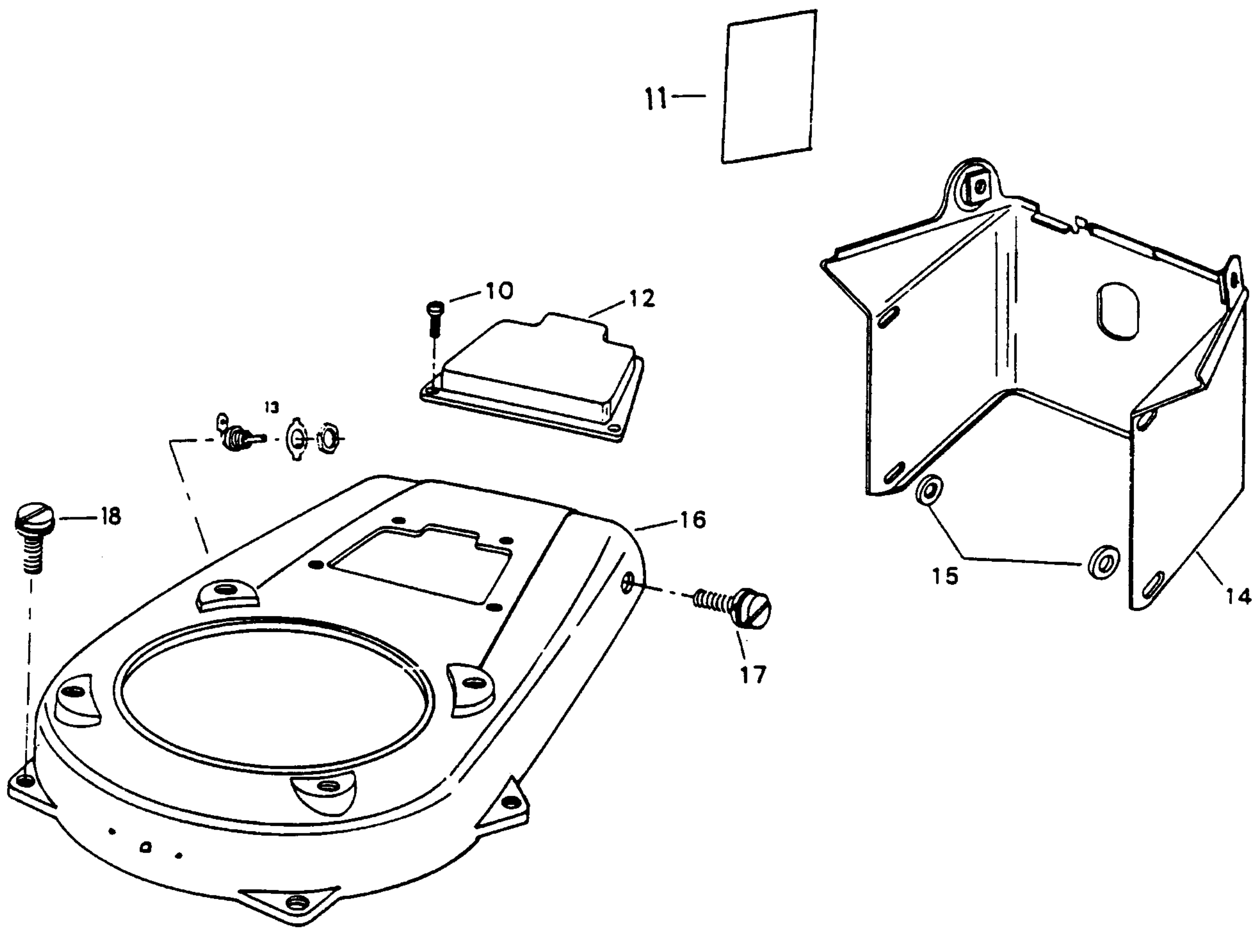
TN96-68 REV C 5-10-96 PM
HALE TYPE 20FP-C8 FYR FLOTE™ PUMP
20FV-C8
"A"
"A"
SECTION "A-A"
REF. ENGINE FAN HOUSING
REF. CARBURETOR SIDE
NOTE: THIS PRODUCT AND ITS COMPONENTS ARE PROTECTED BY THE FOLLOWING U.S. PATENT AND OTHER PATENTS PENDING. (4,553,902)
© HALE PRODUCTS INC.
CONSHOHOCKEN, PA.
2-1-92 D.E.M.


HALE TYPE 20FP-C8 FYR FLOTE™ PUMP
20FV-C8
PLATE NO.675C
DRAWING NO. 2 OF 2
©HALE PRODUCTS INC.
CONSHOHOCKEN, PA.
2-1-92
D.E.M.
VIEW-"C"
VIEW-"E"
FYR FLOTE
TO PRESSURE SWITCH
CHOKE

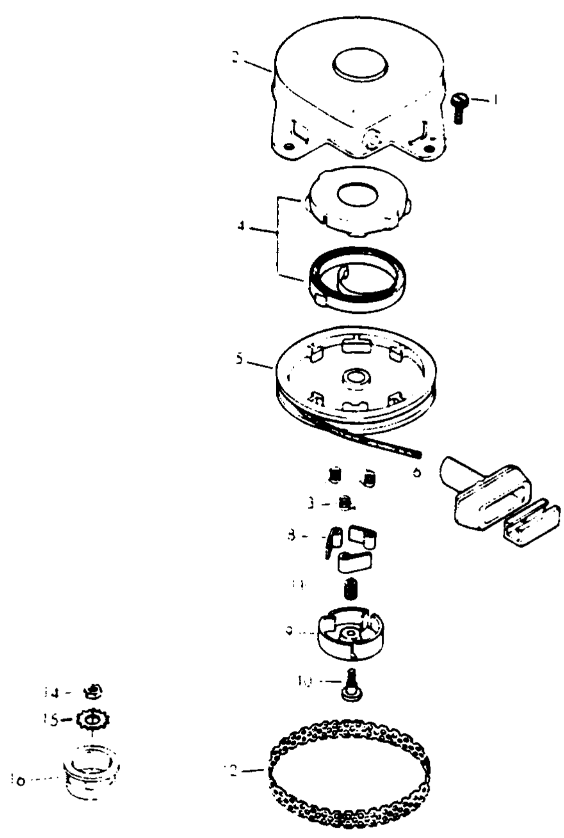
COVER

ILLUS. NO.	PART NO.	QTY.	DESCRIPTION
10	1728	3	Screw, #1 Ox 3/8"
11	174394-1	1	Decal, fuel mixture
12	559408	1	Cover, coil
13	A250449	1	Switch, ignition
14	174648-1	1	Cylinder cover
15	560902	2	Spacers
16	265596	1	Fan housing
17	1096	2	Screw, ¼-20 x ½
18	1282	4	Screw, ¼-20 x 5/8



STARTER

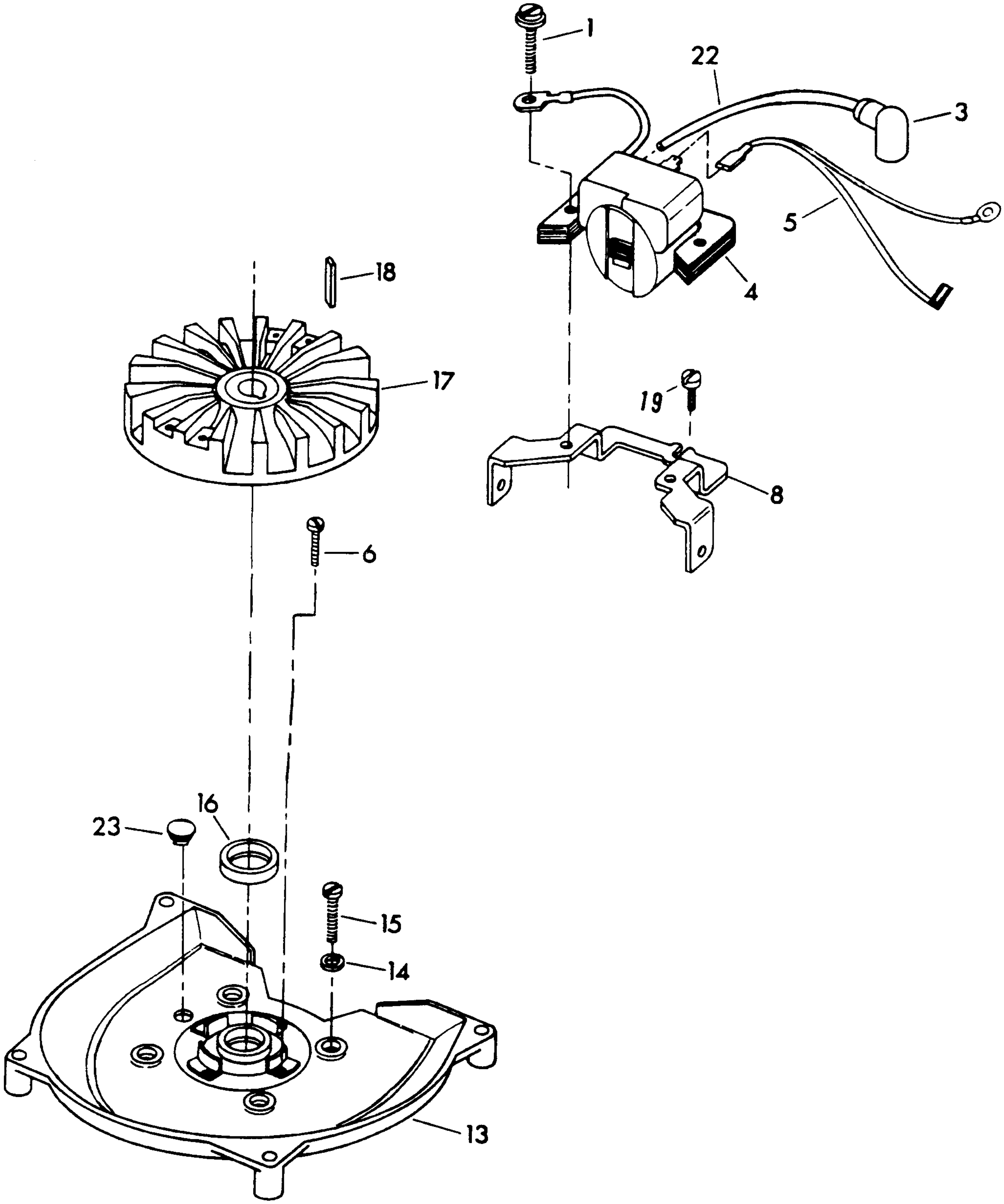
ILLUS. NO.	PART NO.	QTY.	DESCRIPTION
1	1655	4	Hex Hd. Screw w/Lockwasher, 1/4 - 20 x 3/8
2*	15614	1	Cover
3*	250424	3	Dog Springs
4*	A250970	1	Spring & Keeper
5*	15613	1	Pulley w/Bearing
6*	15585	1	Cord
7*	A250132	1	T-Handle and Insert
8*	250421	3	Dog
9*	15612	1	Dog Retainer
10*	15611	1	Screw
11*	250003	1	Brake Spring
12*	15603	1	Screen
	K264063	1	Starter complete, (not shown) inc. illus. marked with an (*) asterisk and Starter Cup
14	1351	1	Flywheel Nut, 7/16 - 20 L.H.
15	8051	1	Lockwasher
16*	560456	1	Cup



ELECTRICAL-ENGINE

Order by Part Number and Name, giving Motor Model and Serial Number

ILLUS. NO.	PART NO.	QTY.	DESCRIPTION
1	1521	2	Screw - 8-32 x ½
4	560475	1	Coil
5	233907	1	Wire, Ground Lead
6	1927	4	Screw, 10-32 x 3/8
8	560501	1	Bracket, coil
13	2A560038-1	1	Support Plate
14	1609	4	Washer, ¼
15	1156	4	Screw, ¼-20 x 1-1/16
16	2770146-1	1	Seal, Magneto end
17	560097	1	Flywheel
18	12150	1	Key
19	1096	1	Slotted Fill. Hd. Screw, ¼-20 x ½
22	560841	1	Wire, Coil
23	9033	1	Plug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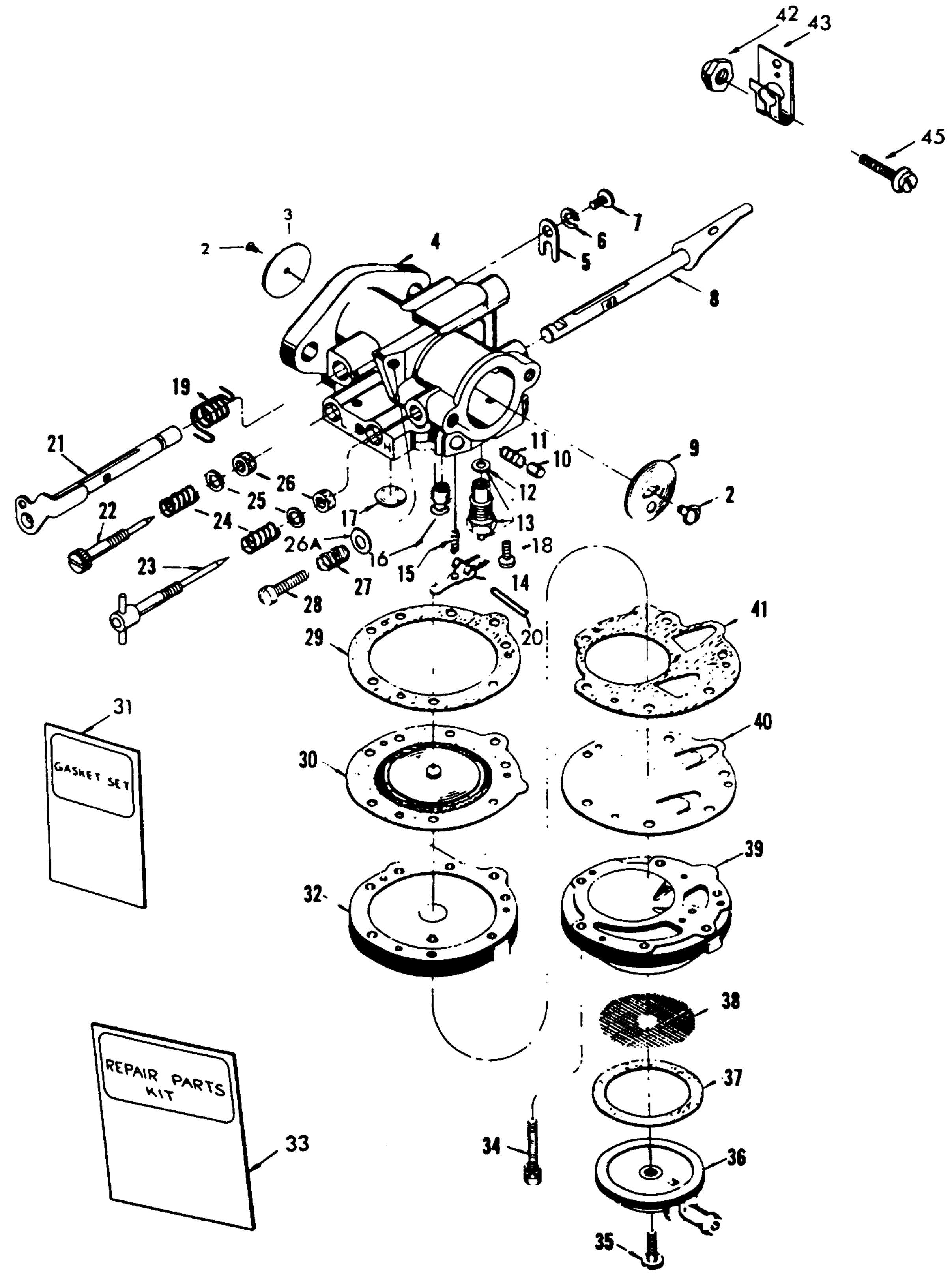
CARBURETOR

Order by Part Number and Name, giving Motor Model and Serial Number

ILLUS. NO.	PART NO.	QTY.	DESCRIPTION
1	175906	1	Gasket, Carburetor (Not Shown)
2	08942	2	Screw w/Lockwasher
3	013534	1	Throttle Shutter
4	175061-2	1	Carburetor, complete (HL232B)
5	09678	1	Throttle Shaft Clip
6	0992	1	Lockwasher
7	01974	1	Screw
8	014288	1	Choke Shaft and Lever
9	013547	1	Choke Shutter
10	04784	1	Choke Friction Pin
11	08805	1	Choke Friction Spring
12	010165	1	Inlet Seat Gasket
13*	015206	1	Inlet needle, seat and gasket
14*	014020	1	Inlet Control Lever
15	011503	1	Inlet Tension Spring
16	018036	1	Body Channel Cup Plug
17*	02531	1	Welch Plug
18	013269	1	Inlet Control Lever Fulcrum Pin Ret. Screw
19	013541	1	Throttle Shaft Return Spring
20	013406	1	Pin-Fulcrum
21	013711	1	Throttle Shaft and Lever
22	011498	1	Idle Adjustment Screw
23	012225	1	Main Adjustment Screw
24	08793	2	Spring
25**	011428	2	Washer
26**	011401	2	Packing
26A	010404	1	Idle Speed Screw Washer
27	0788	1	Regulating Screw Spring
28	05095	1	Idle Speed Regulating Screw
29**	012473	1	Diaphragm Gasket
30*	012475	1	Diaphragm
31*	K10009	1	Gasket and Packing Set
32	013228	1	Diaphragm Cover
33	K10013	1	Repair Parts Kit
34	018031	6	Body Screw
35	010571	1	Cover Retaining Screw
36	010527	1	Strainer Cover
37**	010529	1	Cover Gasket
38	010530	1	Strainer Screen
39	013335	1	Fuel Pump Body
40*	012698	1	Fuel Pump Diaphragm
41**	012930	1	Fuel Pump Gasket
42	7011	1	Stop Nut #10-24
43	A2770589	1	Throttle Shaft Arm (with Illus. 42 & 45)
45	1733	1	Slotted Pan Hd. m. Screw 10-24 x 9/16

* Indicates Contents of Repair Parts Kit (Item 33)

** Indicates Contents of Gasket Set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REPAIR PARTS KIT
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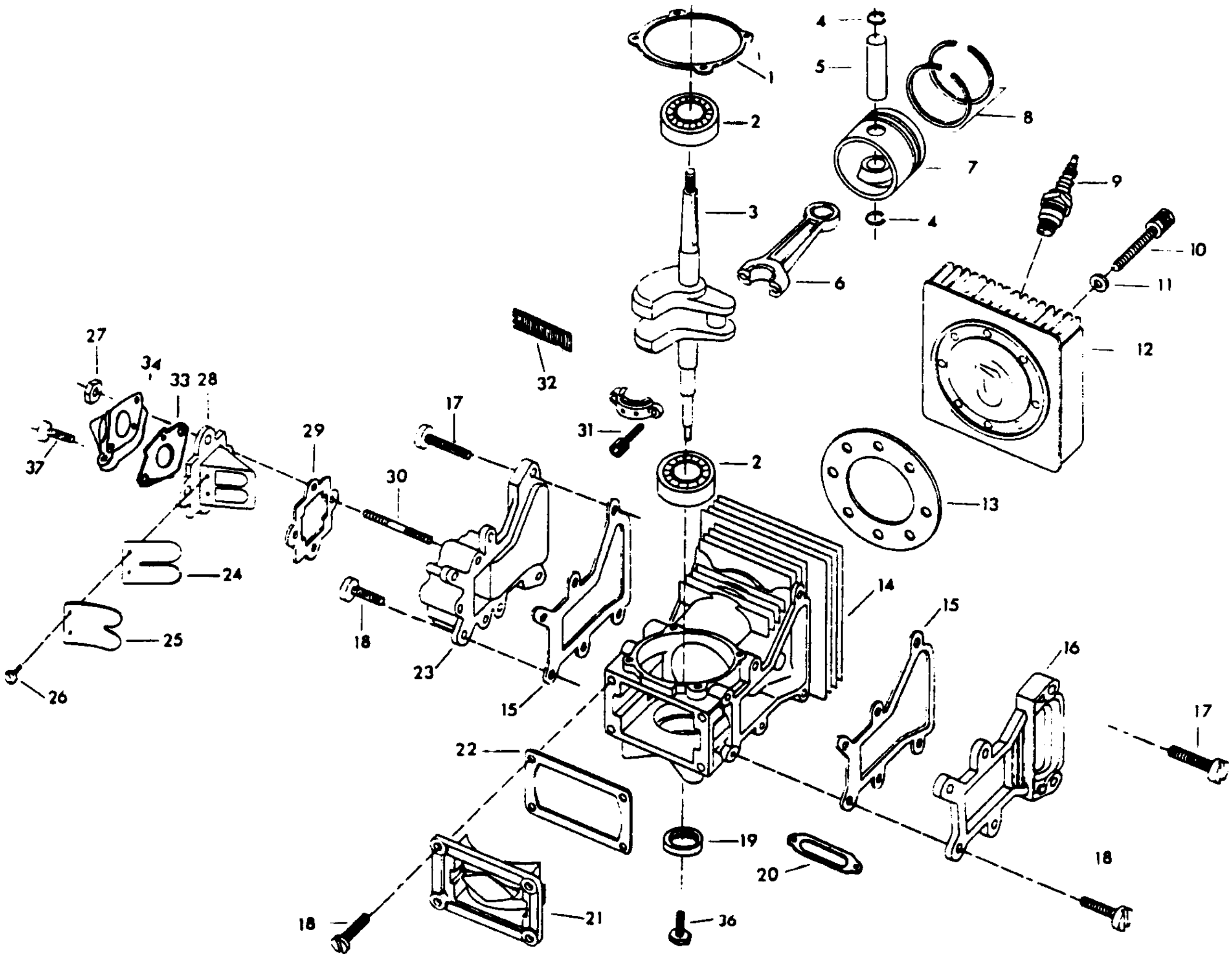
POWER HEAD

ILLUS. NO.	PART NO.	QTY.	DESCRIPTION
1	175277	1	Bearing cage gasket
2	127910-2	2	Ball Bearing
3	258018	1	Crankshaft
4	31410	2	Retaining ring
5	175017	1	Piston pin
6	A174016	1	Connecting rod w/illus. 31
7	175015	1	Piston
8	AI 75260-1	1	Piston ring set (2 per set)
9	5232227	1	Spark plug (Champion L-7)
10	1465	8	Socket Hd cap screw, ¼-20 x 1-1/16
11	8026	8	Plain washer
12	175518-2	1	Cylinder head
13*	175529-062	1	Head gasket
*	175529-032	1	Head gasket
14	2A560010	1	Cylinder, includes item 19
15*	175223	2	Gasket
16	560222	1	Cover, transfer port
17	1497	4	Pan Hd screw w/lockwasher, ¼-20 x 7/8
18	1439	12	Pan Hd screw w/lockwasher, ¼-20 x ¾
19	31146	1	Seal, drive end
20*	247279	1	Exhaust gasket
21	175150	1	Crankcase cover
22*	175148	1	Cover gasket
23	A265157	1	Manifold w/illus. 30
24	31160-1	2	Reed
25	31161	2	Reedstop
26	1755	4	Round Hd screw w/lockwasher, #6-32 x 5/16
27	1490	4	Hex nut
28	A247158	1	Reed plate, includes items 24, 25 and 26
29*	31168	1	Manifold gasket
30	433209-1	2	Stud, carburetor
31	36634	2	Connecting rod cap screw
32	AI 75228	1	Crankpin roller set (28 rollers)
33*	1 74906	2	Elbow gasket
34	247167	1	Carburetor elbow
35	560273	2	Stud, Exhaust
36	175732	1	Screw, crankshaft retaining L.H.
37	1580	2	Hex slot Hd screw w/lockwasher, ¼-20 x 1-1/8
	G819-2	1	Gasket set (not shown) includes illus. marked with an (*) asterisk.
40	8060	2	Lockwasher under carb. elbow nut)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OPERATING INSTRUCTIONS

FUEL MIXTURE

In a separate, clean container thoroughly mix 1/3 pint Chrysler Outboard Oil (BIA-TCW) or equivalent with each gallon of gasoline.
Use regular grade of gasoline. High test, ethyl gasoline is not recommended.

Strain the fuel mixture through a fine meshed screen when filling gasoline tank on engine to remove dirt and water if present.

PREPARATION FOR STARTING

1. Fill gasoline tank with fuel mixture prepared per above instructions. Wipe up all spilled gasoline.

2. Open gasoline shut-off valve.

3. Move choke lever to closed position.

   NOTE: If engine is warm, it may not require choking.

4. Crack open the throttle and crank engine.

5. When engine starts, move choke lever to open position.

   NOTE: The normal main adjustment needle settings are approximately one turn open. Occasional readjustment may be required but it is not necessary to readjust for starting except for cold weather starting when it may be necessary to open the high speed adjusting needle an additional 1/8 turn.

TO STOP ENGINE

Switch will stop engine by shorting magneto to ground.

CARBURETOR ADJUSTMENT

1. Turn both adjustment needles clockwise until completely closed. CAUTION: Do not force needle lightly closed as the seat may be damaged.

2. Turn both needles counterclockwise 1 turn. This is the average setting for proper engine operation.

3. Start engine and allow it to warm up, then if carburetor setting is too "Lean", engine will not run at full speed and will "pop" and may stop. Turn main adjustment needle counter-clockwise an eighth of a turn at a time until the engine runs smoothly.

   If engine runs at full speed without load, but will not maintain full speed under load, turn the main adjustment needle counter-clockwise 118 turn.

   If carburetor setting is too "rich' engine will not develop full power but will roll and run unevenly under load. Turn main adjustment needle clockwise an eighth of a turn at a time until the engine runs smoothly.

4. To verify proper idle needle setting, start engine and allow to warm up. If motor surges and runs at uneven speed, turn the idle adjustment needle slowly clockwise up to 1/4 turn. If this aggravates rather than corrects the situation, return to the original setting, then turn the idle adjustment needle slowly counter-clockwise up to 1/4 turn. This should cause the engine to "settle down" and run at a constant speed. If engine fails to accelerate, open idle screw 1/8 turn.

5. It engine runs too fast at idling speed, back out the idle stop screw a little at a time until desired speed is obtained. To increase idling speed turn in the idle stop screw.

SOLID-STATE IGNITION

1. Flywheel to coil lamination gap .006" -.010" (Flywheel magnets to coil lamination).

AIR CLEANER

Under ordinary operating conditions, the air cleaner should be cleaned daily. However, under extremely dirty conditions, more frequent cleaning is recommended. To clean the air cleaner, follow equipment manufacturers recommendations.

IMPORTANT: Dirt that enters the engine through the carburetor is one of the greatest causes of engine wear. Therefore It Is very Important that the air cleaner be serviced regularly.

STARTER SCREEN

The screen keeps dirt, etc., from entering the fan housing, and clogging the air cooling passages. Because this engine is air-cooled, it is necessary to keep this screen clean at all times to permit the unrestricted passage of air into the fan housing.

SPARK PLUG

Check and clean spark plugs regularly. A fouled, dirty, or carboned spark plug causes hard starting and poor engine performance.
Set spark plug gap at .030".

STORING MOTOR

The following steps should be taken to prepare your engine for storage:

1. Close gasoline shut-off valve.

2. Start engine and allow to run until it stops from lack of fuel. This will use up all the fuel in the carburetor and prevent the formation of deposits due to evaporation of fuel.

3. Disconnect fuel line and permit all fuel to drain from the gasoline tank. Replace fuel line.

4. Remove spark plug and pour 114 cup motor oil into cylinder. Replace spark plug.

5. Crank engine two or three times to distribute oil throughout cylinder This will coat the cylinder walls with oil and prevent rust from forming during the storage period.

TORQUE CHART

FLYWHEEL	420 In. Lbs.
CONNECTING ROD	80-90 In. Lbs.
SPARK PLUG	120-180 In. Lbs.
CYLINDER HEAD	80-90 In. Lbs.

GENERAL SCREWS

10-24	30 In. Lbs.	$^{1}/_{4}$-20	70 In. Lbs.
10-32	35 In. Lbs.	$^{5}/_{16}$-18	160 In. Lbs.
		$^{1}/_{4}$-28	75 In. Lbs.

Authorized Central Distributors

A.V.P. ENTERPRISES Route 12 & Hill Road P.O. Box 447 Richmond, IL 60071	Phone: 815-678-4511 Fax: 815-678-4096 OEM contact: Joyce Haug
Barr's Repair Service 903 Irvington Road Tucson, AZ 85714	Phone: 602-294-8876 Fax: 602-294-9837 OEM contact: Ted Barr
BEBCO INC. 2221 Second Ave. South Birmingham, AL 35233	Phone: 205-251-4600 1-800-828-8094 Fax: 205-324-8718 OEM contact: John Birmingham
CANADA POWER TECH., LTD. 161 Watline Ave. Mississauga, Ontario Canada L4Z IP2	Phone: 905-890-6900 Fax: 905-890-0147 OEM contact: Chris Critshley NO SERVICE
CENTRAL POWER DIST., INC. 2976 North Cleveland St. Paul, MN 55113	Phone: 612-633-5179 Fax: 612-633-6446 OEM contact: (parts) Jay Siemieniak (service-Keith Larson)
E.C. DISTRIBUTING OF WA. 6410 South 196th Kent, WA 98032	Phone: 206-872-7011 1-800-247-5899 Fax: 206-872-6947 Art Grimsby NO SERVICE
ENGINE POWER DISTRIBUTORS P.O. Box 161096 Memphis, TN 38186-1096	Phone: 901-345-0300 1-800-331-7164 Fax: 1-800-442-3290 OEM contacts: Penny Baughen Donnie Gibson Ken Broom
ENGINES SOUTHWEST 215 Spring St. P.O. Box 67 Shreveport, LA 71161	Phone: 318-222-3871 Fax: 318-425-4638 OEM contact: Billy Wright NO SERVICE
G.E.M. PRODUCTS, INC. 496 E. St. Charles Road Carol Stream, IL 60188	Phone: 708-653-1800 Fax: 708-653-3960 David or Earl Larson

Authorized Central Distributors

GARDNER, INC. (West) 1150 Chesapeake Ave Columbus, OH 43212	Phone: 614-488-7951 Fax: 614-486-7122 Service/OEM contact: Stan Murphy x1104
GARDNER, INC. (EAST) 12 Melrich Road RD 3 Cranbury, NJ 08512-9517	Phone: 609-860-8060 Fax: 609-860-8040 Service/OEM contact: Stan Murphy
GARY'S SMALL ENGINE 18909 S.W. 65th Lake Oswego, OR 97035	Phone: 503-639-3474 Fax: Same as Phone Gary Nelson
GRAYSON COMPANY, INC. 1234 Motor Street P.O. Box 565587 Dallas, TX 75356	Phone: 214-630-3272 Fax: 214-631-4759 OEM contact: Jim Denbow NO SERVICE
H.G MAKELIM COMPANY 1520 S. Harris Court Anaheim, CA 92806	Phone: 714-978-7515 Fax: 714-978-6227 OEM contact: John Duncan
H.G. MAKELIM COMPANY 219 Shaw Road P.O. Box 2827 S. San Francisco, CA 94083-2827	Phone: 415-873-4757 Fax: 415-873-8685 OEM contact: George Finato
KEEN EDGE CO. 8615 Ogden Ave. Lyons, IL 60534	Phone: 708-447-4735 OEM contact: Bill Burke
MEDART ENGINES OF ST. LOUIS 100 Larkin Williams Ind. Court Fenton, MO 63026-2409	Phone: 314-343-0505 Fax: 314-343-9530 OEM contact: Randy Bowen NO SERVICE
MIDCO INC. 1523 Fairmount Ave. P.O. Box 15118 Philadelphia, PA 19130	Phone: 215-232-9615 No Fax Charles Bridgeman Jerry McClintock
MOBILE EQUIPMENT COMPONENTS AND SERVICE 156 Golf View Road Ardmore, PA 19003	Phone: 215-649-0968 Fax: 215-642-1905 Lawton Logan Nelson Katz

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CA	CAPITOL POWER EQUIPMENT	SACRAMENTO	916-447-9343
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CA	CLAIREMONT EQUIPMENT	SAN DIEGO	619-278-8351
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NC	PRIME EQUIPMENT	CHARLOTTE	704-332-5171
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NM	ROCKY MOUNTAIN SUPPLY	ALAMAGORDO	505-437-8276
OH	MARIETTA IGNITION	MARIETTA	614-374-6746
OR	ASE SUPPLY	PORTLAND	800-289-2737
PA	MOBILE EQUIPMENT	ARDMORE	610-649-0968
PA	WHARTON EQUIPMENT	PENNSAUKEN	215-925-8800
SC	PRIME EQUIPMENT	CHARLOTTE	704-332-5171
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TN	QUALITY EQUIPMENT	MEMPHIS	901-345-3700
TN	SES ENGINES	FORT MILL	800-845-1911
TX	POND SPRINGS POWER	AUSTIN	512-258-9001
VA	SES ENGINES	FORT MILL	800-845-1191
VA	STARR EQUIPMENT	CHARLOTTESVILLE	804-293-8108
WA	INDUSTRIAL REBUILD	SEATTLE	206-624-7742
WA	MID MOUNTAIN MACHINE	SPOKANE	509-535-0141
WI	AMERICAN POWER	WATERFORD	414-534-4785
W.VA	SES ENGINES	FORT MILL	800-845-1191

OPERATING AND MAINTENANCE MANUAL

MODEL NO.: **FYR-PAK 20FP-C8P**

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 IDEX
IDEX CORPORATION

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

Limited Warranty

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

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

- Subjected to 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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SAFETY PRECAUTIONS

Failure to follow the operating, maintenance and lubrication requirements set forth In this operating and Instruction manual may result in serious personnel injury and/or damage to equipment. These “WARNING” statements indicate potentially hazardous conditions for operator or equipment.

TAKE NECESSARY STEPS TO PROTECT PERSONNEL AND EQUIPMENT.

1. Carefully read instruction manual supplied by engine manufacturer before attempting to assembly, operate, service, or disassemble the engine or any of its parts.

2. **Warning - Gasoline is a highly combustible fuel.**
   The Improper use, handling, or storage of gasoline can be dangerous. Prevent accidents by following these safety rules:

   A Use gasoline only as a fuel, never as a cleaning fluid.

   B Use only an approved container to hold or store gasoline. Never store gasoline in familiar containers such as milk containers or soda bottles.

   C Store gasoline in a cool location, out of the reach of children. Never store gasoline near heat or an open flame.

   D Do not refuel with the engine running. Add fuel to a cool engine only. Spilled fuel on a hot engine or muffler may cause a fire or an explosion. Fill fuel tank out-of-doors and wipe up any spills.

   E Make sure all fuel lines and connectors are secure.

   F Provide a fire extinguisher nearby when working with gasoline. Be sure extinguisher Is In operating condition; chock the pressure gauge or indicator, Be familiar with its proper use. Consult local fire department for the correct type of extinguisher for your application. Extinguishers rated ABC by the NATIONAL FIRE PROTECTION ASSOCIATION are appropriate for most applications.

   G POSITIVELY NO SMOKING!!

3. **DO NOT RUN THE ENGINE IN AN ENCLOSED AREA!!**
   Exhaust fumes contain carbon monoxide that is an odorless poisonous gas. If equipment is located in an enclosed area with an exhaust line to the outside, regularly check the exhaust system for leaks. Be sure the area is well ventilated.

4. Do not operate equipment when mentally or physically fatigued.

5. Stay away from moving parts, avoid wearing loose jackets, shirts and ties.

6. Keep the equipment and surrounding area clean. Cluttered areas invite accidents. Remove all oil deposits from equipment and surrounding area. Accumulations of grease and oil may present a hazard.

7. All visitors should be kept at a safe distance from work area. Keep children away from equipment and discharge hose. Do not allow children to hold discharge hose.

8. Be careful not to touch the exterior of a hot engine, especially the muffler and the surrounding area. The engine is hot enough to be painful or cause injury.

9. Keep power shields and guards in place. Do not make adjustments and repairs while engine is running, unless specified for in repairs. Use extreme caution around hot manifolds and moving parts.

10. Prevent accidental starting by always removing spark plug or by disconnecting and grounding spark plug wire before working on engine or the equipment driven by engine.

11. Maximum speed of the engine is set. Do not tamper with the controls to adjust to run at higher speeds. Excessive speed increases the hazard of personal injury and reduces engine life

12. Familiarize yourself with all controls, learn how to stop engine quickly In a emergency.

13. When shutting off a gasoline engine, be sure It is completely stopped before leaving the work area.

14. For proper handling, storing and transporting fuel, follow fuel tank manufacturer's instruction sheet or instructions printed on tank. Close fuel tank cap vent when storing or transporting.

15. If tank is equipped with a closing vented cap, open when pumping.

16. Check engine fuel level before Initial start-up each day.

17. Flush pump with fresh, clear water if pump has been used to pump salt water or water containing sand.

18. During freezing weather, drain the pump, throttle actuator tubing, and discharge lines after each use.

19. The pump must be primed with the hand pump and the priming valve closed before starting engine.

20. Do not operate unit while it is being carried

21. When operating the unit, hearing protection must be worn.

WARNING LABEL IDENTIFICATION

The equipment described in this manual contains one or more of the following warning labels. The following chart identifies the label and provides an explanation of the hazard associated with the label.

HEARING PROTECTION REQUIRED WHEN OPERATING EQUIPMENT

EYE PROTECTION REQUIRED WHEN OPERATING EQUIP-MENT

EQUIPMENT CONTAINS FLAMMABLE FUEL

CORROSIVE HAZARD

ROTATING COMPONENTS

HOT SURFACES

DANGER OF CARBON MONOXIDE POISONING WHEN EQUIPMENT IS OPERATING

OPERATING EQUIPMENT PRESENTS A DRAW-IN HAZARD

ELECTRICAL SHOCK HAZARD

HALE FYR PORT PUMP MODEL:
20FP-C8FR/C8SK OPERATION AND INSTRUCTION MANUAL
ENGINE DRIVEN,
PORTABLE CENTRIFUGAL PUMPING UNIT

INTRODUCTION

PURPOSE:

This operation and instruction manual is published to guide and assist in the installation, operation, lubrication, maintenance and repair of the Hale FYR PORT pumping unit.

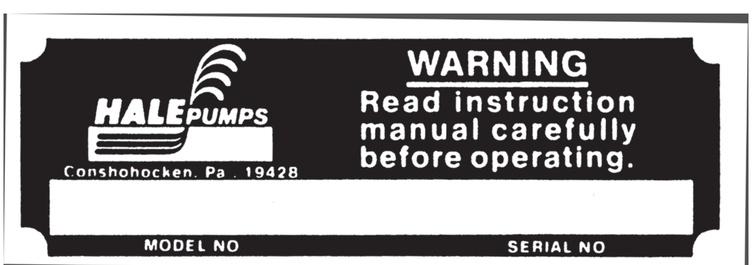
The installer and operator should understand this manual and the engine manufacturer's operating manual before attempting to install or operate the unit.

IDENTIFICATION:

Whenever a question arises regarding your pumping unit, contact your Hale Dealer for the latest available information. This dealer will also be able to advise you of the nearest authorized engine dealer or refer to the supplied list of engine distributors who can provide service for the engine in your pumping unit. Finally, if additional help is needed, contact the Service Department of the Hale Fire Pump Company.

Please supply the complete pump model and serial numbers when requesting information or ordering parts. The pump model and serial numbers are stamped (not cast) on the Hale nameplate or on top of the pump head. For you convenience, fill in the information on the hale nameplate below.

Always mention both the model number and serial number of your engine when ordering engine parts. These numbers are found on the engine identification plate attached to the engine.



To help you identify the parts used in your FYR PORT, a pump parts catalog is included toward the back of this manual. To identify the engine parts used in you pumping unit, refer to the engine manufacturer's parts catalog.

DESCRIPTION

GENERAL:

The FYR PORT is a lightweight, portable, centrifugal pump mounted either on skids or in a wraparound frame. The pumping unit consists of a Hale 20FP single stage centrifugal pump close coupled to an air cooled, 2 cycle, single cylinder, gasoline engine. The unit includes an automatic rewind starter, a spark arresting muffler, engine overspeed control switch, priming pump and priming valve. It is intended for pumping water from draft, relay, or hydrant. The unit will deliver discharge pressures to 220 PSIG and flows to 75 GPM from draft.

The FYR PORT pumping unit consists of 6 major subassemblies; the engine, pump, priming system, mounting base, overspeed control switch and wraparound frame.

ENGINE:

The lightweight engine is a single cylinder, 2 cycle, air-cooled version producing @ 8 hp (6 Kw) from its 8.2 cu. inch (134 cc) displacement using a gasoline/oil mixture fuel.

The engine is equipped with water resistant solid state ignition, a pressure carburetor with built-in fuel pump, and an on/off ignition toggle switch.

The engine's interior is protected from impurities by the use of a wire mesh element air filter, a 75 micron in-line fuel filter, and an integral fuel strainer built into the fuel pump. PUMP:

The engine crankshaft extension serves as the pump shaft with an enclosed type bronze impeller mounted directly on the shaft. The shaft is protected against corrosion by a bronze sleeve, an ''O"-ring, and a mechanical type, self-lubricating and adjusting seal. The impeller is hydraulically sealed by a replaceable, patented, floating, bronze clearance ring located in the inlet of the aluminum volute body. . The volute body is attached to the cast aluminum pump head by four mounting screws.

The pump head, which serves as the mounting bracket for the pump and engine assembly, is attached to the mounting base with rubber vibration and shock mounts. It also incorporates a handle for positioning the unit or carrying short distances.
The pump inlet and discharge connections are either 1 1/2" male national fire hose threads (NST), or 1 1/2" metric threads (ISO 228/1-G 1 1/2 A).

PRIMING SYSTEM:

The priming pump is a hand operated piston pump. Its purpose is to remove air from the pump allowing atmospheric pressure to push water through the inlet hose into the pump.

A priming valve is included which controls air flow through the priming line.

MOUNTING BASE:

The mounting base is an intermediate part to which the engine is attached with three shock-vibration isolation mounts. The base is then attached to the two skids.

The mounting base has the overspeed control switch, priming pump mounting clamps (skid version) and Hale nameplate attached to it.

OVERSPEED CONTROL:

The overspeed switch control assembly is a safeguard against overspeeding of the engine. The overspeed switch is attached to the mounting base of pumping unit below the carburetor. Attached to the front of the overspeed switch is a flexible transparent hose that is connected to the nozzle plate (riveted to the engine fan housing). Connected to the back of the overspeed switch are two wires; one goes to the engine's ignition coil, the other goes to ground (engine). The switch senses the air pressure generated by the engine's cooling fan.

When the engine reaches a speed in excess of that which would normally occur, the fan air pressure generated will be sufficient to cause the switch to close;thereby grounding the solid state ignition. The engine speed will decrease until the air pressure reaches a lower trip point, reactivating the ignition system and the engine will accelerate. The engine will decelerate and accelerate alternately until the operating conditions are returned to their normal mode.

WRAPAROUND FRAME:

The wraparound frame protects the pump, engine and fuel system from damage caused by normal handling. The frame also serves as a convenient means for transporting the FYR PORT unit over long distances.

PREPARATION

INSPECTION OF NEW UNIT:

When unpacking unit do not discard cushioning materials, carton, or case until you are certain everything is correct. Inspect carefully; perfect condition of the outside shipping container does not guarantee undamaged contents. Check for loose, missing, or damaged parts. Also, check the packing slip for any additional parts.

After inspection proves satisfactory discard all shipping material in a proper manner.

> **ATTENTION:** The FYR PORT has been shipped with the engine, carburetor, air filter and fuel systems drained and tagged. Before using, fill with proper quantities and grades of fuel and oil, refer to "Fuel and Lubricant Specifications," page 9. The idle speed, idle and main fuel mixture adjustment screws have been factory set. However, the idle and main fuel mixture adjustment screws may require readjustment, especially for cold weather or high altitudes (see engine manual for adjustment procedure).

IDENTIFICATION OF CONTROLS:

(See plate numbers 534B, 1 of 2 and 2 of 2, in Parts section for location of controls).

EXPLANATION OF CONTROLS:

Air Cleaner: Low restriction cleanable expanded aluminum foil type element.

Carburetor Fuel Strainer: Provides secondary fuel filtering for engine.

Carrying Handle: This is incorporated into the pump head.

Choke: Reduces the amount of air entering the engine to correct the fuel-air ratio for cold start-up.

Discharge Hose Connection: Located on the air cleaner side of the unit for connecting a 1 1/2" NST or ISO hose fitting.

Exhaust Muffler: This is a spark arrester type that also reduces the amount of combustion noise emitted by the engine.

Flexible Transparent Hose: Is connected between the nozzle plate and the overspeed switch control. This allows for visual inspection of dirt and water which may clog hose and reduce amount of pressure reaching switch. Check regularly, and be sure hose is not cracked, crimped, or kinked.

Ignition Toggle Switch: When flipped to the ''ON'' position opens circuit to ground allowing the magneto to develop a spark for the ignition of combustion. Flipped to the ''OFF position closes the circuit to ground magneto.

In-Line Fuel Filter: Provides primary fuel filtering for engine. Nozzle Plate: Riveted to the engine fan housing, directs air pressure to flexible transparent hose and overspeed control.

Overspeed Control: For description refer to ''DESCRIPTION - OVERSPEED CONTROL," page 3.

Starting Handle: Pull to start.

Throttle Lever: Varies the speed of the engine. (Pull up to increase speed). Do not force the lever against the stops.

Fuel Line Connector (Skid Version): Connect the fuel line from the fuel caddie here.

Priming Valve: For description refer to ''DESCRIPTION - PRIMING SYSTEM," page 2.

Priming Pump: for description refer to ''DESCRIPTION - PRIMING SYSTEM-.'' page 2. Pump Inlet: Located at the end of the pump, fitted with 1 1/2" NST or ISO male adapter.

TRANSPORTING

WARNING: Before transporting the FYR PORT (Skid unit) the fuel caddie must be disconnected from the engine, and fuel drained as instructed under ''STOPPING PROCEDURE" page 7. Also, allow engine to cool. When carrying the unit in the wraparound frame close the vent on the fuel tank cap. Carry the unit in an upright position by using the frame.

The FYR PORT has a handle for moving and *positioning* the unit. Care should be taken not to drop or strike the engine or pump as damage may result.
When *transporting* the unit by motor vehicle, care should be taken to fasten it down

securely. Follow the manufacturer's *instructions* for *transporting* the fuel caddie.

OPERATION

INSTALLATION:

1. Choose a suitable location, as near to the source of water as is possible, to place the FYR PORT.

2. Attach hoses. When operating from draft, the inlet hose should slope continuously downward from the pump to the water.

3. Attach fuel line hose when using the Skid mounted unit. CAUTION: Do not attach regular pipe threaded (NPSH/NPT) fittings as they could permanently damage the male threads.

PRIME PUMP:

It is recommended that the pump be primed before starting the engine.

a) PRIMING PROCEDURE:

1. The discharge must be closed either with a discharge valve, shut-off nozzle or by pinching the discharge hose (use a pinch clamp if available).

2. Open priming valve.

3. Operate priming pump until water is discharged from priming pump.

4. Close priming valve.

5. Start engine. See starting procedure.

6. Slowly open discharge valve until a steady stream is discharged.

7. If an unsteady stream is discharged (incomplete prime), open priming valve and operate hand primer to purge remaining air until a steady stream is discharged. Then close priming valve and adjust throttle for desired output.

b) ALTERNATE PRIMING METHOD:
If the inlet hose is fitted with a foot valve, the pump may be primed by jabbing the end of the inlet hose in and out of the water until water expands the discharge hose. The discharge line must be open when this method is used. Again, be sure the priming valve is closed before starting engine.

STARTING PROCEDURE

WARNING: DO NOT RUN THE ENGINE IN AN ENCLOSED AREA!!! Exhaust fumes *contain* carbon monoxide which is an ordorless and poisonous gas. Be sure the area is well ventilated.

1. Make sure there is a fresh mixture of gasoline and oil in the tank. Refer to ‘‘FUEL SPECIFICATIONS.’’ page 9, for proper amounts and type.

WARNING: Do not change or fill fuel caddies or tank while engine is running. Fill them out of doors away from any source of ignition.

2. Connect fuel caddie to fuel line connector on engine base (Skid Unit). Open the air vent on the caddie or tank cap. Squeeze and release the priming bulb until resistance is felt, indicating the fuel line is full. Further action will pump fuel past the check valve into the carburetor, flooding it.

3. Close choke.

NOTE: A warm engine requires less choking than a cold engine. 4. Open throttle slightly (1/4). Closed is down.

5. Move ignition switch to ‘’ON’’ position.

6. Place foot on frame or skid to prevent movement.

7. Pull the starting handle slowly to bleed off some compression; then, pull with a quick short stroke. Repeat as necessary.

8. When engine starts, slowly open choke. 9. Slowly open discharge valve.

10. Set throttle to desired operating point.

NOTE: When operating from draft, especially on high lifts, do not increase engine speed without a corresponding increase in pump pressure. If the engine speed increases with no increase in flow or pressure reduce the throttle setting until the pressure of flow decreases slightly and operate at that point.

STOPPING PROCEDURE

1. Idle engine by pushing throttle lever down.

2. Move ON/OFF switch to off position.

3. Disconnect fuel caddie quick disconnect coupling, close cap and store fuel line (skid unit). Simply close the fuel tank vent on the frame unit.

4. Restart engine, with water flowing through pump, and allow to idle until it stops from lack of fuel (skid unit).

5. Allow lines to drain. Disconnect hoses.

CAUTION: Be careful not to touch the, exterior of the engine, especially the muffler and the surrounding area. The engine is hot enough to cause injury.

6. Without inlet and discharge caps in place, drain pump by tilting inlet end of pump downward. Open the priming valve and operate the priming pump until all water is discharged. When pump is drained, replace caps to prevent damage to threads.

RELAY PROCEDURE

For pumping water over long distances or up high vertical rises, it may be necessary to use several pumps in series.

When this is done, pressure, (not exceeding 100 PSI), should be maintained at the inlet of the second and subsequent pumps. PREPARATION FOR STORAGE:

WARNING: Prevent accidental starting by always removing spark plug or by disconnecting and grounding spark plug wire before working on engine or pump.

NOTE: Replace the spark plug or wire only after all preparation is completed on both pump and engine.

1. Fuel System:

If the unit is to be stored for any length of time, drain the fuel system by running until it stops as instructed in STOPPING PROCEDURE''. The wraparound frame unit can be run until the fuel tank is empty and it stops due to lack of fuel.

2. Engine:

See engine manual for storage instructions.

3. Pump:

a) Follow the procedure under 'Maintenance-Daily or every 8 Hours'', item 2 ''Pump inlet.''

b) Drain water from pump thoroughly. After the flow has ceased, pump should be turned over a few revolutions so that all water will drain from impeller.

c) While turning the pump over, using the starting handle spray into the pump inlet and discharge tube with a white lithium or silicone type lubricant.
This treatment coats the inside of the pump and tends to prevent the clearance ring and impeller hub from sticking due to corrosion.

d) Spray the threads of the inlet and discharge connections with either a white lithium or silicone type lubricant.

LUBRICATION AND MAINTENANCE

FUEL AND LUBRICANT SPECIFICATIONS:

GASOLINE: Use clean, fresh, ‘’regular grade leaded’’ or ‘’low lead “ type. When “regular “ or ‘’ low-lead “ is unavailable an “unleaded” type fuel may be used; however, it should be limited to emergency use only. Oil must be mixed with the gasoline, refer to fuel mixture below.

OIL: Use a good quality outboard motor oil or equivalent. The oil should meet the Boating Institute of America (BIA) classification type TC-W. Gasoline must be mixed with the oil, refer to fuel mixture below.

FUEL MIXTURE:

The engine used in the FYR PORT requires that oil be mixed with the gasoline. For ease of starting, it is desirable to have a fresh mixture of fuel: therefore, mix only an amount of fuel you anticipate using in the near future. As a guide, the engine consumes approximately one gallon (3.8 L.) per hr. at full throttle (depending on load), less at partial throttle.

To mix fuel, add oil to a small amount of gasoline in the fuel caddie, then add the rest of the gasoline and shake well. Also, if the fuel caddie has been sitting still for an extended period, shake container before filling.

The correct ratio of oil to gasoline is one (1) part oil to 24 parts gasoline (1:24). Table 1 shows various quantities of fuel mixture and the amount of oil and gasoline required.

APPROXIMATE QUANTITY OF FUEL DESIRED	**OIL**	**GASOLINE**
ONE GALLON (PLUS) (3.9 LITERS)	5 OZ. (158 ML)	1 GALLON (3.8 L.)
THREE GALLONS (PLUS) (11.8 LITERS)	16 OZ. (473 ML)	3 GALLONS (11.4 L.)
FIVE GALLONS (PLUS) (19.7 LITERS)	27 OZ. (789 ML) (18.9	5 GALLONS

TABLE 1

SAFETY PRECAUTIONS:
1. DO NOT RUN THE ENGINE IN AN ENCLOSED AREA. Be sure the area is well ventilated.

2. Stay away from moving parts. Avoid wearing loose jackets, shirts and ties.

3. Keep the equipment and surrounding area clean. Cluttered areas invite accidents.

4. Keep power shields and guards in place. Do not make adjustments and repairs while the engine is running, unless specified for in repairs.

5. Do not run the pump more than two min. without water in pump.

6. Be careful not to touch the exterior of a hot engine, especially the muffler and the surrounding area.

7. Prevent accidental starting by always removing spark plug or by disconnecting and grounding spark plug wire before working on engine or pump.

8. When working on any part of the fuel system be sure the unit is cool. Remove any sources of heat or flame.

<u>ABSOLUTELY NO SMOKING</u>

Reassembly Note:

Before reassembly begins, visually inspect parts. See that parts are clean; all sealing surfaces are free of corrosion and nicks. Remove any metal chips from casting cavities and tapped holes. Also inspect for any damaged or excessively worn parts which should be replaced.

Refer to ''Parts Catalog'' Plate NO. 534B, 1 of 2 of 2, for component parts' location and orientation.

MAINTENANCE SCHEDULE;
Daily or Every 8 hours:

1. Leaks - (gaskets, fuel, seals, washers, and water) Check for any leaks before operating unit. These leaks must be repaired before operating.

2. Pump Inlet:
a) Remove any debris that might collect in the inlet, impeller eye, or the inlet hose strainer.

Monthly or Every 25 Hours:

1. Expanded aluminum foil element: Clean as follows.
   Note: Service air cleaner more often under dusty conditions.

a) Remove (2) screws and washers so foil element and end plates can be removed.

b) Wash foil element in kerosene or liquid detergent and water.

c) Dry foil element by shaking out excess water. Use compressed air if available.

d) Install foil element, end plates, screws and washers on carburetor.

2. Spark Plug: Clean and regap at .030 inch (.8 mm). Spark plug type is Champion #RL-86C, NGK#BR5HS, AC#R46FF, motorcraft #AER6, and Fram-Autolite #426. CAUTION: Do not blast clean spark plug. Blasting material could lodge in recesses of plug and eventually work loose, damaging aluminum bore. Spark plug should be cleaned by scraping or wire brushing and washing with a commercial solvent.

3. Fuel Filters: General:
   a) Place the unit in a horizontal position.
   b) Disconnect fuel caddie.
   c) Place a rag under the carburetor and fuel line to catch any fuel spillage.
   d) Refer to filter maintenance below.
   e) Wipe up any additional fuel spillage and discard rag in an approved safety container.

In-Line Fuel Filter:

a) Remove the two clamps from both sides of filter and pull hoses using a slight twisting motion.

b) Observe hoses for any signs of cracking or deterioration and replace if necessary.

c) Install a new filter with the word ‘‘IN’’ toward fuel caddie connection. Replace clamps.

Carburetor Fuel Strainer:

a) Remove the screw holding the plastic cover in place (where the fuel line connects to carburetor). Gently remove the cover, gasket, and strainer screen.

b) Clean screen in a nonflammable solvent, blow dry.

c) Replace strainer screen, gasket, cover and screw.

4. Hoses, Fittings, and Tubes: Clean and check all hoses, fittings and tubes for signs of cracks, kinks, deterioration, etc. They should have uniform bends; If any are kinked or collapsed they should be replaced. Fittings and clamps should be tight, but not overtight.

Seasonal or as Required:

1. Engine cooling system: Clean the starter screen, flywheel (fan), and engine cooling fins. Foreign matter may clog cooling system after prolonged service. Continued operation with a clogged cooling system causes severe overheating and possible engine damage.

a) Remove the four screws that fasten the fan housing to the sheet metal cylinder cover.

b) Remove the flexible transparent hose from nozzle plate and the spark plug wire from spark plug.

c) Carefully lift the fan housing from engine, push the spark plug and overspeed switch wires' rubber grommet from housing. Reach inside of housing and disconnect the magneto wire from ignition switch. The fan housing can now be completely removed and cleaned.

d) Remove the four screws that fasten the sheet metal cylinder cover to engine; be careful, the lower two holes have small spacers between the cover and engine.

e) To reassemble; reverse above procedure.

2. Pump: Except for draining the casing during freezing weather, the pump requires only an occasional cleaning.

3. Removal of Pump/Engine Assemble from Mounting Base: a) Place the unit in a horizontal position.

b) Remove the fuel line from the fuel line connector. Catch any fuel spillage with a rag. Dispose of the rag in an approved safety container.

c) Disconnect the overspeed switch wire at the connector. Disconnect the short overspeed switch ground wire by pulling spade connector from the overspeed switch.

d) Remove the overspeed switch tubing from the overspeed switch.

e) Remove the three locknuts from the vibration isolators that fasten them to the pump mounting base. The fuel tank must first be lowered on the frame version by removing the four screws used to retain the straps. This allows access to the locknut on the large vibration isolator.

f) Remove priming hose from the fitting at the pump.

g) Lift the pump/engine assembly from the mounting base.

4. Assembly of Pump/Engine to Mounting Base:

a) Assembly is the reverse of the removal procedure above

5. Repair or replacement of any Components in Pump: (Replacing Mechanical Seal)

a) Remove pump/engine assembly from mounting base. Refer to item 3, ‘’Removal of Pump/Engine Assembly’’

b) Remove the four screws that fasten the volute body to the pump head. Remove the volute body.

c) Remove the impeller retaining screw and washer.
ATTENTION: The impeller screw is left hand thread.

NOTE: To prevent the engine from rotating, when removing the impeller screw, place a long 3/8 screw or 3/8 diameter bar through one of the pump head mounting holes and a flat bar in one of the impeller cavities.

d) Remove impeller by putting hardwood wedges on each side of impeller, between impeller and pump head. The wedges should bear against impeller disc directly behind impeller vanes to prevent damaging the impeller; refer to figure 4. Tap end of engine shaft with a soft (rawhide, rubber) headed mallet, while maintaining pressure with wedges until impeller comes off.

DO NOT PUT TOO MUCH PRESSURE ON WEDGES

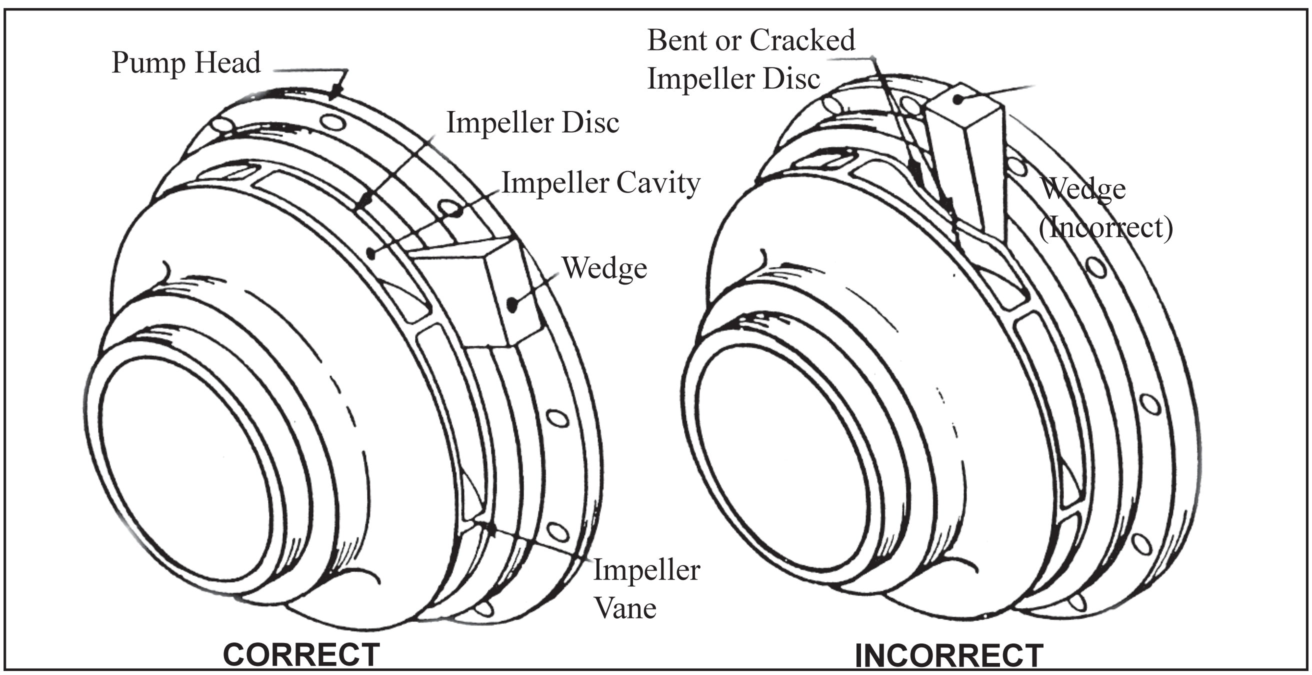


Figure 4

e) With impeller removed, remove the impeller key.

f) Remove the spring and carbon section (sealing washer) of mechanical seal from engine crankshaft sleeve. Observe the ceramic seal seat and carbon sealing washer. If they are scored or lip on the sealing washer is worn or cracked, replace complete assembly.

g) If further disassembly is required beyond mechanical seal replacement, remove the four 5/16-18 X 2 1/2 lg. screws and 5/16 flat brass washers that fasten pump head to engine.

h) If mechanical seal ceramic seat was not removed previously, remove from head.

i) Pull engine crankshaft protection sleeve from shaft.
j) There is a replaceable clearance or wear ring used in this pump. Inspect impeller hub and clearance ring bore, replace if any of these surfaces are scored or worn excessively.

Assembly of Pump to Engine:

a) Coat the engine crankshaft with a thin layer of gasket sealer; such as, Loctite Gasket Eliminator 504.

b) Lubricate the groove in the pump shaft sleeve (048-077000) using a multipurpose grease and install ‘’ O “ ring (0400180-00) in groove. Slide this assembly on engine crankshaft.

c) Position pump head on engine and align holes. If original screws are in good condition, reuse, but apply a thread locking adhesive; such as, Loctite Threadlocker 242 or equal to threads. If original screws were damaged or corroded replace with four new 5/16-18 X 2 1/2 lg. plated nylok screws P.N 018-1424-07. When installing screws use a new 5/16 flat brass washer (097-0810-00) under the head of each screw.
NOTE: Hale has available small tubes of Loctite threadlocker adhesive (0.5cc), Hale P/N 029-0010-01 d) Coat rubber cup of mechanical seal ceramic seal with oil and press into pump head with ceramic surface toward you.

e) Coat rubber on inside of mechanical seal carbon sealing washer with oil and using a turning motion, push onto shaft sleeve until carbon lip comes into contact with ceramic surface.

CAUTION: Keep the ceramic seal seat and carbon sealing washer surfaces clean. Be careful not to crack or chip ceramic surface or carbon wearing lip.

f) Line up keyway of impeller with keyway of shaft, push impeller on shaft. Insert impeller key (017-0060-01) until flush with face of impeller.

g) Coat end of shaft and impeller with thin layer of gasket sealer.

h) Coat the threads of a new impeller screw (018-9350-00) with a thread locking adhesive (Loctite 242 or equal).

i) Mount impeller washer (097-0381-00) and impeller screw, torque impeller screw to loft./lbs.

ATTENTION: The impeller screw is left hand thread.

If impeller clearance ring requires replacement, proceed with the following steps. However, if impeller clearance ring is in good condition proceed to step ''M''.

j) With clearance ring removed from volute body inspect clearance ring pins (064-0310-02), if these are damaged, replace.

k) Apply a thin coat of oil to groove of impeller clearance ring (321-0121-00) and install ''O”-ring (040-2320-00) into groove. Coat the outside of clearance ring and “O ring with oil.

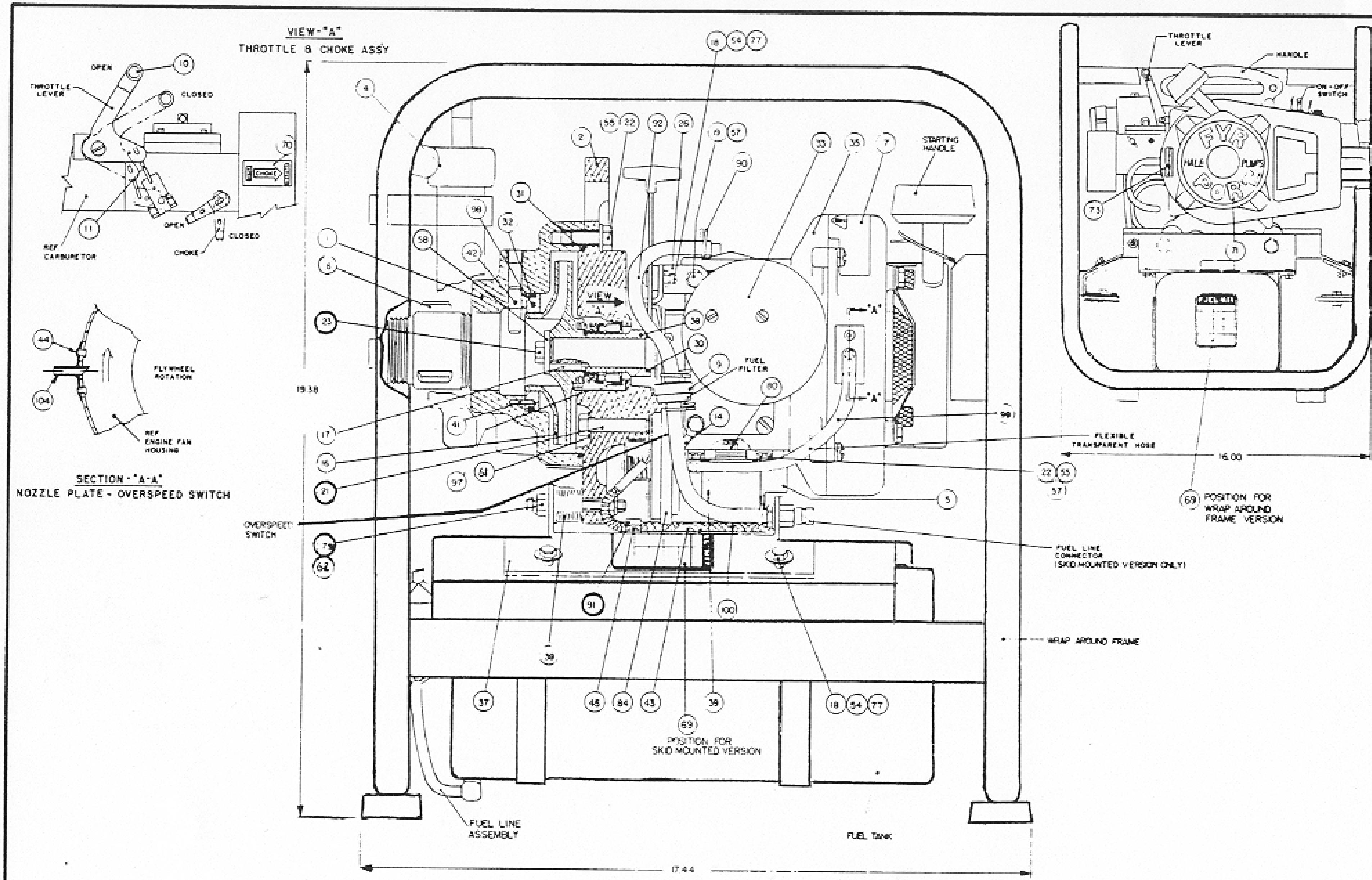
l) Align the holes in impeller clearance ring with pins in volute body and press clearance ring into volute body.

m) Coat the inside of clearance ring bore and outside of impeller hub with oil.

n) Install ''O”-ring (040-1590-00) on pump head pilot and coat ''O”-ring and pump head pilot diameter with either oil or a multipurpose grease.

o) Mount volute body with clearance ring to pump head. Align holes and bolt volute body to pump head using four 3/8-16 X 7/8 lg. stainless steel screws (018-1607-12) and four 3/8 cad plated lock washers (097-0140-01).

p) Install the pump/engine assembly to mounting base. Refer to item 4, ''Assembly of pump/engine to mounting base.''



HALE TYPE 20FP-C8FR FYR PORT

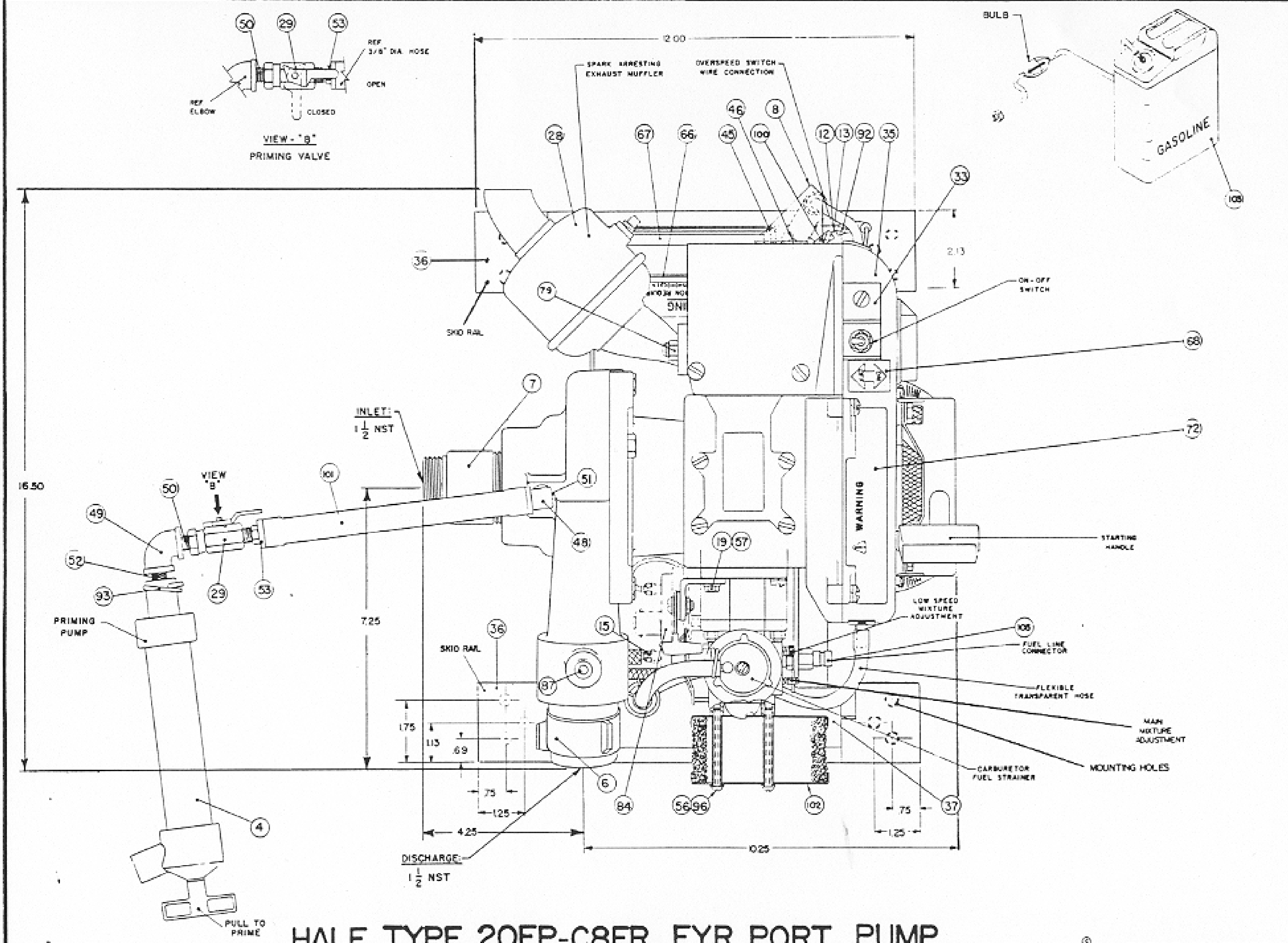
(PICTURED WITH WRAPAROUND FRAME)

HALE FIRE PUMP COMPANY
CONSHOHOCKEN, PA 19428

PLATE NO. 534B

DRAWING 1 OF 2

RAG 7-17-90



HALE TYPE 20FP-C8FR FYR PORT PUMP

(SHOWN WITH SKID RAILS)

PLATE NO. 534B

DRAWING 2 OF 2

©HALE FIRE PUMP CO.
CONSHOHOCKEN, PA.

4-26-90 RAG

PARTS CATALOG

OPERATING INSTRUCTIONS AND PARTS CATALOG

For

MODEL

82038

FYR PORT

ENGINE

"L" Series

CU. IN. DISPLACEMENT

8.20

(134.c.c.)

BORE AND STROKE

2.531 x 1.62

Always mention both the Model Number and Serial Number of your engine when ordering parts.

These numbers are found on the identification plate attached to the engine.

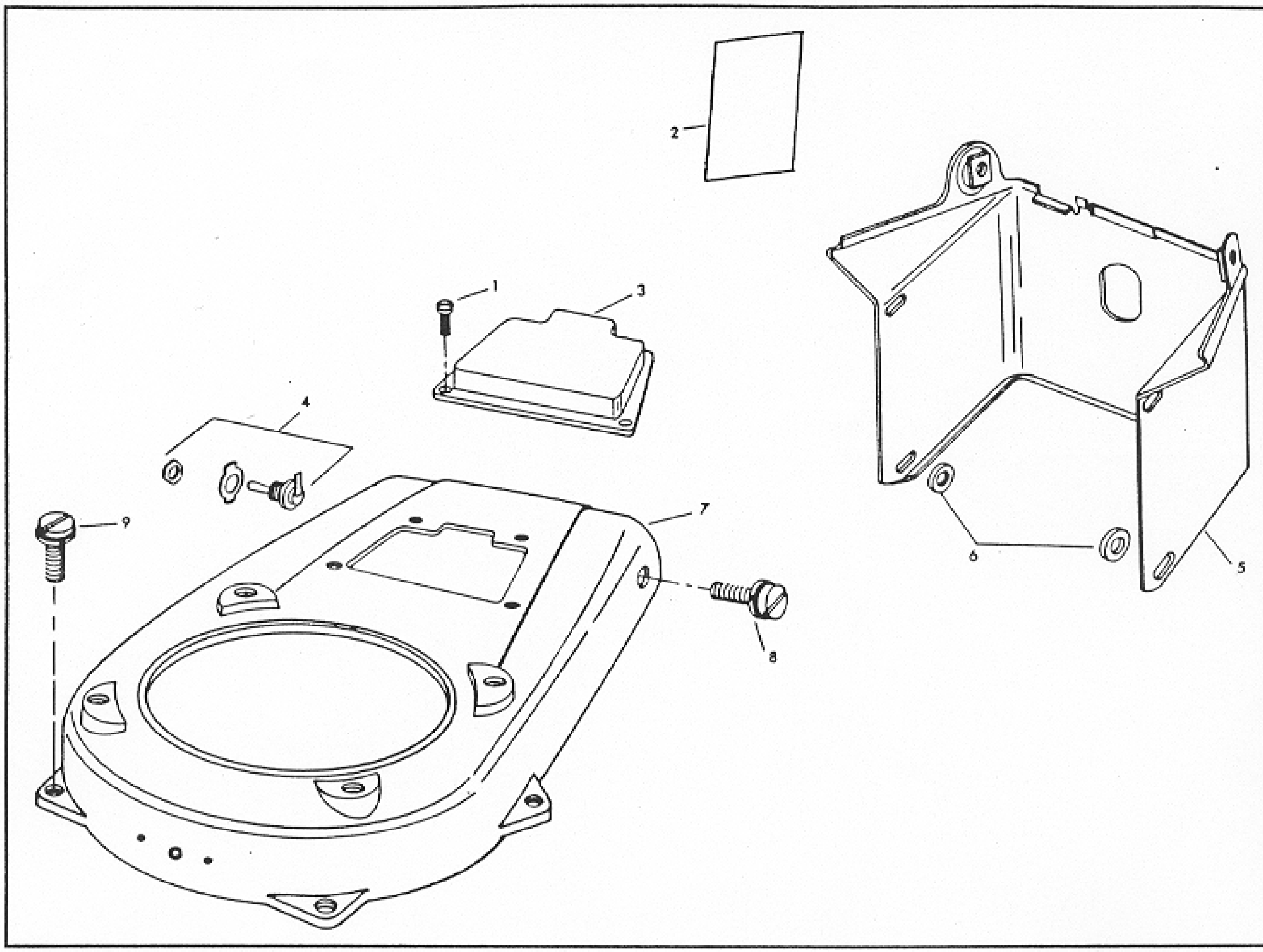
U.S. MARINE CORPORATION

2-CYCLE POWER BEE ENGINES

1/84

PRINTED IN U.S.A

FAN HOUSING

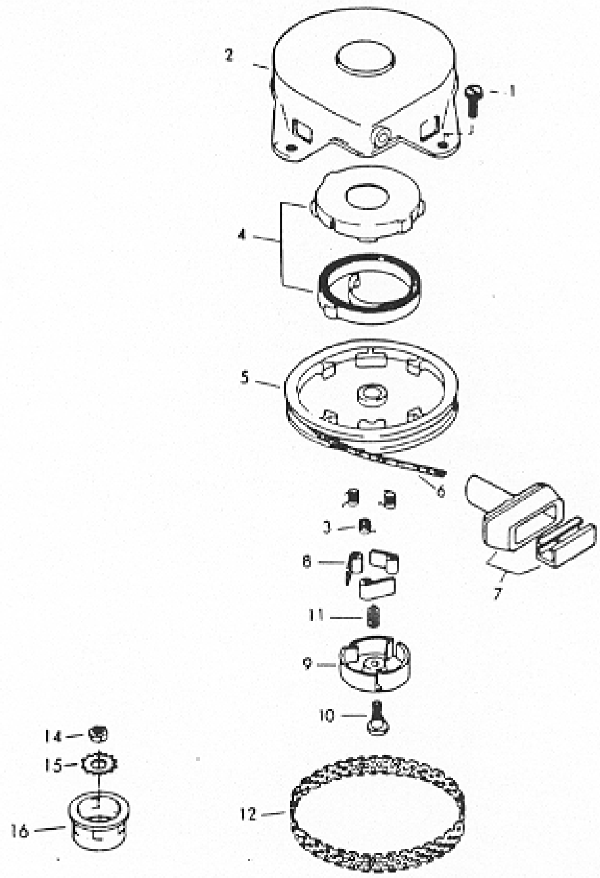


ILLUS. NO.	PART NO.	QTY.	DESCRIPTION
1	1728	3	Screw, #10 x 3/8"
2	174394-1	1	Decal, fuel mixture
3	559408	1	Cover, coil
4	A250449	1	Switch, ignition
5	174648-1	1	Cylinder cover
6	560902	2	Spacers
7	265596	1	Fan housing
8	1096	1	Screw, 1/4 - 20 x 1/2
9	1282	4	Screw, 1/4 - 20 x 5/8

NOTE

To obtain identification plate, call or write to:
US MARINE CORPORATION
105 N. Marine Drive
Hartford, Wisconsin 53027
Attn: Publications Manager

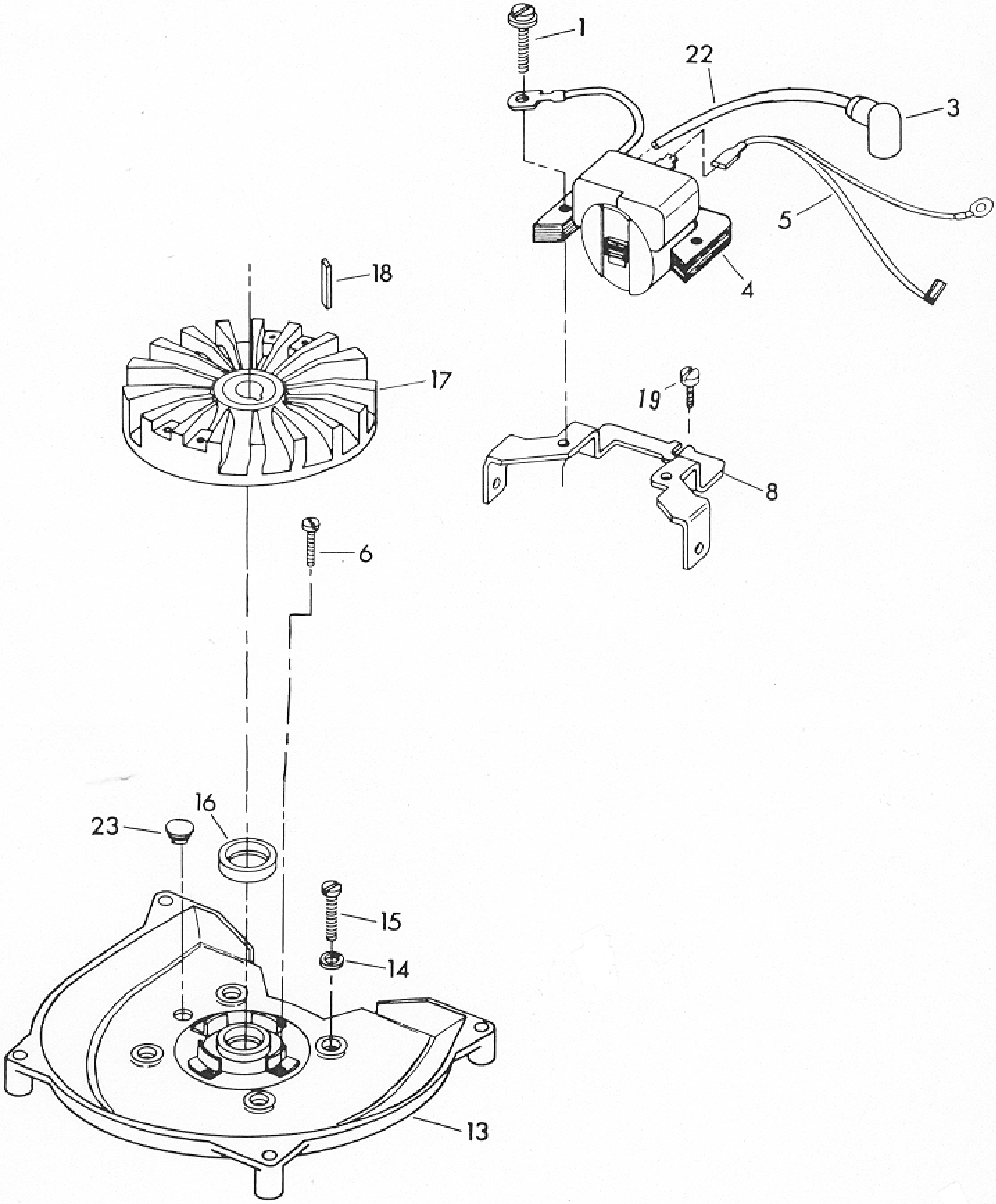
STARTER



ILLUS. NO.	PART NO.	QTY.	DESCRIPTION
1	1655	4	Hex hd. screw w/lockwasher, 1/4 - 20 x 3/8
2*	15614	1	Cover
3*	250424	3	Dog springs
4*	A250970	1	Spring and keeper
5*	15613	1	Pulley w/bearing
6*	15585	1	Cord
7*	A250132	1	T-handle and insert
8*	250421	3	Dog
9*	15612	1	Dog retainer
10*	15611	1	Screw
11*	250003	1	Brake spring
12*	15603	1	Screen
	K264063	1	Starter **complete**, (not shown) inc. illus marked with an (*) asterisk.
14	1351	1	Flywheel nut, 7/16 - 20 L.H.
15	8051	1	Lockwasher
16*	560456	1	Cup

ELECTRICAL

ILLUS. NO.	PART NO.	QTY.	DESCRIPTION
1	1521	2	Pan hd. screw, 8 - 32 x 1/2
2	175899	1	Grommet
3	K750-2	1	Sparkie Kit
4	560475	1	Coil
5	265907	1	Wire, ground lead
6	1927	4	Screw, 10 - 32 x 3/8
7	1877	1	Ty-Rap (not shown)
8	5606501	1	Bracket, coil
13	2A560038-1	1	Support plate, includes item 16 and illus. 2 on page 8
14	1609	4	Ext. tooth lockwasher
15	1156	4	Screw, 1/4 - 20 x 11/16
16	2770146-1	1	Seal, magneto end
17	560097	1	Flywheel
18	128498	1	Key
19	1096	1	Pan hd. screw, 1/4 - 20 x 1/2
20	560841	1	Wire, coil
21	9033	1	Plug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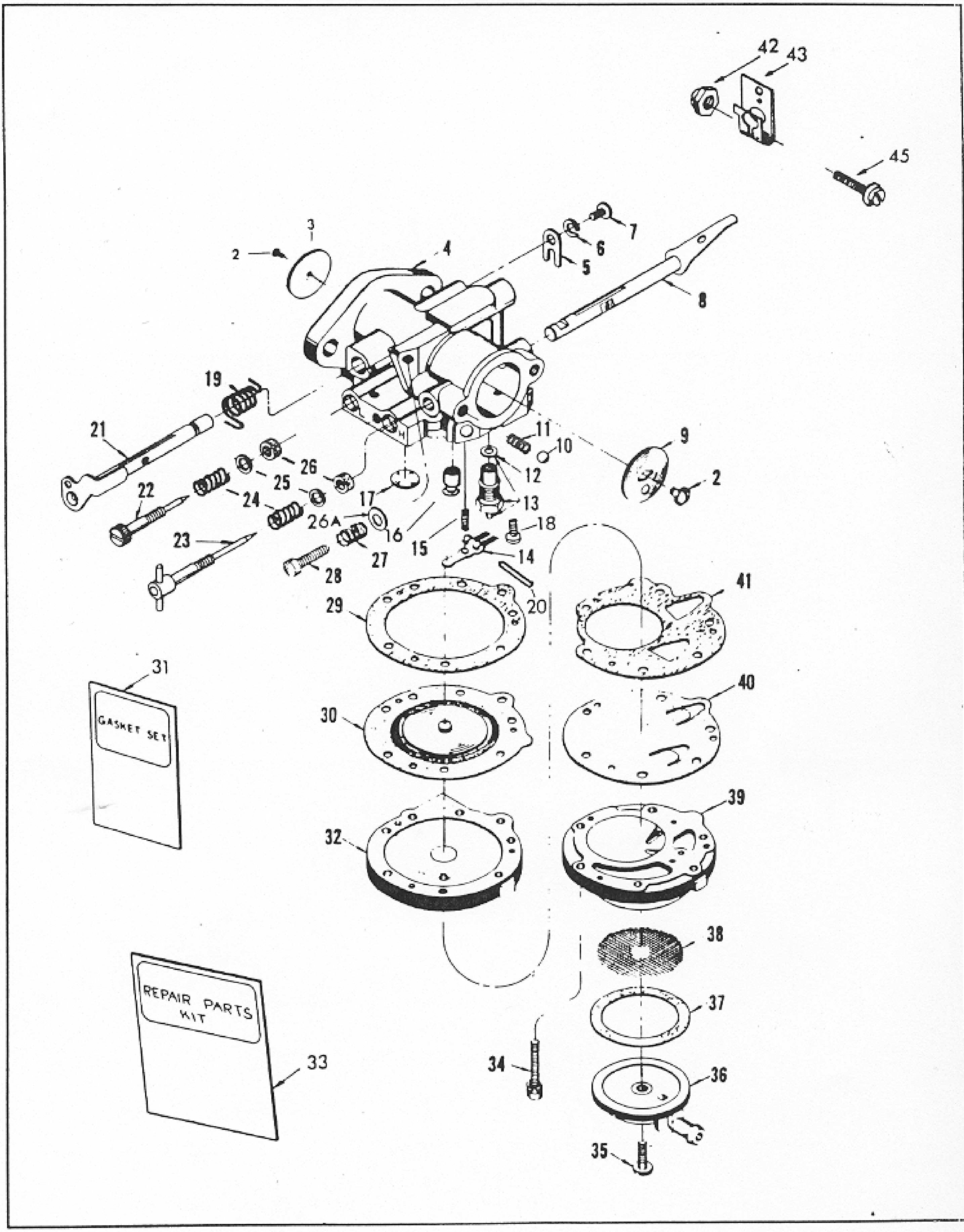
CARBURETOR

ILLUS. NO.	PART NO.	QTY.	DESCRIPTION
1	175906	1	Gasket, carburetor. See page 8, illus. 33.
2	08942	2	Screw w/lockwasher
3	013534	1	Throttle shutter
4	175061-3	1	Carburetor, complete (HL232C)
5	09678	1	Throttle shaft clip
6	0992	1	Lockwasher
7	01974	1	Screw
8	014288	1	Choke shaft and lever
9	013547	1	Choke shutter
10	04784	1	Ball
11	08805	1	Choke friction spring
12	010165	1	Inlet seat gasket
13*	015206	1	Inlet needle, seat and gasket
14*	014020	1	Inlet control lever
15	011503	1	Inlet tension spring
16	018036	1	Nozzle assy.
17*	02531	1	Welch plug
18	013269	1	Inlet control lever fulcrum pin ret. screw
19	013541	1	Throttle shaft return spring
20	013406	1	Pin-fulcrum
21	~~013711~~ - 013091	1	Throttle shaft and lever
22	011498	1	Idle adjustment screw
23	012225	1	Main adjustment screw
24	08793	2	Spring
25**	011428	2	Washer
26**	011401	2	Packing
26A	010404	1	Idle speed screw washer
27	0788	1	Regulating screw spring
28	05095	1	Idle speed regulating screw
29**	012473	1	Diaphragm gasket
30*	012475	1	Diaphragm
31*	K10009	1	Gasket and packing set
32	013228	1	Diaphragm cover
33	K10013	1	Repair parts kit
34	018031	6	Body screw
35	010571	1	Cover retaining screw
36	010527	1	Strainer cover
37**	010529	1	Cover gasket
38	010530	1	Strainer screen
39	013335	1	Fuel pump body
40*	012698	1	Fuel pump diaphragm
41**	012930	1	Fuel pump gasket
42	7011	1	Stop nut, #10 - 24
43	A2770589	1	Throttle shaft arm (with illus. 42 & 45)
45	1733	1	Slotted pan hd. m. screw, 10 - 24 x 9/16

*Indicates Contents of Repair Parts Kit (Item 33)
**Indicates Contents of Gasket Set.

CARBURETOR



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REPAIR PARTS KIT
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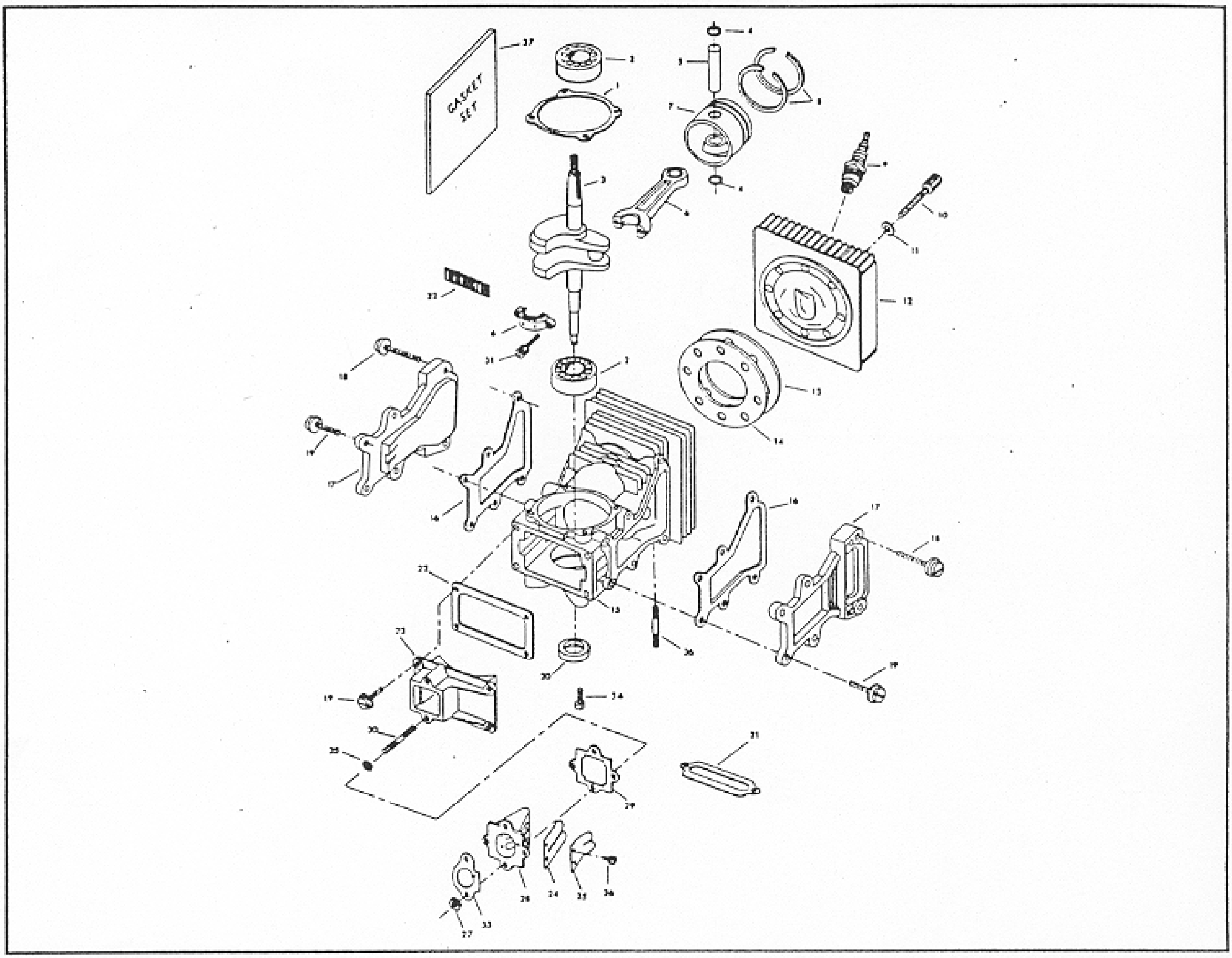
POWER HEAD



ILLUS. NO.	PART NO.	QTY.	DESCRIPTION
1*	175277	1	Bearing cage gasket
2	127910-2	2	Ball bearing
3	258018	1	Crankshaft
4	31410	2	Retaining ring
5	175017	1	Piston pin
6	A174016	1	Connecting rod w/illus. 31
7	175015	1	Piston
8	A175260-1	1	Piston ring set (2 per set)
9	C247227-1	1	Spark plug (Champion RL86)
10	1465	8	Socket hd. cap screw, 1/4 - 20 x 1-1/16
11	8026	8	Plain washer
12	175518-2	1	Cylinder head
13*	175529-062	1	Head gasket
14*	175529-032	1	Head gasket,
15	2A560010	1	Cylinder, includes item 19
16*	175223	2	Gasket
17	560222	2	Cover, transfer port
18	1497	4	Pan hd. screw, w/lockwasher, 1/4 - 20 x 7/8
19	1439	12	Pan hd. screw, w/lockwasher, 1/4 - 20 x 3/4
20	31146	1	Seal, drive end
21*	247279	1	Exhaust gasket
22*	175148	1	Cover gasket
23	2A560157	1	Manifold, w/illus. 30
24	31160-1	2	Reed
25	31161	2	Reed stop
26	1755	4	Round hd. screw, w/lockwasher, 6 - 32 x 5/16
27	1490	2	Hex nut
28	A31158-1	1	Reed plate, includes items 24, 25 and 26
29*	31168	1	Manifold gasket
30	27209-1	2	Stud, carburetor
31	36634	2	Connecting rod cap screw
32	A175228	1	Crankpin roller set (28 rollers)
33*	175906	1	Gasket, carburetor
34	175732	1	Screw, crankshaft retaining L.H.
35	8060	2	Lockwasher (under carb. elbow nut)
36	560273	2	Stud, muffler
37	G819-2	1	Gasket set (not shown). Includes all items marked with an asterisk (*).

OPERATING INSTRUCTIONS

FUEL MIXTURE

In a separate, clean container thoroughly mix 1/3 pint US MARINE CORPORATION Oil (BIA-TCW) or equivalent with each gallon of gasoline.

Use regular grade of gasoline. High test, ethyl gasoline is not recommended.

Strain the fuel mixture through a fine meshed screen when filling gasoline tank on engine to remove dirt and water if present.

PREPARATION FOR STARTING

1. Fill gasoline tank with fuel mixture prepared per above instructions. Wipe up all spilled gasoline.
2. Open gasoline shut-off valve.
3. Move choke lever to closed position.

NOTE: If engine is warm, it may not require choking.

4. Crack open the throttle and crank engine.
5. When engine starts, move choke lever to open position.

NOTE: The normal main adjustment needle settings are approximately one turn open. Occasional readjustment may be required but it is not necessary to readjust for starting except for cold weather starting when it may be necessary to open the high speed adjusting needle an additional 1/8 turn.

TO STOP ENGINE

Switch will stop engine by shorting magneto to ground.

CARBURETOR ADJUSTMENT

1. Turn both adjustment needles clockwise until completely closed.

CAUTION: Do not force needle tightly closed as the seat may be damaged.

2. Turn both needles counterclockwise 1 turn. This is the average setting for proper engine operation.
3. Start engine and allow it to warm up, then, if carburetor setting is too "Lean", engine will not run at full speed and will "Pop", and may stop. Turn main adjustment needle counterclockwise an eighth of a turn at a time until the engine runs smoothly.

   If engine runs at full speed without load, but will not maintain full speed under load, turn the main adjustment needle counterclockwise 1/8 turn.

   If carburetor setting is too "Rich", engine will not develop full power but will roll and run unevenly under load. Turn main adjustment needle clockwise an eighth of a turn at a time until the engine runs smoothly.
4. To verify proper idle needle setting, start engine and allow to warm up. If motor surges and runs at uneven speed, turn the idle adjustment needle slowly clockwise up to 1/4 turn. If this aggravates rather than corrects the situation, return to the original setting, then turn the idle adjustment needle slowly counterclockwise up to 1/4 turn. This should cause the engine to "settle down" and run at a constant speed. If engine fails to accelerate, open idle screw 1/8 turn.
5. If engine runs too fast at idling speed, back out the idle stop screw a little at a time until desired speed is obtained. To increase idling speed turn in the idle stop screw.

SOLID-STATE IGNITION

1. Flywheel to coil lamination gap .006" - .010" -
   (Flywheel magnets to coil lamination)

AIR CLEANER

Under ordinary operating conditions, the air cleane should be cleaned daily. However, under extremely dirt conditions, more frequent cleaning is recommended. ¯ clean the air cleaner, follow equipment manufacturer recommendations.

IMPORTANT: Dirt that enters the engine through th carburetor is one of the greatest causes c engine wear. Therefore, **it is very importar that the air cleaner be serviced regularly**

STARTER SCREEN

The screen keeps dirt, etc., from entering the fan housin and clogging the air cooling passages.

Because this engine is air-cooled, it is necessary to ke this screen clean at all times to permit the unrestricte passage of air into the fan housing.

SPARK PLUG

Check and clean spark plugs regularly. A fouled, dirty c carboned spark plug causes hard starting and poor engir performance.

Set spark plug gap at .030".

STORING MOTOR

The following steps should be taken to prepare yo engine for storage:

1. Close gasoline shut-off valve.
2. Start engine and allow to run until it stops from lack : fuel. This will use up all the fuel in the carburetor ar prevent the formation of deposits due to evaporation : fuel.
3. Disconnect fuel line and permit all fuel to drain from th gasoline tank. Replace fuel line.
4. Remove spark plug and pour 1/4 cup of motor oil in cylinder. Replace spark plug.
5. Crank engine two or three times to distribute c throughout cylinder. This will coat the cylinder wa with oil and prevent rust from forming during th storage period.

TORQUE CHART

FLYWHEEL	420 In. Lbs.
CONNECTING ROD	80-90 In. Lbs.
SPARK PLUG	120-180 In. Lbs.
CYLINDER HEAD	80-90 In. Lbs.

GENERAL SCREWS

10 - 24	30 In. Lbs.	1/4 - 20	70 In. L
10 - 32	35 In. Lbs.	5/16 - 18	160 In. L
		1/4 - 28	75 In. Lt

CHECK LIST

TROUBLE	CAUSE	WHAT TO DO
1. Engine fails to start.	No fuel in tank.	Fill tank.
	Gasoline shut-off valve closed.	Open shut-off valve.
	Fuel line or fuel tank screen clogged.	Clean fuel line and screen.
	Flooded.	Close carburetor main adjustment needle and crank until engine starts. Then turn needle to 1 turn open.
	Spark plug shorted or fouled.	Install new spark plug.
	Spark plug broken (cracked porcelain or electrodes broken).	Replace spark plug.
	Magneto lead wire shorted, broken or disconnected from spark plug.	Replace lead wire or attach to spark plug.
	Magneto inoperative (no spark from lead wire).	Contact the factory or your nearest authorized dealer.
2. Engine hard to start.	Water in gasoline or stale fuel mixture.	Drain entire fuel system and refill with fresh fuel.
	Too much oil in fuel mixture.	Drain and refill with correct mixture.
	Engine over or under choked.	If flooded by over choking, proceed according to instructions in previous section. If under choked, move choke lever to closed position and crank two or three times.
	Carburetor out of adjustment.	See "Operating Instructions" under "Carburetor Adjustment".
	Gasket leaks (carburetor or reed plate gaskets).	Replace gaskets.
	Weak spark at lead wire.	Contact the factory or your nearest authorized dealer.
3. Engine misses.	Dirt in fuel line or carburetor.	Remove and clean.
	Carburetor improperly adjusted.	See "Operating Instructions" under "Carburetor Adjustment".
	Spark plug fouled, broken or incorrect gap setting.	Clean or replace spark plug - set gap to .030".
	Weak or intermittent spark at lead wire.	Contact the factory or your nearest authorized dealer.
4. Engine lacks power.	Air cleaner clogged.	Clean air cleaner.
	Carburetor out of adjustment.	See "Operating Instructions" under "Carburetor Adjustment".
	Muffler clogged.	Clean carbon from muffler.
	Clogged exhaust ports.	Remove muffler, rotate engine until the piston is at bottom of cylinder. With a wooden scraper or blunt tool, remove all carbon from exhaust ports. Be careful not to scratch or damage piston or cylinder walls. Blow and loose carbon with compressed air. Start engine and run briefly to remove all carbon, then install muffler and gasket.
	Poor compression.	Contact the factory or your nearest authorized dealer.
	Flywheel to coil lamination air gap.	Reset .006" - .010".
5. Engine overheats.	Insufficient oil in fuel mixture.	Mix fuel as shown in starting instructions.
	Air flow obstructed.	Clean flywheel and cylinder fins and screen.
6. Engine noisy or knocking.	Loose flywheel.	Tighten flywheel nut.
	Spark plugs incorrect heat range.	Replace with plugs specified for engine.
	Worn bearings, piston rings or cylinder walls.	Contact the factory or your nearest authorized dealer.
	Bent fan housing.	Remove fan housing and straighten bent portion.
7. Engine "stalls" under load.	Carburetor main adjustment too "lean".	See "Operating Instructions" under "Carburetor Adjustment".
	Engine overheats.	See Section 5 above.

2 CYCLE ENGINE

AUTHORIZED CENTRAL SERVICE DISTRIBUTORS

COAST DIESELECT LTD.
1920 MAIN ST.
VANCOUVER, BC. CANADA, V5T-3B9

OTHER COAST DIESELECT LTD.
LOCATIONS IN CANADA.
MUSSISAUGA, TORANTO(ONT.,)
CALGARY, ALBERTA.

MIDCO INC
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PHILADELPHIA, PA. 19130
(215) 232-9615

E.J. SMITH & SONS CO.
4250 GOLF ACRES DRIVE
CHARLOTTE, NC. 28208
(704) 394-3361

SPENCER ENGINE INC.
P.O. BOX 2579
TAMPA, FL. 33601
(813) 253-6035

AUTOMOTIVE ELECTRICAL CORP.
3250 MILLBRANCH ROAD
BOX 161096
MEMPHIS TN. 38116
(901) 345-0300

WISCONSIN MAGNETO INC.
4727 N. TEUTONIA AVE
MILWAUKEE, WI. 53209
(414) 445-2800

ORGINAL EQUIPMENT INC.
905 SECOND AVENUE NORTH
BILLINGS, MT. 59101
(406) 245-3081

MEDART ENGINES & PARTS
100 LARKIN WILLIAMS IN CT.
FENTON, MO. 63026
(314) 343-0515

POWER DISTRIBUTORS INC
102 MAYFIELD AVE.
EDISON, NJ. 08837
(201) 225-4922

PITT AUTO ELECTRIC CO.
2900 STAYTON STREET
PITTSBURGH, PA. 15212
(412) 766-9112

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515 ROMANS ROAD
ELMHURST, IL. 60126
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MEDART ENG. & PARTS OF KANSAS
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LENEXA, KS. 66215
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2 CYCLE ENGINE

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P.O. BOX 1945
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P.O. BOX 10588
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(303) 629-3441

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PORTLAND, OR. 97214
(503) 234-5241

NORTHWEST MOTOR PARTS
P.O. BOX 3816
SEATTLE, WA. 98124
(206) 624-4448

OPERATING AND MAINTENANCE MANUAL

MODEL NO.: FYR PORT
SERIAL NO.____________

⚠ WARNING

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

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

ALWAYS INCLUDE THE PUMP SERIAL NUMBER IN CORRESPONDENCE

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

Limited Warranty

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

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

- Subjected to 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.

SAFETY PRECAUTIONS

Failure to follow the operating, maintenance and lubrication requirements set forth In this operating and Instruction manual may result in serious personnel injury and/or damage to equipment. These “WARNING” statements indicate potentially hazardous conditions for operator or equipment.

TAKE NECESSARY STEPS TO PROTECT PERSONNEL AND EQUIPMENT.

1. Carefully read “Engine Operating Instructions,” before attempting to operate, service, or disassemble the engine or any of its parts.

2. **Warning - Gasoline is a highly combustible fuel.**
   The Improper use, handling, or storage of gasoline can be dangerous. Prevent accidents by following these safety rules:

   A Use gasoline only as a fuel, never as a cleaning fluid.

   B Use only an approved container to hold or store gasoline. Never store gasoline in familiar containers such as milk containers or soda pop bottles.

   C Store gasoline in a cool location, out of the reach of children. Never store gasoline near heat or an open flame.

   D Do not refuel with the engine running. Add fuel to a cool engine only. Spilled fuel on a hot engine or muffler may cause a fire or an explosion. Fill fuel tank out-of-doors and wipe up any spills.

   E Make sure all fuel lines and connectors are secure.

   F Provide a fire extinguisher nearby when working with gasoline. Be sure extinguisher Is In operating condition; chock the pressure gauge or indicator, Be familiar with its proper use. Consult local fire department for the correct type of extinguisher for your application. Extinguishers rated ABC by the NATIONAL FIRE PROTECTION ASSOCIATION are appropriate for most applications.

   G POSITIVELY NO SMOKING!!

3. **DO NOT RUN THE ENGINE IN AN ENCLOSED AREA!!**
   Exhaust fumes contain carbon monoxide that is an odorless poisonous gas. If equipment is located in an enclosed area with an exhaust line to the outside, regularly check the exhaust system for leaks. Be sure the area is well ventilated.

4. Do not operate equipment when mentally or physically fatigued.

5. Stay away from moving parts, avoid wearing loose jackets, shirts and ties.

6. Keep the equipment and surrounding area clean. Cluttered areas invite accidents. Remove all oil deposits from equipment and surrounding area. Accumulations of grease and oil may present a hazard.

7. All visitors should be kept at a safe distance from work area. Keep children away from equipment and discharge hose. Do not allow children to hold discharge hose.

8. Be careful not to touch the exterior of a hot engine, especially the muffler and the surrounding area. The engine is hot enough to be painful or cause injury.

9. Keep power shields and guards in place. Do not make adjustments and repairs while engine is running, unless specified for in repairs. Use extreme caution around hot manifolds and moving parts.

10. Prevent accidental starting by always removing spark plug or by disconnecting and grounding spark plug wire before working on engine or the equipment driven by engine.

11. Maximum speed of the engine is set. Do not tamper with the controls to adjust to run at higher speeds. Excessive speed increases the hazard of personal injury and reduces engine life

12. Familiarize yourself with all controls, learn how to stop engine quickly In a emergency.

13. When shutting off a gasoline engine, be sure It is completely stopped before leaving the work area.

14. Close fuel tank cap vent when storing or transporting.

15. Do not store vertical with fuel in tank.

16. Open fuel tank cap vent when pumping.

17. Check engine fuel level before Initial start-up each day.

18. Do not run pump more than two minutes without placing in water. After engine has been started and is operating smoothly, place pump in at least 4 inches (100 mm.) of water.

19. During freezing weather, drain the pump, throttle actuator tubing, and discharge lines after each use.

20. Flush pump with fresh, clear water if pump has been used to pump salt water or water containing sand.

HALE FYR PORT PUMP MODEL:
20FP-C8FR/C8SK OPERATION AND INSTRUCTION MANUAL
ENGINE DRIVEN,
PORTABLE CENTRIFUGAL PUMPING UNIT

INTRODUCTION

PURPOSE:

This operation and instruction manual is published to guide and assist in the installation, operation, lubrication, maintenance and repair of the Hale FYR PORT pumping unit.

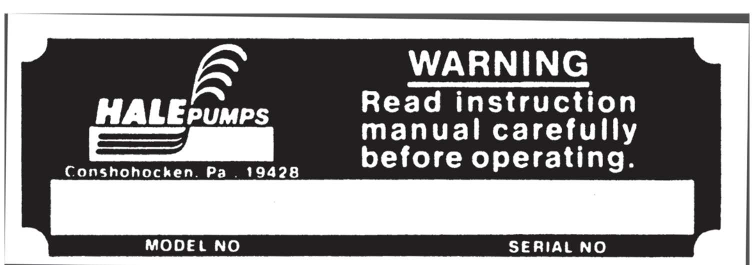
The installer and operator should understand this manual and the engine manufacturer's operating manual before attempting to install or operate the unit.

IDENTIFICATION:

Whenever a question arises regarding your pumping unit, contact your Hale Dealer for the latest available information. This dealer will also be able to advise you of the nearest authorized engine dealer or refer to the supplied list of engine distributors who can provide service for the engine in your pumping unit. Finally, if additional help is needed, contact the Service Department of the Hale Fire Pump Company.

Please supply the complete pump model and serial numbers when requesting information or ordering parts. The pump model and serial numbers are stamped (not cast) on the Hale nameplate or on top of the pump head. For you convenience, fill in the information on the hale nameplate below.

Always mention both the model number and serial number of your engine when ordering engine parts. These numbers are found on the engine identification plate attached to the engine.



To help you identify the parts used in your FYR PORT, a pump parts catalog is included toward the back of this manual. To identify the engine parts used in you pumping unit, refer to the engine manufacturer's parts catalog.

DESCRIPTION

GENERAL:

The FYR PORT is a lightweight, portable, centrifugal pump mounted either on skids or in a wraparound frame. The pumping unit consists of a Hale 20FP single stage centrifugal pump close coupled to an air cooled, 2 cycle, single cylinder, gasoline engine. The unit includes an automatic rewind starter, a spark arresting muffler, engine overspeed control switch, priming pump and priming valve. It is intended for pumping water from draft, relay, or hydrant. The unit will deliver discharge pressures to 220 PSIG and flows to 75 GPM from draft.

The FYR PORT pumping unit consists of 6 major subassemblies; the engine, pump, priming system, mounting base, overspeed control switch and wraparound frame.

ENGINE:

The lightweight engine is a single cylinder, 2 cycle, air-cooled version producing @ 8 hp (6 Kw) from its 8.2 cu. inch (134 cc) displacement using a gasoline/oil mixture fuel.

The engine is equipped with water resistant solid state ignition, a pressure carburetor with built-in fuel pump, and an on/off ignition toggle switch.

The engine’s interior is protected from impurities by the use of a wire mesh element air filter, a 75 micron in-line fuel filter, and an integral fuel strainer built into the fuel pump. PUMP:

The engine crankshaft extension serves as the pump shaft with an enclosed type bronze impeller mounted directly on the shaft. The shaft is protected against corrosion by a bronze sleeve, an ‘’O”-ring, and a mechanical type, self-lubricating and adjusting seal. The impeller is hydraulically sealed by a replaceable, patented, floating, bronze clearance ring located in the inlet of the aluminum volute body. . The volute body is attached to the cast aluminum pump head by four mounting screws.

The pump head, which serves as the mounting bracket for the pump and engine assembly, is attached to the mounting base with rubber vibration and shock mounts. It also incorporates a handle for positioning the unit or carrying short distances.
The pump inlet and discharge connections are either 1 1/2" male national fire hose threads (NST), or 1 1/2" metric threads (ISO 228/1-G 1 1/2 A).

PRIMING SYSTEM:

The priming pump is a hand operated piston pump. Its purpose is to remove air from the pump allowing atmospheric pressure to push water through the inlet hose into the pump.

A priming valve is included which controls air flow through the priming line.

MOUNTING BASE:

The mounting base is an intermediate part to which the engine is attached with three shock-vibration isolation mounts. The base is then attached to the two skids.

The mounting base has the overspeed control switch, priming pump mounting clamps (skid version) and Hale nameplate attached to it.

OVERSPEED CONTROL:

The overspeed switch control assembly is a safeguard against overspeeding of the engine. The overspeed switch is attached to the mounting base of pumping unit below the carburetor. Attached to the front of the overspeed switch is a flexible transparent hose that is connected to the nozzle plate (riveted to the engine fan housing). Connected to the back of the overspeed switch are two wires; one goes to the engine's ignition coil, the other goes to ground (engine). The switch senses the air pressure generated by the engine's cooling fan.

When the engine reaches a speed in excess of that which would normally occur, the fan air pressure generated will be sufficient to cause the switch to close;thereby grounding the solid state ignition. The engine speed will decrease until the air pressure reaches a lower trip point, reactivating the ignition system and the engine will accelerate. The engine will decelerate and accelerate alternately until the operating conditions are returned to their normal mode.

WRAPAROUND FRAME:
The wraparound frame protects the pump, engine and fuel system from damage caused by normal handling. The frame also serves as a convenient means for transporting the FYR PORT unit over long distances.

PREPARATION

INSPECTION OF NEW UNIT:

When unpacking unit do not discard cushioning materials, carton, or case until you are certain everything is correct. Inspect carefully; perfect condition of the outside shipping container does not guarantee undamaged contents. Check for loose, missing, or damaged parts. Also, check the packing slip for any additional parts.

After inspection proves satisfactory discard all shipping material in a proper manner.

> **ATTENTION:** The FYR PORT has been shipped with the engine, carburetor, air filter and fuel systems drained and tagged. Before using, fill with proper quantities and grades of fuel and oil, refer to "Fuel and Lubricant Specifications," page 9. The idle speed, idle and main fuel mixture adjustment screws have been factory set. However, the idle and main fuel mixture adjustment screws may require readjustment, especially for cold weather or high altitudes (see engine manual for adjustment procedure).

IDENTIFICATION OF CONTROLS:

(See plate numbers 534B, 1 of 2 and 2 of 2, in Parts section for location of controls).

EXPLANATION OF CONTROLS:

Air Cleaner: Low restriction cleanable expanded aluminum foil type element.

Carburetor Fuel Strainer: Provides secondary fuel filtering for engine.

Carrying Handle: This is incorporated into the pump head.

Choke: Reduces the amount of air entering the engine to correct the fuel-air ratio for cold start-up.

Discharge Hose Connection: Located on the air cleaner side of the unit for connecting a 1 1/2" NST or ISO hose fitting.

Exhaust Muffler: This is a spark arrester type that also reduces the amount of combustion noise emitted by the engine.

Flexible Transparent Hose: Is connected between the nozzle plate and the overspeed switch control. This allows for visual inspection of dirt and water which may clog hose and reduce amount of pressure reaching switch. Check regularly, and be sure hose is not cracked, crimped, or kinked.

Ignition Toggle Switch: When flipped to the ''ON'' position opens circuit to ground allowing the magneto to develop a spark for the ignition of combustion. Flipped to the ''OFF position closes the circuit to ground magneto.

In-Line Fuel Filter: Provides primary fuel filtering for engine. Nozzle Plate: Riveted to the engine fan housing, directs air pressure to flexible transparent hose and overspeed control.

Overspeed Control: For description refer to ‘’DESCRIPTION - OVERSPEED CONTROL,” page 3.

Starting Handle: Pull to start.

Throttle Lever: Varies the speed of the engine. (Pull up to increase speed). Do not force the lever against the stops.

Fuel Line Connector (Skid Version): Connect the fuel line from the fuel caddie here.

Priming Valve: For description refer to ‘’DESCRIPTION - PRIMING SYSTEM,” page 2.

Priming Pump: for description refer to ‘’DESCRIPTION - PRIMING SYSTEM-.’’ page 2. Pump Inlet: Located at the end of the pump, fitted with 1 1/2" NST or ISO male adapter.

TRANSPORTING

WARNING: Before transporting the FYR PORT (Skid unit) the fuel caddie must be disconnected from the engine, and fuel drained as instructed under ‘’STOPPING PROCEDURE” page 7. Also, allow engine to cool. When carrying the unit in the wraparound frame close the vent on the fuel tank cap. Carry the unit in an upright position by using the frame.

The FYR PORT has a handle for moving and *positioning* the unit. Care should be taken not to drop or strike the engine or pump as damage may result.
When *transporting* the unit by motor vehicle, care should be taken to fasten it down

securely. Follow the manufacturer’s *instructions* for *transporting* the fuel caddie.

OPERATION

INSTALLATION:

1. Choose a suitable location, as near to the source of water as is possible, to place the FYR PORT.

2. Attach hoses. When operating from draft, the inlet hose should slope continuously downward from the pump to the water.

3. Attach fuel line hose when using the Skid mounted unit. CAUTION: Do not attach regular pipe threaded (NPSH/NPT) fittings as they could permanently damage the male threads.

PRIME PUMP:

It is recommended that the pump be primed before starting the engine.

a) PRIMING PROCEDURE:

1. The discharge must be closed either with a discharge valve, shut-off nozzle or by pinching the discharge hose (use a pinch clamp if available).

2. Open priming valve.

3. Operate priming pump until water is discharged from priming pump.

4. Close priming valve.

5. Start engine. See starting procedure.

6. Slowly open discharge valve until a steady stream is discharged.

7. If an unsteady stream is discharged (incomplete prime), open priming valve and operate hand primer to purge remaining air until a steady stream is discharged. Then close priming valve and adjust throttle for desired output.

b) ALTERNATE PRIMING METHOD:

If the inlet hose is fitted with a foot valve, the pump may be primed by jabbing the end of the inlet hose in and out of the water until water expands the discharge hose. The discharge line must be open when this method is used. Again, be sure the priming valve is closed before starting engine.

STARTING PROCEDURE

WARNING: DO NOT RUN THE ENGINE IN AN ENCLOSED AREA!!! Exhaust fumes *contain* carbon monoxide which is an ordorless and poisonous gas. Be sure the area is well ventilated.

1. Make sure there is a fresh mixture of gasoline and oil in the tank. Refer to ‘‘FUEL SPECIFICATIONS.’’ page 9, for proper amounts and type.

WARNING: Do not change or fill fuel caddies or tank while engine is running. Fill them out of doors away from any source of ignition.

2. Connect fuel caddie to fuel line connector on engine base (Skid Unit). Open the air vent on the caddie or tank cap. Squeeze and release the priming bulb until resistance is felt, indicating the fuel line is full. Further action will pump fuel past the check valve into the carburetor, flooding it.

3. Close choke.

NOTE: A warm engine requires less choking than a cold engine. 4. Open throttle slightly (1/4). Closed is down.

5. Move ignition switch to ‘’ON’’ position.

6. Place foot on frame or skid to prevent movement.

7. Pull the starting handle slowly to bleed off some compression; then, pull with a quick short stroke. Repeat as necessary.

8. When engine starts, slowly open choke. 9. Slowly open discharge valve.

10. Set throttle to desired operating point.

NOTE: When operating from draft, especially on high lifts, do not increase engine speed without a corresponding increase in pump pressure. If the engine speed increases with no increase in flow or pressure reduce the throttle setting until the pressure of flow decreases slightly and operate at that point.

STOPPING PROCEDURE

1. Idle engine by pushing throttle lever down.

2. Move ON/OFF switch to off position.

3. Disconnect fuel caddie quick disconnect coupling, close cap and store fuel line (skid unit). Simply close the fuel tank vent on the frame unit.

4. Restart engine, with water flowing through pump, and allow to idle until it stops from lack of fuel (skid unit).

5. Allow lines to drain. Disconnect hoses.

CAUTION: Be careful not to touch the, exterior of the engine, especially the muffler and the surrounding area. The engine is hot enough to cause injury.

6. Without inlet and discharge caps in place, drain pump by tilting inlet end of pump downward. Open the priming valve and operate the priming pump until all water is discharged. When pump is drained, replace caps to prevent damage to threads.

RELAY PROCEDURE

For pumping water over long distances or up high vertical rises, it may be necessary to use several pumps in series.

When this is done, pressure, (not exceeding 100 PSI), should be maintained at the inlet of the second and subsequent pumps. PREPARATION FOR STORAGE:

WARNING: Prevent accidental starting by always removing spark plug or by disconnecting and grounding spark plug wire before working on engine or pump.

NOTE: Replace the spark plug or wire only after all preparation is completed on both pump and engine.

1. Fuel System:

If the unit is to be stored for any length of time, drain the fuel system by running until it stops as instructed in STOPPING PROCEDURE''. The wraparound frame unit can be run until the fuel tank is empty and it stops due to lack of fuel.

2. Engine:

See engine manual for storage instructions.

3. Pump:

a) Follow the procedure under 'Maintenance-Daily or every 8 Hours'', item 2 ''Pump inlet.''

b) Drain water from pump thoroughly. After the flow has ceased, pump should be turned over a few revolutions so that all water will drain from impeller.

c) While turning the pump over, using the starting handle spray into the pump inlet and discharge tube with a white lithium or silicone type lubricant.
This treatment coats the inside of the pump and tends to prevent the clearance ring and impeller hub from sticking due to corrosion.

d) Spray the threads of the inlet and discharge connections with either a white lithium or silicone type lubricant.

LUBRICATION AND MAINTENANCE

FUEL AND LUBRICANT SPECIFICATIONS:

GASOLINE: Use clean, fresh, ‘’regular grade leaded’’ or ‘’low lead “ type. When “regular “ or ‘’ low-lead “ is unavailable an “unleaded” type fuel may be used; however, it should be limited to emergency use only. Oil must be mixed with the gasoline, refer to fuel mixture below.

OIL: Use a good quality outboard motor oil or equivalent. The oil should meet the Boating Institute of America (BIA) classification type TC-W. Gasoline must be mixed with the oil, refer to fuel mixture below.

FUEL MIXTURE:

The engine used in the FYR PORT requires that oil be mixed with the gasoline. For ease of starting, it is desirable to have a fresh mixture of fuel: therefore, mix only an amount of fuel you anticipate using in the near future. As a guide, the engine consumes approximately one gallon (3.8 L.) per hr. at full throttle (depending on load), less at partial throttle.

To mix fuel, add oil to a small amount of gasoline in the fuel caddie, then add the rest of the gasoline and shake well. Also, if the fuel caddie has been sitting still for an extended period, shake container before filling.

The correct ratio of oil to gasoline is one (1) part oil to 24 parts gasoline (1:24). Table 1 shows various quantities of fuel mixture and the amount of oil and gasoline required.

APPROXIMATE QUANTITY OF FUEL DESIRED	**OIL**	**GASOLINE**
ONE GALLON (PLUS) (3.9 LITERS)	5 OZ. (158 ML)	1 GALLON (3.8 L.)
THREE GALLONS (PLUS) (11.8 LITERS)	16 OZ. (473 ML)	3 GALLONS (11.4 L.)
FIVE GALLONS (PLUS) (19.7 LITERS)	27 OZ. (789 ML) (18.9	5 GALLONS

TABLE 1

SAFETY PRECAUTIONS:
1. DO NOT RUN THE ENGINE IN AN ENCLOSED AREA. Be sure the area is well ventilated.

2. Stay away from moving parts. Avoid wearing loose jackets, shirts and ties.

3. Keep the equipment and surrounding area clean. Cluttered areas invite accidents.

4. Keep power shields and guards in place. Do not make adjustments and repairs while the engine is running, unless specified for in repairs.

5. Do not run the pump more than two min. without water in pump.

6. Be careful not to touch the exterior of a hot engine, especially the muffler and the surrounding area.

7. Prevent accidental starting by always removing spark plug or by disconnecting and grounding spark plug wire before working on engine or pump.

8. When working on any part of the fuel system be sure the unit is cool. Remove any sources of heat or flame.

<u>ABSOLUTELY NO SMOKING</u>

Reassembly Note:

Before reassembly begins, visually inspect parts. See that parts are clean; all sealing surfaces are free of corrosion and nicks. Remove any metal chips from casting cavities and tapped holes. Also inspect for any damaged or excessively worn parts which should be replaced.

Refer to ''Parts Catalog'' Plate NO. 534B, 1 of 2 of 2, for component parts' location and orientation.

MAINTENANCE SCHEDULE;
Daily or Every 8 hours:

1. Leaks - (gaskets, fuel, seals, washers, and water) Check for any leaks before operating unit. These leaks must be repaired before operating.

2. Pump Inlet:
a) Remove any debris that might collect in the inlet, impeller eye, or the inlet hose strainer.

Monthly or Every 25 Hours:

1. Expanded aluminum foil element: Clean as follows.
   Note: Service air cleaner more often under dusty conditions.

a) Remove (2) screws and washers so foil element and end plates can be removed.

b) Wash foil element in kerosene or liquid detergent and water.

c) Dry foil element by shaking out excess water. Use compressed air if available.

d) Install foil element, end plates, screws and washers on carburetor.

2. Spark Plug: Clean and regap at .030 inch (.8 mm). Spark plug type is Champion #RL-86C, NGK#BR5HS, AC#R46FF, motorcraft #AER6, and Fram-Autolite #426. CAUTION: Do not blast clean spark plug. Blasting material could lodge in recesses of plug and eventually work loose, damaging aluminum bore. Spark plug should be cleaned by scraping or wire brushing and washing with a commercial solvent.

3. Fuel Filters: General:
   a) Place the unit in a horizontal position.
   b) Disconnect fuel caddie.
   c) Place a rag under the carburetor and fuel line to catch any fuel spillage.
   d) Refer to filter maintenance below.
   e) Wipe up any additional fuel spillage and discard rag in an approved safety container.

In-Line Fuel Filter:

a) Remove the two clamps from both sides of filter and pull hoses using a slight twisting motion.

b) Observe hoses for any signs of cracking or deterioration and replace if necessary.

c) Install a new filter with the word ''IN'' toward fuel caddie connection. Replace clamps.

Carburetor Fuel Strainer:

a) Remove the screw holding the plastic cover in place (where the fuel line connects to carburetor). Gently remove the cover, gasket, and strainer screen.

b) Clean screen in a nonflammable solvent, blow dry.

c) Replace strainer screen, gasket, cover and screw.

4. Hoses, Fittings, and Tubes: Clean and check all hoses, fittings and tubes for signs of cracks, kinks, deterioration, etc. They should have uniform bends; If any are kinked or collapsed they should be replaced. Fittings and clamps should be tight, but not overtight.

Seasonal or as Required:

1. Engine cooling system: Clean the starter screen, flywheel (fan), and engine cooling fins. Foreign matter may clog cooling system after prolonged service. Continued operation with a clogged cooling system causes severe overheating and possible engine damage.

a) Remove the four screws that fasten the fan housing to the sheet metal cylinder cover.

b) Remove the flexible transparent hose from nozzle plate and the spark plug wire from spark plug.

c) Carefully lift the fan housing from engine, push the spark plug and overspeed switch wires' rubber grommet from housing. Reach inside of housing and disconnect the magneto wire from ignition switch. The fan housing can now be completely removed and cleaned.

d) Remove the four screws that fasten the sheet metal cylinder cover to engine; be careful, the lower two holes have small spacers between the cover and engine.

e) To reassemble; reverse above procedure.

2. Pump: Except for draining the casing during freezing weather, the pump requires only an occasional cleaning.

3. Removal of Pump/Engine Assemble from Mounting Base: a) Place the unit in a horizontal position.

b) Remove the fuel line from the fuel line connector. Catch any fuel spillage with a rag. Dispose of the rag in an approved safety container.

c) Disconnect the overspeed switch wire at the connector. Disconnect the short overspeed switch ground wire by pulling spade connector from the overspeed switch.

d) Remove the overspeed switch tubing from the overspeed switch.

e) Remove the three locknuts from the vibration isolators that fasten them to the pump mounting base. The fuel tank must first be lowered on the frame version by removing the four screws used to retain the straps. This allows access to the locknut on the large vibration isolator.

f) Remove priming hose from the fitting at the pump.

g) Lift the pump/engine assembly from the mounting base.

4. Assembly of Pump/Engine to Mounting Base:

a) Assembly is the reverse of the removal procedure above

5. Repair or replacement of any Components in Pump: (Replacing Mechanical Seal)

a) Remove pump/engine assembly from mounting base. Refer to item 3, ‘’Removal of Pump/Engine Assembly’’

b) Remove the four screws that fasten the volute body to the pump head. Remove the volute body.

c) Remove the impeller retaining screw and washer.
ATTENTION: The impeller screw is left hand thread.

NOTE: To prevent the engine from rotating, when removing the impeller screw, place a long 3/8 screw or 3/8 diameter bar through one of the pump head mounting holes and a flat bar in one of the impeller cavities.

d) Remove impeller by putting hardwood wedges on each side of impeller, between impeller and pump head. The wedges should bear against impeller disc directly behind impeller vanes to prevent damaging the impeller; refer to figure 4. Tap end of engine shaft with a soft (rawhide, rubber) headed mallet, while maintaining pressure with wedges until impeller comes off.

DO NOT PUT TOO MUCH PRESSURE ON WEDGES

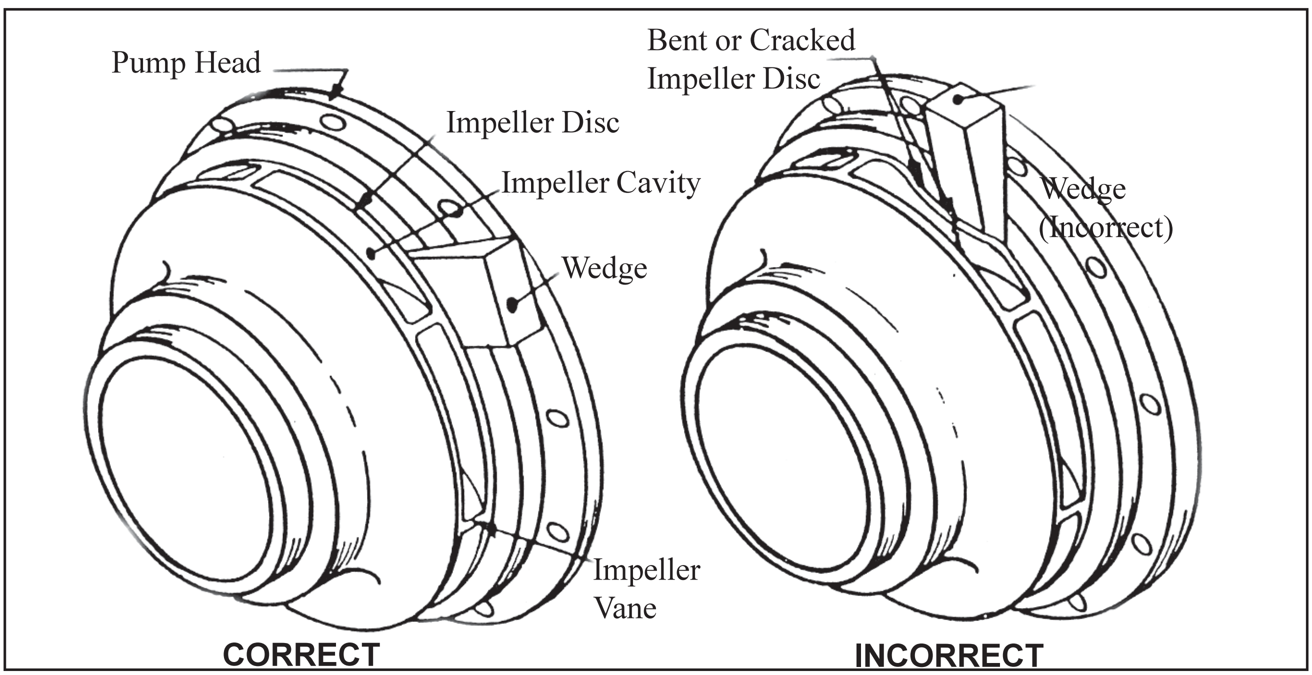


Figure 4

e) With impeller removed, remove the impeller key.

f) Remove the spring and carbon section (sealing washer) of mechanical seal from engine crankshaft sleeve. Observe the ceramic seal seat and carbon sealing washer. If they are scored or lip on the sealing washer is worn or cracked, replace complete assembly.

g) If further disassembly is required beyond mechanical seal replacement, remove the four 5/16-18 X 2 1/2 lg. screws and 5/16 flat brass washers that fasten pump head to engine.

h) If mechanical seal ceramic seat was not removed previously, remove from head.

i) Pull engine crankshaft protection sleeve from shaft.
j) There is a replaceable clearance or wear ring used in this pump. Inspect impeller hub and clearance ring bore, replace if any of these surfaces are scored or worn excessively.

Assembly of Pump to Engine:

a) Coat the engine crankshaft with a thin layer of gasket sealer; such as, Loctite Gasket Eliminator 504.

b) Lubricate the groove in the pump shaft sleeve (048-077000) using a multipurpose grease and install ‘’ O “ ring (0400180-00) in groove. Slide this assembly on engine crankshaft.

c) Position pump head on engine and align holes. If original screws are in good condition, reuse, but apply a thread locking adhesive; such as, Loctite Threadlocker 242 or equal to threads. If original screws were damaged or corroded replace with four new 5/16-18 X 2 1/2 lg. plated nylok screws P.N 018-1424-07. When installing screws use a new 5/16 flat brass washer (097-0810-00) under the head of each screw.
NOTE: Hale has available small tubes of Loctite threadlocker adhesive (0.5cc), Hale P/N 029-0010-01 d) Coat rubber cup of mechanical seal ceramic seal with oil and press into pump head with ceramic surface toward you.

e) Coat rubber on inside of mechanical seal carbon sealing washer with oil and using a turning motion, push onto shaft sleeve until carbon lip comes into contact with ceramic surface.

CAUTION: Keep the ceramic seal seat and carbon sealing washer surfaces clean. Be careful not to crack or chip ceramic surface or carbon wearing lip.

f) Line up keyway of impeller with keyway of shaft, push impeller on shaft. Insert impeller key (017-0060-01) until flush with face of impeller.

g) Coat end of shaft and impeller with thin layer of gasket sealer.

h) Coat the threads of a new impeller screw (018-9350-00) with a thread locking adhesive (Loctite 242 or equal).

i) Mount impeller washer (097-0381-00) and impeller screw, torque impeller screw to loft./lbs.

ATTENTION: The impeller screw is left hand thread.

If impeller clearance ring requires replacement, proceed with the following steps. However, if impeller clearance ring is in good condition proceed to step ''M''.

j) With clearance ring removed from volute body inspect clearance ring pins (064-0310-02), if these are damaged, replace.

k) Apply a thin coat of oil to groove of impeller clearance ring (321-0121-00) and install ''O"-ring (040-2320-00) into groove. Coat the outside of clearance ring and "O ring with oil.

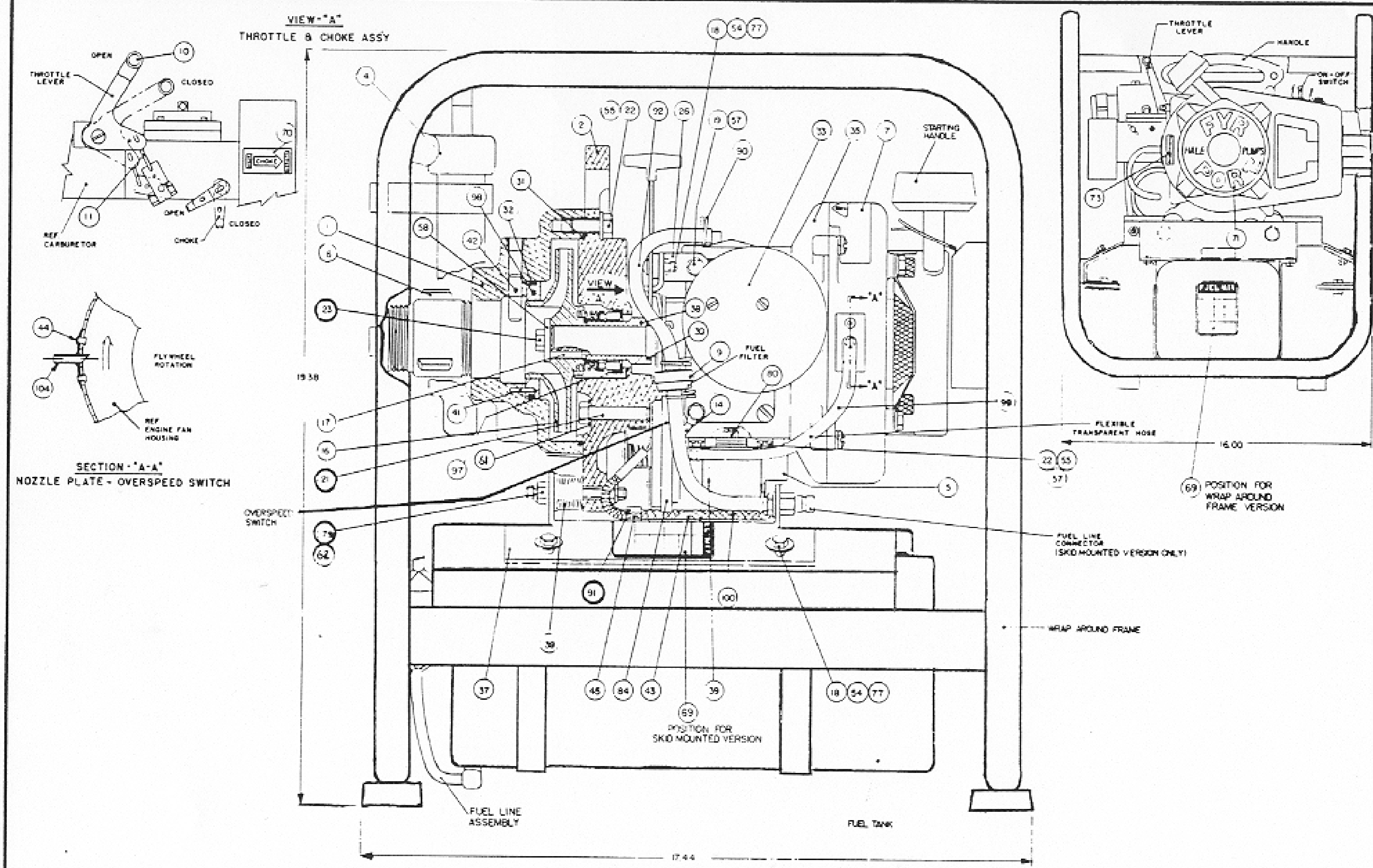
l) Align the holes in impeller clearance ring with pins in volute body and press clearance ring into volute body.

m) Coat the inside of clearance ring bore and outside of impeller hub with oil.

n) Install ''O"-ring (040-1590-00) on pump head pilot and coat ''O"-ring and pump head pilot diameter with either oil or a multipurpose grease.

o) Mount volute body with clearance ring to pump head. Align holes and bolt volute body to pump head using four 3/8-16 X 7/8 lg. stainless steel screws (018-1607-12) and four 3/8 cad plated lock washers (097-0140-01).

p) Install the pump/engine assembly to mounting base. Refer to item 4, ''Assembly of pump/engine to mounting base.''



HALE TYPE 20FP-C8FR FYR PORT

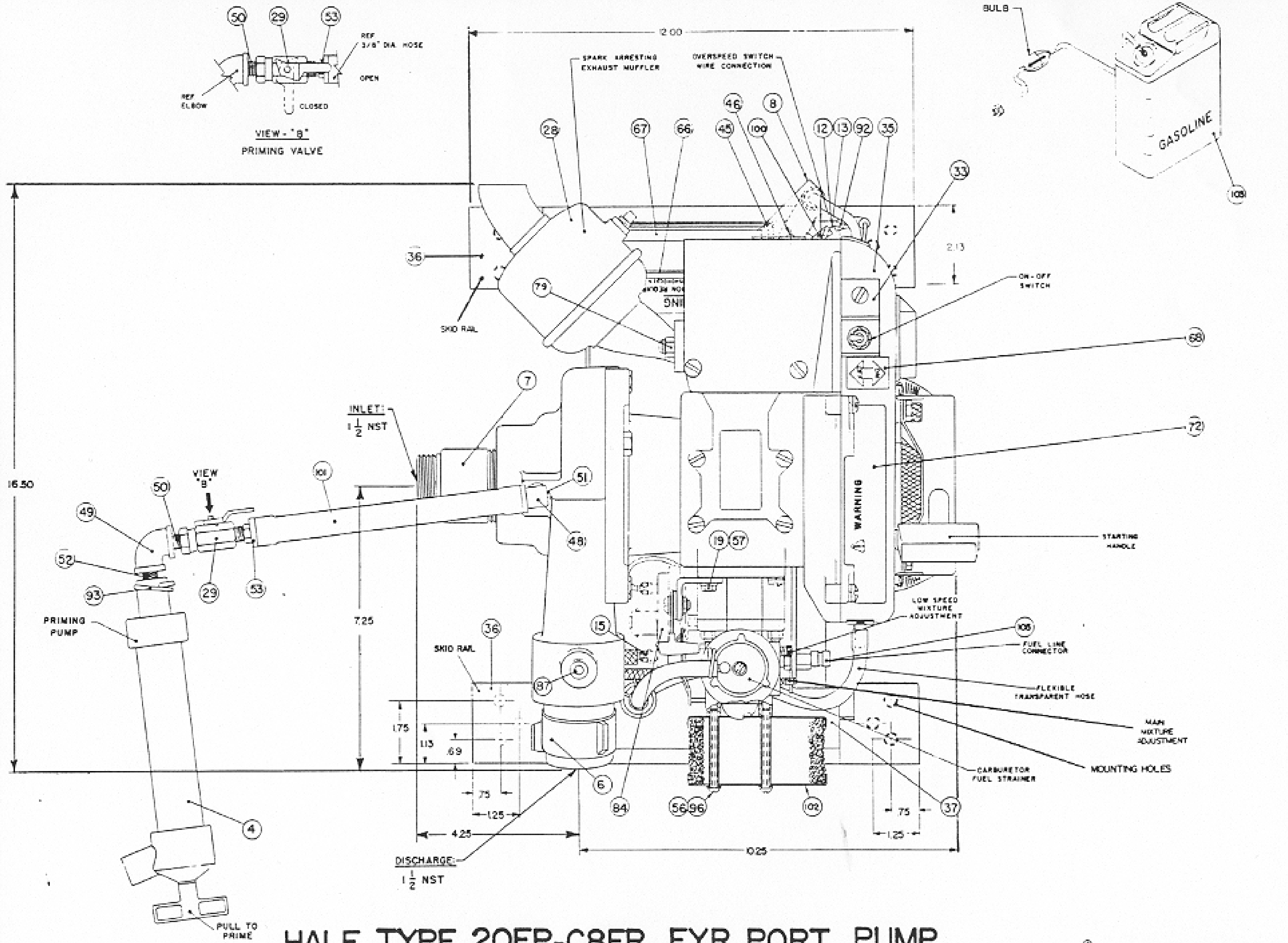
(PICTURED WITH WRAPAROUND FRAME)

HALE FIRE PUMP COMPANY
CONSHOHOCKEN, PA 19428

PLATE NO. 534B

DRAWING 1 OF 2

RAG 7-17-90



HALE TYPE 20FP-C8FR FYR PORT PUMP

(SHOWN WITH SKID RAILS)

©HALE FIRE PUMP CO.
CONSHOHOCKEN, PA.

PLATE NO. 534B

DRAWING 2 OF 2

4-26-90 RAG

PARTS CATALOG

ENG 413

OPERATING INSTRUCTIONS AND PARTS CATALOG

For

MODEL

82038

FYR PORT

ENGINE

"L" Series

CU. IN. DISPLACEMENT

8.20

(134.c.c.)

BORE AND STROKE

2.531 x 1.62

Always mention both the Model Number and Serial Number of your engine when ordering parts.

These numbers are found on the identification plate attached to the engine.

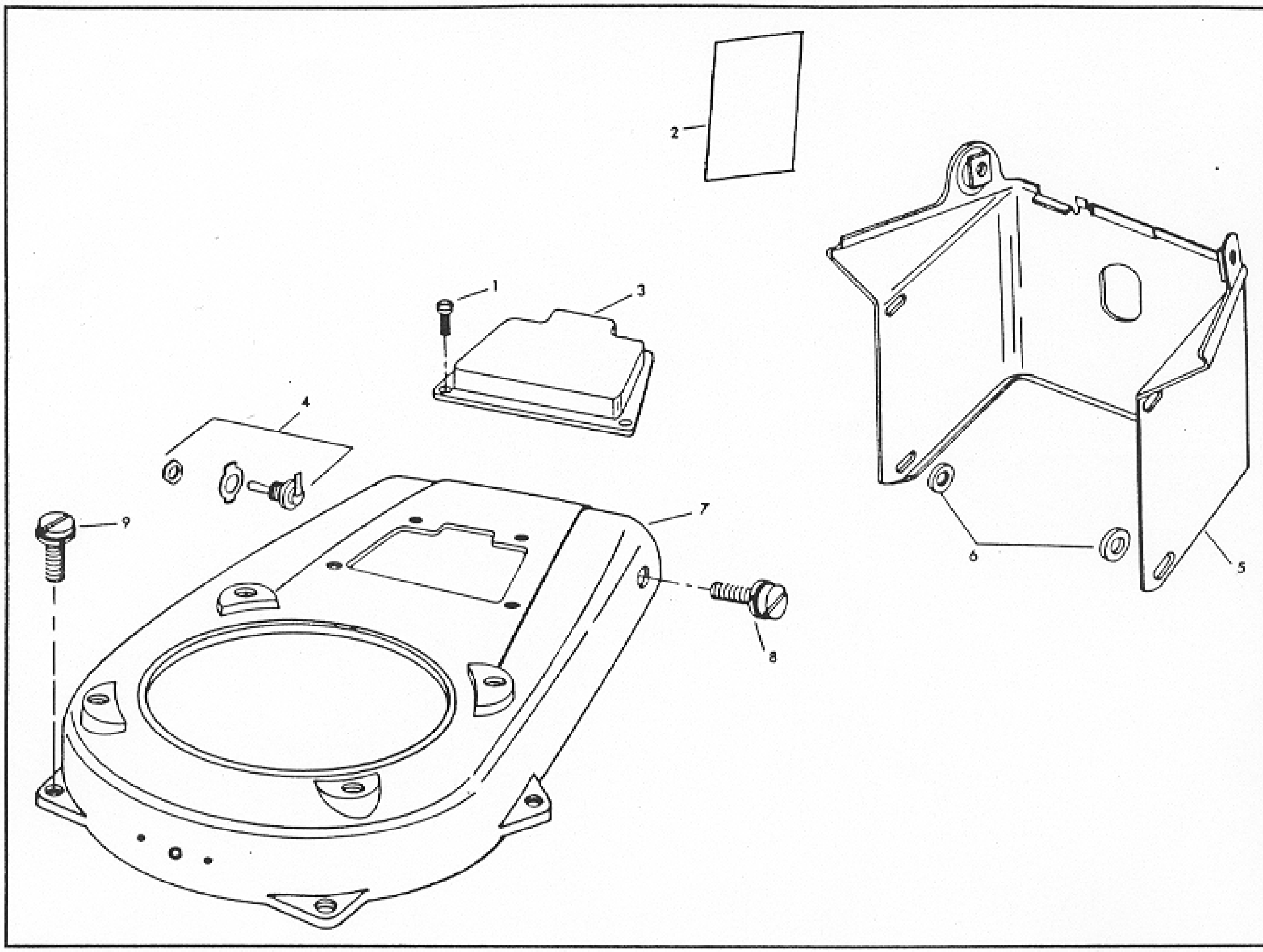
U.S. MARINE CORPORATION

2-CYCLE POWER BEE ENGINES

1/84

PRINTED IN U.S.A

FAN HOUSING

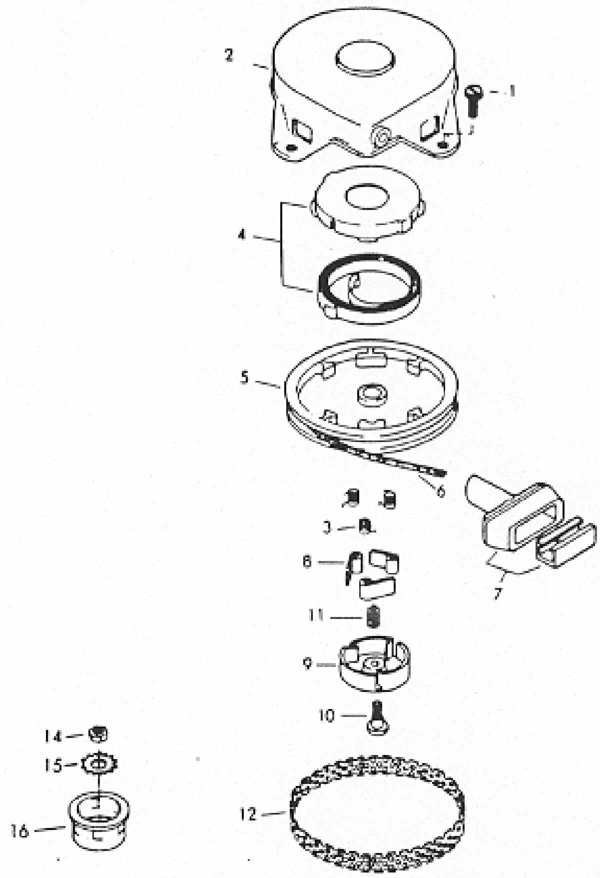


ILLUS. NO.	PART NO.	QTY.	DESCRIPTION
1	1728	3	Screw, #10 x 3/8"
2	174394-1	1	Decal, fuel mixture
3	559408	1	Cover, coil
4	A250449	1	Switch, ignition
5	174648-1	1	Cylinder cover
6	560902	2	Spacers
7	265596	1	Fan housing
8	1096	1	Screw, 1/4 - 20 x 1/2
9	1282	4	Screw, 1/4 - 20 x 5/8

NOTE

To obtain identification plate, call or write to:
US MARINE CORPORATION
105 N. Marine Drive
Hartford, Wisconsin 53027
Attn: Publications Manager

STARTER

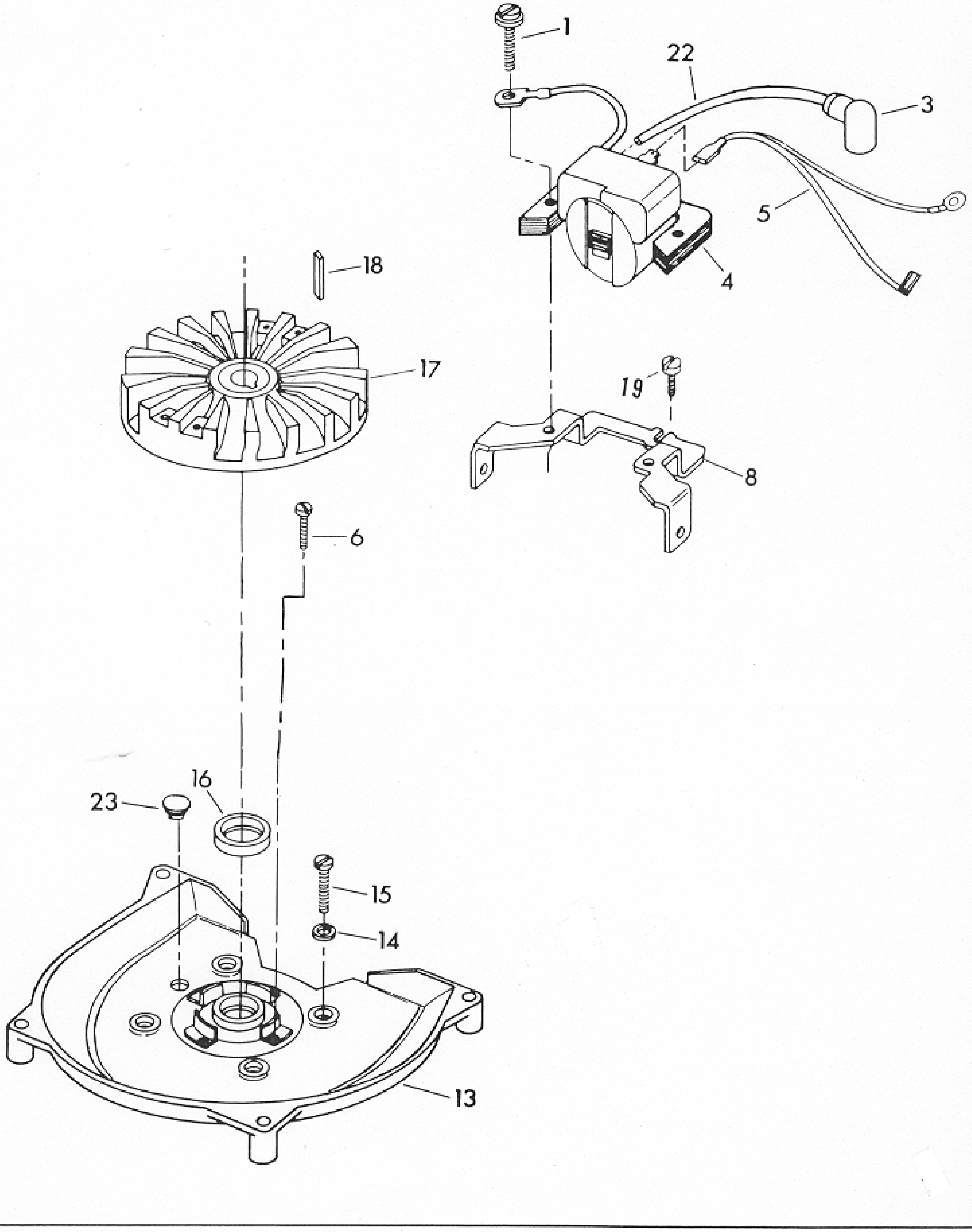


ILLUS. NO.	PART NO.	QTY.	DESCRIPTION
1	1655	4	Hex hd. screw w/lockwasher, 1/4 - 20 x 3/8
2*	15614	1	Cover
3*	250424	3	Dog springs
4*	A250970	1	Spring and keeper
5*	15613	1	Pulley w/bearing
6*	15585	1	Cord
7*	A250132	1	T-handle and insert
8*	250421	3	Dog
9*	15612	1	Dog retainer
10*	15611	1	Screw
11*	250003	1	Brake spring
12*	15603	1	Screen
	K264063	1	Starter **complete**, (not shown) inc. illus marked with an (*) asterisk.
14	1351	1	Flywheel nut, 7/16 - 20 L.H.
15	8051	1	Lockwasher
16*	560456	1	Cup

ELECTRICAL

ILLUS. NO.	PART NO.	QTY.	DESCRIPTION
1	1521	2	Pan hd. screw, 8 - 32 x 1/2
2	175899	1	Grommet
3	K750-2	1	Sparkie Kit
4	560475	1	Coil
5	265907	1	Wire, ground lead
6	1927	4	Screw, 10 - 32 x 3/8
7	1877	1	Ty-Rap (not shown)
8	5606501	1	Bracket, coil
13	2A560038-1	1	Support plate, includes item 16 and illus. 2 on page 8
14	1609	4	Ext. tooth lockwasher
15	1156	4	Screw, 1/4 - 20 x 11/16
16	2770146-1	1	Seal, magneto end
17	560097	1	Flywheel
18	128498	1	Key
19	1096	1	Pan hd. screw, 1/4 - 20 x 1/2
20	560841	1	Wire, coil
21	9033	1	Plug

Order by Part Number and Name, giving Motor Model and Serial Number.

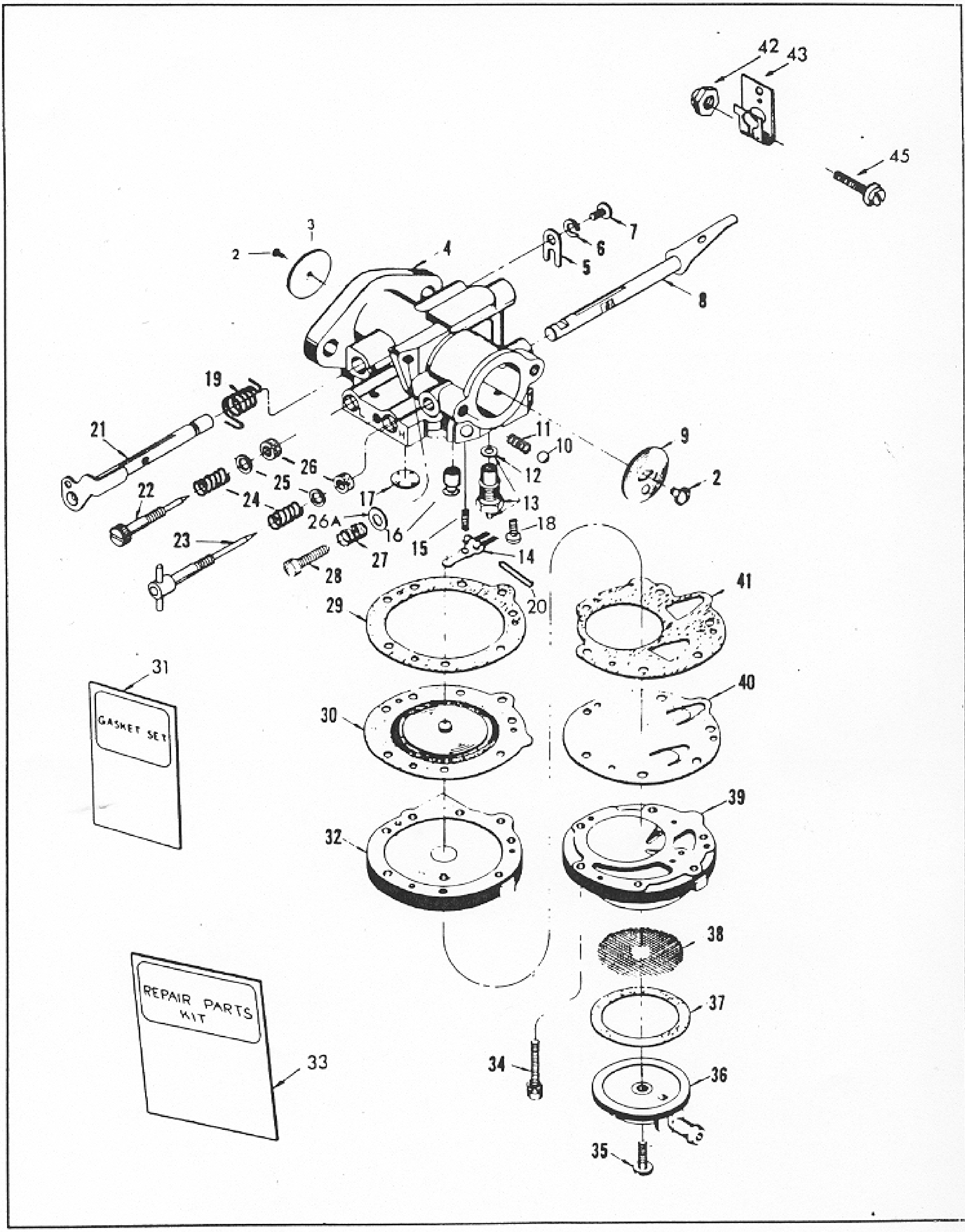


CARBURETOR

ILLUS. NO.	PART NO.	QTY.	DESCRIPTION
1	175906	1	Gasket, carburetor. See page 8, illus. 33.
2	08942	2	Screw w/lockwasher
3	013534	1	Throttle shutter
4	175061-3	1	Carburetor, complete (HL232C)
5	09678	1	Throttle shaft clip
6	0992	1	Lockwasher
7	01974	1	Screw
8	014288	1	Choke shaft and lever
9	013547	1	Choke shutter
10	04784	1	Ball
11	08805	1	Choke friction spring
12	010165	1	Inlet seat gasket
13*	015206	1	Inlet needle, seat and gasket
14*	014020	1	Inlet control lever
15	011503	1	Inlet tension spring
16	018036	1	Nozzle assy.
17*	02531	1	Welch plug
18	013269	1	Inlet control lever fulcrum pin ret. screw
19	013541	1	Throttle shaft return spring
20	013406	1	Pin-fulcrum
21	~~013711~~-012091	1	Throttle shaft and lever
22	011498	1	Idle adjustment screw
23	012225	1	Main adjustment screw
24	08793	2	Spring
25**	011428	2	Washer
26**	011401	2	Packing
26A	010404	1	Idle speed screw washer
27	0788	1	Regulating screw spring
28	05095	1	Idle speed regulating screw
29**	012473	1	Diaphragm gasket
30*	012475	1	Diaphragm
31*	K10009	1	Gasket and packing set
32	013228	1	Diaphragm cover
33	K10013	1	Repair parts kit
34	018031	6	Body screw
35	010571	1	Cover retaining screw
36	010527	1	Strainer cover
37**	010529	1	Cover gasket
38	010530	1	Strainer screen
39	013335	1	Fuel pump body
40*	012698	1	Fuel pump diaphragm
41**	012930	1	Fuel pump gasket
42	7011	1	Stop nut, #10 – 24
43	A2770589	1	Throttle shaft arm (with illus. 42 & 45)
45	1733	1	Slotted pan hd. m. screw, 10 – 24 x 9/16

*Indicates Contents of Repair Parts Kit (Item 33)
**Indicates Contents of Gasket Set.

CARBURETOR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GASKET SET
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REPAIR PARTS KIT
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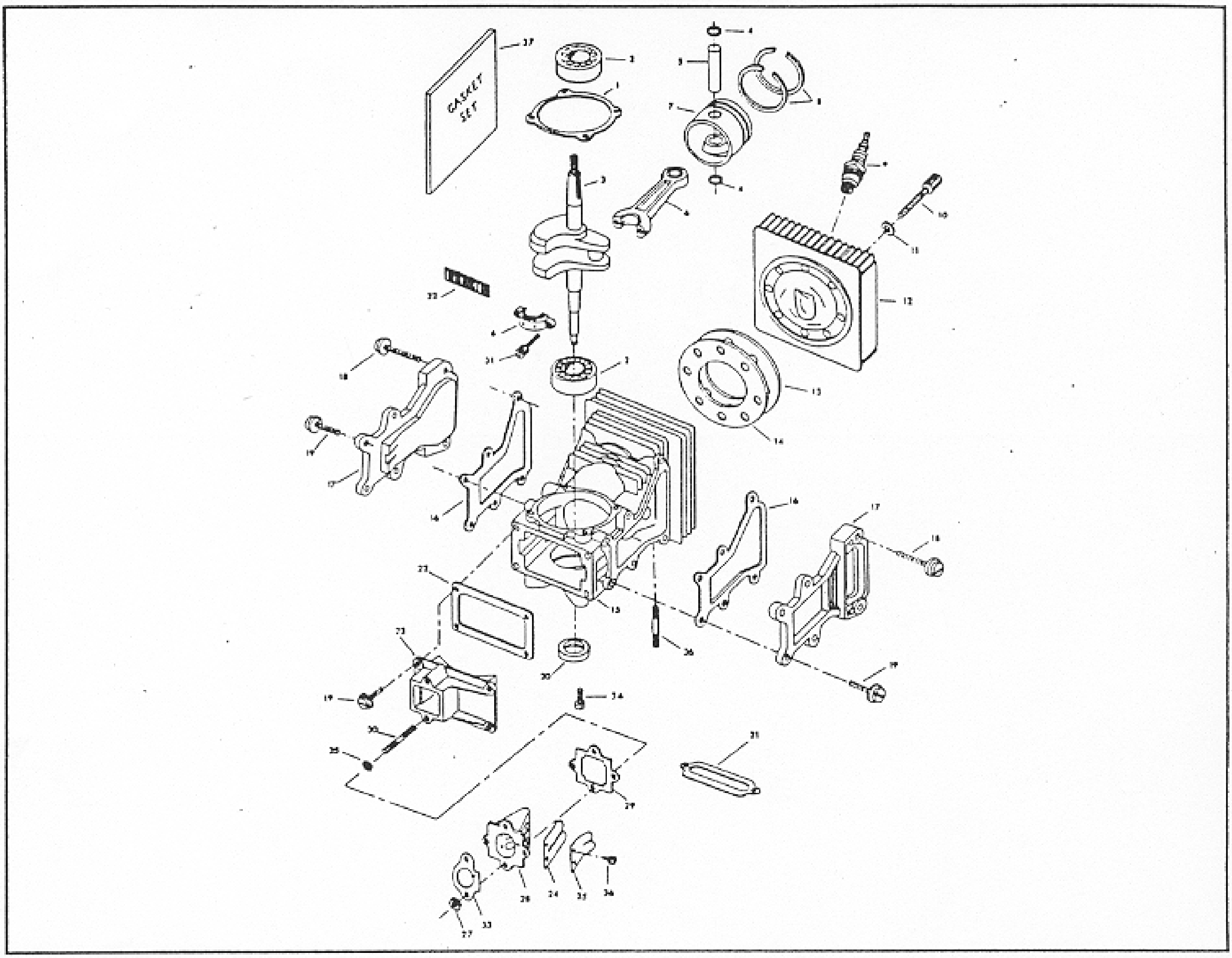
35

POWER HEAD



ILLUS. NO.	PART NO.	QTY.	DESCRIPTION
1*	175277	1	Bearing cage gasket
2	127910-2	2	Ball bearing
3	258018	1	Crankshaft
4	31410	2	Retaining ring
5	175017	1	Piston pin
6	A174016	1	Connecting rod w/illus. 31
7	175015	1	Piston
8	A175260-1	1	Piston ring set (2 per set)
9	C247227-1	1	Spark plug (Champion RL86)
10	1465	8	Socket hd. cap screw, 1/4 - 20 x 1-1/16
11	8026	8	Plain washer
12	175518-2	1	Cylinder head
13*	175529-062	1	Head gasket
14*	175529-032	1	Head gasket,
15	2A560010	1	Cylinder, includes item 19
16*	175223	2	Gasket
17	560222	2	Cover, transfer port
18	1497	4	Pan hd. screw, w/lockwasher, 1/4 - 20 x 7/8
19	1439	12	Pan hd. screw, w/lockwasher, 1/4 - 20 x 3/4
20	31146	1	Seal, drive end
21*	247279	1	Exhaust gasket
22*	175148	1	Cover gasket
23	2A560157	1	Manifold, w/illus. 30
24	31160-1	2	Reed
25	31161	2	Reed stop
26	1755	4	Round hd. screw, w/lockwasher, 6 - 32 x 5/16
27	1490	2	Hex nut
28	A31158-1	1	Reed plate, includes items 24, 25 and 26
29*	31168	1	Manifold gasket
30	27209-1	2	Stud, carburetor
31	36634	2	Connecting rod cap screw
32	A175228	1	Crankpin roller set (28 rollers)
33*	175906	1	Gasket, carburetor
34	175732	1	Screw, crankshaft retaining L.H.
35	8060	2	Lockwasher (under carb. elbow nut)
36	560273	2	Stud, muffler
37	G819-2	1	Gasket set (not shown). Includes all items marked with an asterisk (*).

OPERATING INSTRUCTIONS

FUEL MIXTURE

In a separate, clean container thoroughly mix 1/3 pint US MARINE CORPORATION Oil (BIA-TCW) or equivalent with each gallon of gasoline.

Use regular grade of gasoline. High test, ethyl gasoline is not recommended.

Strain the fuel mixture through a fine meshed screen when filling gasoline tank on engine to remove dirt and water if present.

PREPARATION FOR STARTING

1. Fill gasoline tank with fuel mixture prepared per above instructions. Wipe up all spilled gasoline.
2. Open gasoline shut-off valve.
3. Move choke lever to closed position.

NOTE: If engine is warm, it may not require choking.

4. Crack open the throttle and crank engine.
5. When engine starts, move choke lever to open position.

NOTE: The normal main adjustment needle settings are approximately one turn open. Occasional readjustment may be required but it is not necessary to readjust for starting except for cold weather starting when it may be necessary to open the high speed adjusting needle an additional 1/8 turn.

TO STOP ENGINE

Switch will stop engine by shorting magneto to ground.

CARBURETOR ADJUSTMENT

1. Turn both adjustment needles clockwise until completely closed.

CAUTION: Do not force needle tightly closed as the seat may be damaged.

2. Turn both needles counterclockwise 1 turn. This is the average setting for proper engine operation.
3. Start engine and allow it to warm up, then, if carburetor setting is too "Lean", engine will not run at full speed and will "Pop", and may stop. Turn main adjustment needle counterclockwise an eighth of a turn at a time until the engine runs smoothly.

   If engine runs at full speed without load, but will not maintain full speed under load, turn the main adjustment needle counterclockwise 1/8 turn.

   If carburetor setting is too "Rich", engine will not develop full power but will roll and run unevenly under load. Turn main adjustment needle clockwise an eighth of a turn at a time until the engine runs smoothly.
4. To verify proper idle needle setting, start engine and allow to warm up. If motor surges and runs at uneven speed, turn the idle adjustment needle slowly clockwise up to 1/4 turn. If this aggravates rather than corrects the situation, return to the original setting, then turn the idle adjustment needle slowly counterclockwise up to 1/4 turn. This should cause the engine to "settle down" and run at a constant speed. If engine fails to accelerate, open idle screw 1/8 turn.
5. If engine runs too fast at idling speed, back out the idle stop screw a little at a time until desired speed is obtained. To increase idling speed turn in the idle stop screw.

SOLID-STATE IGNITION

1. Flywheel to coil lamination gap .006" - .010" -
   (Flywheel magnets to coil lamination)

AIR CLEANER

Under ordinary operating conditions, the air cleane should be cleaned daily. However, under extremely dirt conditions, more frequent cleaning is recommended. T clean the air cleaner, follow equipment manufacturer recommendations.

IMPORTANT: Dirt that enters the engine through th carburetor is one of the greatest causes c engine wear. Therefore, **it is very importar that the air cleaner be serviced regularly**

STARTER SCREEN

The screen keeps dirt, etc., from entering the fan housin and clogging the air cooling passages.

Because this engine is air-cooled, it is necessary to ke this screen clean at all times to permit the unrestricte passage of air into the fan housing.

SPARK PLUG

Check and clean spark plugs regularly. A fouled, dirty c carboned spark plug causes hard starting and poor engin performance.

Set spark plug gap at .030".

STORING MOTOR

The following steps should be taken to prepare yo engine for storage:

1. Close gasoline shut-off valve.
2. Start engine and allow to run until it stops from lack fuel. This will use up all the fuel in the carburetor ar prevent the formation of deposits due to evaporation fuel.
3. Disconnect fuel line and permit all fuel to drain from th gasoline tank. Replace fuel line.
4. Remove spark plug and pour 1/4 cup of motor oil in cylinder. Replace spark plug.
5. Crank engine two or three times to distribute c throughout cylinder. This will coat the cylinder wa with oil and prevent rust from forming during th storage period.

TORQUE CHART

FLYWHEEL	420 In. Lbs.
CONNECTING ROD	80-90 In. Lbs.
SPARK PLUG	120-180 In. Lbs.
CYLINDER HEAD	80-90 In. Lbs.

GENERAL SCREWS

10 - 24	30 In. Lbs.	1/4 - 20	70 In. L
10 - 32	35 In. Lbs.	5/16 - 18	160 In. L
		1/4 - 28	75 In. Lt

CHECK LIST

TROUBLE	CAUSE	WHAT TO DO
1. Engine fails to start.	No fuel in tank.	Fill tank.
	Gasoline shut-off valve closed.	Open shut-off valve.
	Fuel line or fuel tank screen clogged.	Clean fuel line and screen.
	Flooded.	Close carburetor main adjustment needle and crank until engine starts. Then turn needle to 1 turn open.
	Spark plug shorted or fouled.	Install new spark plug.
	Spark plug broken (cracked porcelain or electrodes broken).	Replace spark plug.
	Magneto lead wire shorted, broken or disconnected from spark plug.	Replace lead wire or attach to spark plug.
	Magneto inoperative (no spark from lead wire).	Contact the factory or your nearest authorized dealer.
2. Engine hard to start.	Water in gasoline or stale fuel mixture.	Drain entire fuel system and refill with fresh fuel.
	Too much oil in fuel mixture.	Drain and refill with correct mixture.
	Engine over or under choked.	If flooded by over choking, proceed according to instructions in previous section. If under choked, move choke lever to closed position and crank two or three times.
	Carburetor out of adjustment.	See "Operating Instructions" under "Carburetor Adjustment".
	Gasket leaks (carburetor or reed plate gaskets).	Replace gaskets.
	Weak spark at lead wire.	Contact the factory or your nearest authorized dealer.
3. Engine misses.	Dirt in fuel line or carburetor.	Remove and clean.
	Carburetor improperly adjusted.	See "Operating Instructions" under "Carburetor Adjustment".
	Spark plug fouled, broken or incorrect gap setting.	Clean or replace spark plug - set gap to .030".
	Weak or intermittent spark at lead wire.	Contact the factory or your nearest authorized dealer.
4. Engine lacks power.	Air cleaner clogged.	Clean air cleaner.
	Carburetor out of adjustment.	See "Operating Instructions" under "Carburetor Adjustment".
	Muffler clogged.	Clean carbon from muffler.
	Clogged exhaust ports.	Remove muffler, rotate engine until the piston is at bottom of cylinder. With a wooden scraper or blunt tool, remove all carbon from exhaust ports. Be careful not to scratch or damage piston or cylinder walls. Blow and loose carbon with compressed air. Start engine and run briefly to remove all carbon, then install muffler and gasket.
	Poor compression.	Contact the factory or your nearest authorized dealer.
	Flywheel to coil lamination air gap.	Reset .006" - .010".
5. Engine overheats.	Insufficient oil in fuel mixture.	Mix fuel as shown in starting instructions.
	Air flow obstructed.	Clean flywheel and cylinder fins and screen.
6. Engine noisy or knocking.	Loose flywheel.	Tighten flywheel nut.
	Spark plugs incorrect heat range.	Replace with plugs specified for engine.
	Worn bearings, piston rings or cylinder walls.	Contact the factory or your nearest authorized dealer.
	Bent fan housing.	Remove fan housing and straighten bent portion.
7. Engine "stalls" under load.	Carburetor main adjustment too "lean".	See "Operating Instructions" under "Carburetor Adjustment".
	Engine overheats.	See Section 5 above.

US. MARINE

2 CYCLE ENGINE

AUTHORIZED CENTRAL SERVICE DISTRIBUTORS

COAST DIESELECT LTD.
1920 MAIN ST.
VANCOUVER, BC. CANADA, V5T-3B9

OTHER COAST DIESELECT LTD.
LOCATIONS IN CANADA.
MUSSISAUGA, TORANTO(ONT.,)
CALGARY, ALBERTA.

MIDCO INC
1526 FAIRMOUNT AVE.
PHILADELPHIA, PA. 19130
(215) 232-9615

E.J. SMITH & SONS CO.
4250 GOLF ACRES DRIVE
CHARLOTTE, NC. 28208
(704) 394-3361

SPENCER ENGINE INC.
P.O. BOX 2579
TAMPA, FL. 33601
(813) 253-6035

AUTOMOTIVE ELECTRICAL CORP.
3250 MILLBRANCH ROAD
BOX 161096
MEMPHIS TN. 38116
(901) 345-0300

WISCONSIN MAGNETO INC.
4727 N. TEUTONIA AVE
MILWAUKEE, WI. 53209
(414) 445-2800

ORGINAL EQUIPMENT INC.
905 SECOND AVENUE NORTH
BILLINGS, MT. 59101
(406) 245-3081

MEDART ENGINES & PARTS
100 LARKIN WILLIAMS IN CT.
FENTON, MO. 63026
(314) 343-0515

POWER DISTRIBUTORS INC
102 MAYFIELD AVE.
EDISON, NJ. 08837
(201) 225-4922

PITT AUTO ELECTRIC CO.
2900 STAYTON STREET
PITTSBURGH, PA. 15212
(412) 766-9112

RBI CORPORATION
101 CEDAR RIDGE DRIVE
ASHLAND, VA. 23005
(804) 798-1541

SEDCO INC.
1414 RED PLUM ROAD
NORCROSS, GA. 30093

BEBCO/AIR COOLED ENGINE DIV.
2221 2ND AVENUE SOUTH
BIRMINGHAM, AL. 35233
(205) 251-2078

GARDNER INC.
1150 CHESAPEAKE AVE.
COLUMBUS, OH, 43212
(614) 488-7951

R.L. GOULD & COMPANY
3711 LEXINGTON AVE. N.
ST. PAUL, MN. 55112
(612) 484-8411

MIDWEST ENGINE WAREHOUSE
515 ROMANS ROAD
ELMHURST, IL. 60126
(312) 833-1200

MEDART ENG. & PARTS OF KANSAS
15500 W. 109TH STREET
LENEXA, KS. 66215
(913) 888-8828

US. MARINE

2 CYCLE ENGINE

AUTHORIZED CENTRAL SERVICE DISTRIBUTORS

GRAYSON CO.
100 FANNIN ST.
P.O. BOX 206
SHREVEPORT, LA. 71101
(318) 222-3211

AMERICAN ELEC. IGN. CO.
124 N.W. 8TH ST.
P.O. BOX 1945
OKLAHOMA CITY, OK. 73101
(405) 236-3551

GRAYSON CO. OF THE SW. INC.
1232 MOTOR STREET
P.O. BOX 10588
DALLAS, TX. 75207

SPITZER INDUSTRIAL PROD.
6601 NO. WASHINGTON ST.
THORTON,
DENVER, CO. 80229
(303) 629-3441

QUICK'S INC.
2240 SO 9TH EAST
SALT LAKE CITY, UT. 84106
(801) 466-2547

SPITZER ENG. & PARTS INC.
1016 THIRD STREET
P.O. BOX 25065
ALBUQUERQUE, NM. 87125
(505) 842-6472

H.G. MAKELIM CO.
P.O. BOX 2827-219 SHAW RD.
SO. SAN FRANCISCO, CA. 94080
(415) 873-4753

SMALL ENGINE CLINIC
98019 KAM HWY
HONOLULU, HI. 96701
(808) 488-0711

AUTOMOTIVE PRODUCTS INC.
1700 SE. GRAND AVE.
P.O. BOX 14668
PORTLAND, OR. 97214
(503) 234-5241

NORTHWEST MOTOR PARTS
P.O. BOX 3816
SEATTLE, WA. 98124
(206) 624-4448

OPERATING AND MAINTENANCE MANUAL

MODEL NO. 25/30 FB
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
IDEX CORPORATION

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

Limited Warranty

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

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

- Subjected to 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.

WARNING LABEL IDENTIFICATION

The equipment described in this manual contains one or more of the following warning labels. The following chart identifies the label and provides an explanation of the hazard associated with the label.

HEARING PROTECTION REQUIRED WHEN OPERATING EQUIPMENT

EYE PROTECTION REQUIRED WHEN OPERATING EQUIP-MENT

EQUIPMENT CONTAINS FLAMMABLE FUEL

CORROSIVE HAZARD

ROTATING COMPONENTS

HOT SURFACES

DANGER OF CARBON MONOXIDE POISONING WHEN EQUIPMENT IS OPERATING

OPERATING EQUIPMENT PRESENTS A DRAW-IN HAZARD

ELECTRICAL SHOCK HAZARD

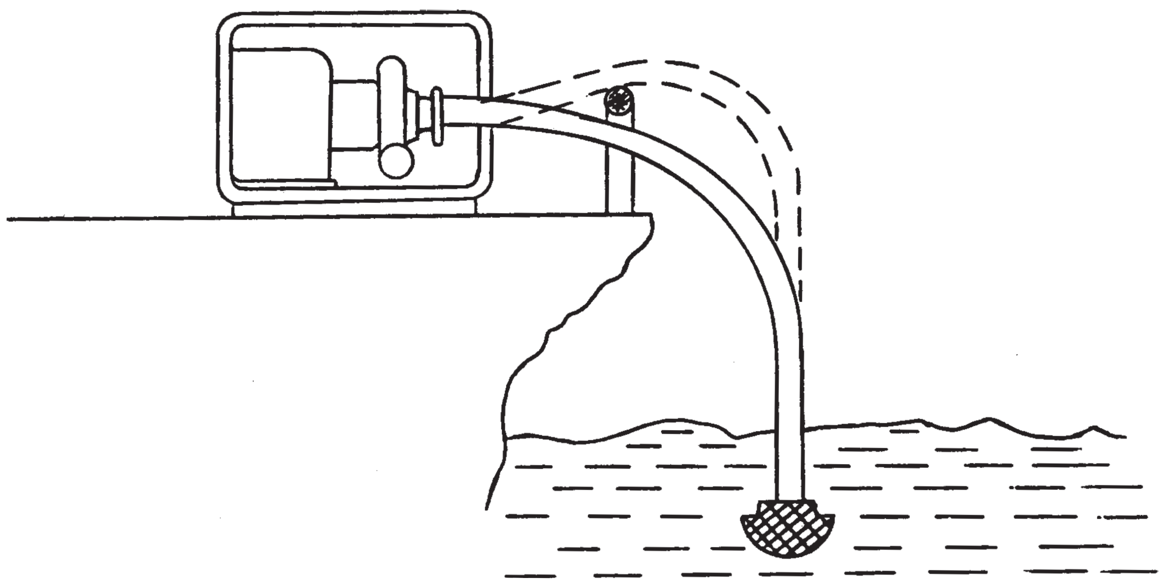
OPERATION AND CARE OF HALE PORTABLE PUMPING UNITS

This instruction manual is published as a guide and reference to assist in the operation of the Hale Pumping Unit. The operator should have a thorough understanding of this manual and the engine operator's manual before attempting to operate this unit. If any difficulty should be encountered in the operation of the unit and outside help is needed, contact the dealer from whom it was purchased. This dealer will also be able to advise you of the nearest authorized engine dealer in your locality prepared to take care of the engine in your pumping unit. Finally, the Customer Service Department of Hale Products Inc. is ready to provide you service.

Every HALE pumping unit is thoroughly tested at the factory and shipped properly adjusted, with lubricant in all parts needing lubrication, except the engine crankcase, the carburetor air cleaner, and the pump transmission on 15FD and 20FD pumping units.

INSPECTION OF NEW UNIT:
Check to see if any parts are missing or have been broken in shipment. A starting rope or crank, an engine instruction book, this manual and a parts list are supplied with each pump.

INSTALLATION: If the unit is to be permanently installed, it should be firmly bolted down in a level position. Suction connections from the source of water should not be less than 1 1/2" for the 15FD pump, 2" for the 20FD pump, 2 1/2" for the 25FA, 25FR, 25FZZ pumps, and 3" for the 30FC and 30FZA pumps, as short as possible, and with a minimum of elbows. If at all possible, air traps should be avoided (see sketch).
The unit should not be directly connected to solid piping. There should be flexible connections between the pipe line and the pump suction and pump discharge. The suction connections must be air tight at all times. Be sure all connections in the suction line have matching threads and gaskets are used with fittings that require them.



PORTABLE PUMPING UNITS

GASKETS AND WASHERS: If suction hose is used, check suction hose rubber washers frequently, as foreign matter under these washers will cause air leaks which may prevent getting water when priming. Even if you do get water, the air will cause an irregular stream.

In special cases where pump has been used for pumping salt water, hook the pump to a source of fresh, clean water and pump for a few minutes to clean out salt water.

If you have been forced to pump water containing sand and other foreign matter, do the same as for salt water.

LUBRICATION

ENGINE: For lubrication, care and operation of the engine, see the Engine Instruction Book shipped with this unit.

PUMP: Except for draining the casing during freezing weather and an occasional cleaning out, the pump requires very little care. There are no lubrication points on the pump proper.

DISCHARGE VALVE: Periodically disassemble the discharge valve. (See valve instruction sheet). Clean all parts thoroughly, then apply waterproof grease and reassemble.

PRIMING VALVE: If this valve becomes hard to operate, disassemble and lubricate with waterproof grease.

EXPLANATION OF TERMS

IMPELLER: The working part of a centrifugal pump which imparts energy to the water.

DIAPHRAGM PRIMER PRIMING SYSTEM: The Diaphragm Primer consists of a rubber diaphragm working in an aluminum chamber. The diaphragm is actuated by a lever attached to it by a connecting rod. Air is drawn into the chamber through a suction valve on the up-stroke and discharged through a discharge valve on the down-stroke.

EJECTOR PRIMING SYSTEM: A method first developed by HALE for priming centrifugal pumps by using exhaust gas from engine.

PRIMING LINE: The pipe connecting the suction of the pump to the suction of the ejector.

PRIMING COCK: A Shut-Off cock in the priming line to be opened when priming and closed when pumping.

EXHAUST VALVE: A valve to shut off exhaust pipe, which, when closed diverts the exhaust gas through the ejector.

HAND THROTTLE: A hand throttle is furnished to control engine speed and pump pressure.

PORTABLE PUMPING UNITS

GOVERNOR: This is part of the engine. It prevents extreme engine speeds regardless of hand throttle setting. Governor is set to factory specifications.

GAUGE: This is a compound gauge graduated in pounds per square inch and inches of mercury vacuum. It indicates the water pressure in the discharge lines and the vacuum during priming.

OPERATING FROM DRAFT

Get as close to the water as possible and place pump in an approximately level position. As the vertical lift increases, the maximum pump capacity will decrease. It will also take slightly longer to prime the pump on higher lifts.

STARTING: Put strainer on the suction hose and submerge strainer in water. Next attach suction hose to pump. It is very desirable to have 1 ft. or more water over the strainer. Use every precaution to keep strainer off bottom. Also be sure to clear sand, leaves or other foreign matter away from strainer. No pump will pump water containing sand or other foreign matter without damage. Be sure all drain cocks are closed.

Be sure crankcase contains correct viscosity of oil to proper level. Be sure air cleaner contains correct amount of oil.

Be sure suction is air tight.

Be sure Discharge Valves (if used) are closed.

NOTE: During the priming operation, the discharge valve must be closed. Start engine,

PRIMING SYSTEMS

EXHAUST-EJECTOR PRIMING SYSTEM: Close exhaust valve firmly and open throttle wide. Then open Priming Valve. After water reaches ejector, wait until the gauge shows a steady pressure of 30 to 50 pounds. Open the discharge valve slowly. When a steady stream of water flows from the discharge nozzles, close the priming valve. Last of all open the exhaust valve. It is important to prime in this order. On a 10 ft. lift, the ejector should discharge water in 10 to 20 seconds. A 20 foot lift should take about 30 to 50 seconds.

HAND PRIMING SYSTEM: Prime pump with hand primer with pump turning over at engine idle speed. When all the air is drawn out of the pump and the pump is filled with water as indicated by the hand primer, increase speed until desired pressure is reached. Do not run pump dry except during priming operation.

INSTALLATION: See Plate No. EQ. 362. Attach mounting bracket to centrifugal pump, skid or engine. Connect primer suction inlet to priming connection on pump with hose or flexible tubing. Be sure all connections are air tight.A valve is required between the primer and the pump if it is to be operated from a tank or hydrant. All primers are furnished with a drain cock installed in the suction chamber for draining excess water from the primer after each use. Drain cock must always be closed when primer is in use.

PORTABLE PUMPING UNITS ADDITIONAL PRIMING INFORMATION

If, when throttle is opened, speed increases without a corresponding increase in pump pressure, the pump is not fully primed; in this case, continue to prime until a steady flow is obtained from the discharge. However, if an air leak is in the suction line (priming taking too long), it can often be detected by stopping the engine and listening for it. If there is an unavoidable air trap in the suction line, priming will be slower. It is important to keep on priming until a steady stream flows from the discharge. The ejector will gradually remove the trapped air.

IN CASE OF SHUTDOWN: If a shutdown is desired when working from draft — for changing hose or for any other reason — close the discharge valve and slow down to about 50 pounds pressure. To resume, simply open the discharge valve and throttle.

OPERATING FROM SOURCE OF WATER UNDER PRESSURE.

If foreign matter is suspected, flush outlet before attaching pump to source of water. Attach one end of suction hose to outlet and the other end to the pump. Open the feed line valve.

Start engine.

Open discharge valve (if used).

Open throttle gradually until desired pressure is obtained.

Watch the pressure gauge as you open the engine throttle. If the engine speed continues to increase without a corresponding increase in pressure, you have passed the most efficient point.
In this case, close the throttle slowly until the pressure begins to drop and the engine speed becomes reasonable. The only way to get more discharge pressure is to use smaller tips.

USEFUL INFORMATION

Air leaks on the suction side of the pump will cause high engine speed in relation to pump pressure. They will also cause a ragged stream and an irregular pulsation of the suction and discharge hose.

Foreign matter on the strainer or in the pump will cause the delivery pressure and volume to drop while engine speed will increase.

When using the pump for volume at low pressure, as in filling a tank or draining a cellar, open the throttle slowly until maximum volume is obtained.

When maintaining pressure without water flowing through discharge line, as when running with discharge valve closed, the water in the pump will tend to overheat. Under these conditions bleed off a little water periodically.

After pumping salt, muddy or sandy water, pump clear water to assure removal of salt water and dirt.
In freezing weather when pump is not in operation, it should be thoroughly drained. To do this, remove the discharge cap and open the valve. After the water has stopped draining, turn the engine over by hand so that water trapped by the impeller will be drained.

PORTABLE PUMPING UNITS

If unit is to be stored for any length of time, the fuel should be run completely out of the carburetor. This can be accomplished by closing the valve under the fuel tank and letting the engine run until it stops of its own accord. This will tend to prevent the carburetor from becoming gummed up with deposits left after the gasoline has evaporated. Oil the pump by inserting an oil can nozzle through the suction and into the space between the impeller and volute body. Turn engine over by hand.

TEST FOR PRIMING LEAKS

If an air leak is suspected, cap suction hose and close discharge valve. Start engine, prime until compound gauge shows at least 15" of vacuum. Stop engine and watch compound gauge. If vacuum falls rapidly, it is an indication of an air leak or leaks.

Air leaks nearly always cause a hissing sound and may often be located by listening for them. A leak in discharge valve may easily be detected by placing the palm of the hand over the discharge outlet for half a minute. If leaking, suction can be felt on your hand. Leaks in the suction connections, hose or couplings can often be heard after the pump has been primed by putting the ear against the suction hose or pipe.

HYDROSTATIC TEST

Leaks which are invisible or inaudible can usually be detected by a hydrostatic test. This consists of connecting the pump to a source of water pressure — not over 100 PSI. With water pressure on, open the discharge for a few seconds until water runs out. This allows air to escape. Then, by closing the discharge valve, the pressure rise in the pump will cause leaks to become visible.

ADDITIONAL OPERATING INSTRUCTIONS: 25FB/30FB PUMPS SEMIAUTOMATIC

EXHAUST EJECTOR PRIMING SYSTEMS: Consists of an exhaust valve which, when closed, diverts engine exhaust gases through an ejector. The ejector connected, through a valve, to pump suction.

When working from draft, valve handle is to be parallel with line. When working from positive head, valve handle to be perpendicular to line.

SEQUENCE OF OPERATING FROM DRAFT:

1. Set Throttle for idle (1200 RPM) (B-42 – Full Throttle).
2. Close exhaust valve and hold closed. (Priming valve should be in draft position.
3. When liquid reaches ejector, it will come out as a spray. Wait until pressure gauge indicates a reading of 40-65 PSI. If pump is equipped with a discharge valve, open slowly enough to maintain pressure.
4. When steady stream flows from discharge, open exhaust valve.

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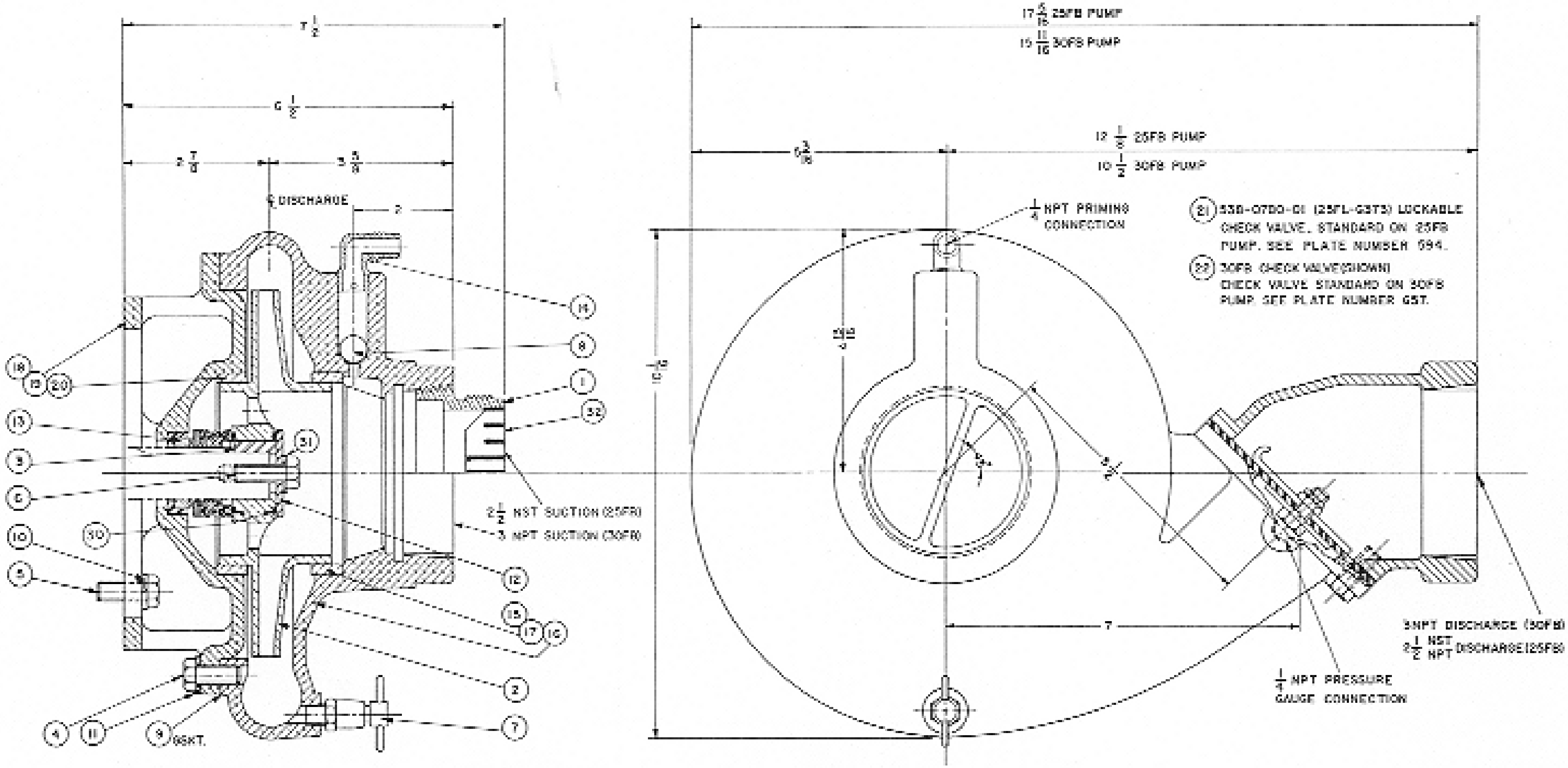
INSTRUCTION FOR DISASSEMBLY OF 25FB/30FB PUMP - REFER TO PLATE NO.634A

1. Remove discharge, priming, and suction lines. Also battery cables (Optional). First, remove battery ground cable, then positive cable.
2. Remove screws which fastens pump volute body to pump head. Tap body free with soft hammer (rawhide, rubber head, etc.)
3. Remove screws and washers which fasten impeller to shaft. NOTE: Place a long 3/8" screw or a 3/8" diameter bar through one of the pump head mounting holes and a flat bar in one of the impeller cavities. This will prevent engine from rotating when removing screw.
4. Remove impeller by putting hardwood wedges on each side of impeller, between it and pump head. The wedges should bear against impeller disc directly behind impeller vanes to prevent damaging the impeller. Impeller
5. Key can be removed after impeller.
6. Remove the spring and carbon section (sealing washer) of seal from shaft. Observe the seal seat and sealing washer to determine if they are scored or the lip on sealing washer is worn. Replace complete assembly.
7. Inspect impeller hubs and clearance rings in pump volute and pump head and replace if any of these surfaces are scored or worn excessively.

ASSEMBLY:

1. Wipe light oil on outside of seal seat and press into pump head with ceramic surface toward you.
2. Wipe light oil on side of sealing washer and turn onto shaft until the lip comes into contact with ceramic surface. CAUTION: Keep the seal seat (Ceramic) and sealing washer surfaces clean. Be careful not to crack or chip ceramic surface or carbon wearing lip.
3. Place "O" rings in grooves of impeller, then line up keyway of shaft. Push impeller on shaft. Insert Impeller key.
4. Replace screw, copper washer, and steel washer and tighten. NOTE: Use same method under No. 3 of first part to keep shaft from rotating.
5. Clean gasket surfaces on pump head and pump volute body. Then use greased gasket, bolt pump volute body to pump head. NOTE: Hale recommends that when reassembling pump that a new impeller screw, copper washer, gaskets, "O" rings and nylon locking cap (pump head to pump volute body) screws be used.



HALE TYPE 25FB 30FB PUMPS

CONSHOHOCKEN, PA.

PLATE NO. 643A

3-20-89 WFM

PARTS LIST HALE TYPE 25FB & 30FB SERIES PUMP

PLATE NO. 643A

Item No.	Part No.	Description	Qty. Ea.
1	007-0990-00	Adapter-Suction (3 NPT to 2-1/2 NST) (25FB Pump)	1
2	016-0191-00	Impeller	1
3	017-0240-00	Key-Impeller	1
4	018-1610-02	Screw-3/8-16 x 1 Lg. Zinc Pl. Hex. Hd. Cap	4
5	018-1610-07	Screw-3/8-16 x 1 Lg. Zinc Pl. Hex. Hd. 360° Nylon Locking Cap	8
6	018-1710-17	Screw-3/8-24 x 1 Lg. Stainless Stl. Hex. Hd. 360° Nylon Locking Cap	1
7	038-0200-00	Valve-1/8 Drain	1
8	039-0200-00	Ball-Priming Tank	1
9	046-0310-00	Gasket-Volute Body	1
10	097-0140-00	Washer-Head Lock	4
11	097-0170-00	Washer-Head Flat	8
12	097-0890-00	Washer-Impeller	1
13	296-5011-00	Seal-Mechanical, Assembly	1
14	276-0181-00	Retainer-Check Valve Assembly	1
	064-0309-12	Pin	1
	062-0321-02	Elbow	1
15	501-0311-00	Body-Volute, Assembly	1
16	001-0151-00	Body-Volute	1
17	321-0070-00	Ring Clearance	1
18	502-0140-00	Head-Pump Assembly	1
19	002-0141-00	Head-Pump	1
20	321-0070-00	Ring Clearance	1
30	142-0600-00	Ring-Impeller Seal	2
31	097-0210-00	Washer-Impeller Screw	1

HALE TYPE 25FL LOCKABLE CHECK VALVE (25FB PUMP)

21	538-0780-01	Valve-2-1/2 NST Lockable Check, Assembly	1	*(Refer to Plate No. 594 for Parts List.)*

HALE TYPE 30FB CHECK VALVE (30FB PUMP)

22	538-1000-00	Valve-Assembly,30FB Check (3" NPT)	1	*(Refer to Plate No. 657 for Parts List.)*

ACCESSORIES

Part No.	Description	Qty.
007-0980-00	Adapter-Suction (3NPT to 3NST)	1
006-0110-00	Cap-Suction (2-1/2 NST)	1
006-0120-00	Cap-Suction (3 NST)	1
097-0110-00	Washer-Suction Cap (2-1/2)	1
097-0120-00	Washer-Cap (3)	1

HALE FIRE PUMP COMPANY
700 Spring Mill Avenue, Conshohocken, PA 19428

Unit Parts List No. U-1344B

Briggs & Stratton 25 C.I.D. Gasoline Engine with Hale Type 25FB, 30FB Series Pumps

Part No.	Quantity	Description
545-0270-01	1	Engine Assembly B-25 Std. consists of:
045-0330-01	1	Engine — Briggs & Stratton B-25 252417
019-0320-67	1	Starter switch panel
200-0120-01	1	Switch, starter
018-1206-45	2	Screw, 1/4-20 x 3/4 lg.rd.hd. s.steel
097-0300-01	4	Washer, 1/4 steel lock
110-1200-00	2	Nut, 1/4-20 steel hex
018-1206-02	2	Screw, 1/4-20 x 3/4 stl. hex hd steel
013-0620-00	1	Cable, B-15-6-C
	Optional FHC Panel Common Parts	
019-0320-68	1	Panel, gauge
013-1610-08	1	Term, 16/14 ga — 5/16 ring
200-0190-01	1	Socket assembly, light bulb
200-0200-00	1	Bulb, 12-volt light (#67)
200-0590-00	1	Resistor, 10 watt, 10 OHM
013-1610-27	2	Splice, 16/14 ga
007-1380-00	.42 ft.	Tube, heat shrink w/liner
013-0620-00	1	Cable, B-15-6-C
082-0218-00	1	Elbow, 1/4 NPT x 45°
082-0219-02	1	Fitting, 1/4 NPT x 1/4 tube
604-0079-00	2 ft.	Tubing, 1/4 OD
082-0220-02	1	Elbow, 1/4 NPT x 1/4 tube
012-0220-00	1	Grip, rubber hand (exh. tank)
513-0070-00	1	Remote battery connector assembly
142-0410-00	2	Insert
168-0040-25	1	Gauge, discharge pressure 0-400 L.F.
513-0070-00	1	Remote Battery Connector Assy. Optional consists of:
588-0050-00	1	Connector assembly
018-0607-42	2	Screw, #6-32 x 7/8 lg.rd.hd.stl. chrome pl.
097-0610-00	2	Washer, #6 steel lock
110-0600-00	2	Nut, #6-32 steel hex
088-0240-00	1	Connector, battery cable 2-pole (loose)
	Battery System	
200-0611-00	1	Battery assembly B25 optional, consists of
200-0600-00	1	Battery, 12 volt neg. grd. @ 12N14-3A
047-0031-05	1	Base, battery
019-0741-00	1	Support, battery base
018-1606-00	1	Screw, 3/8-16 x 3/4 lg. steel hex
097-0140-00	1	Washer, 3/8 steel lock
110-1600-00	1	Nut, 3/8-16 steel hex

Unit Parts List No. U-1344B

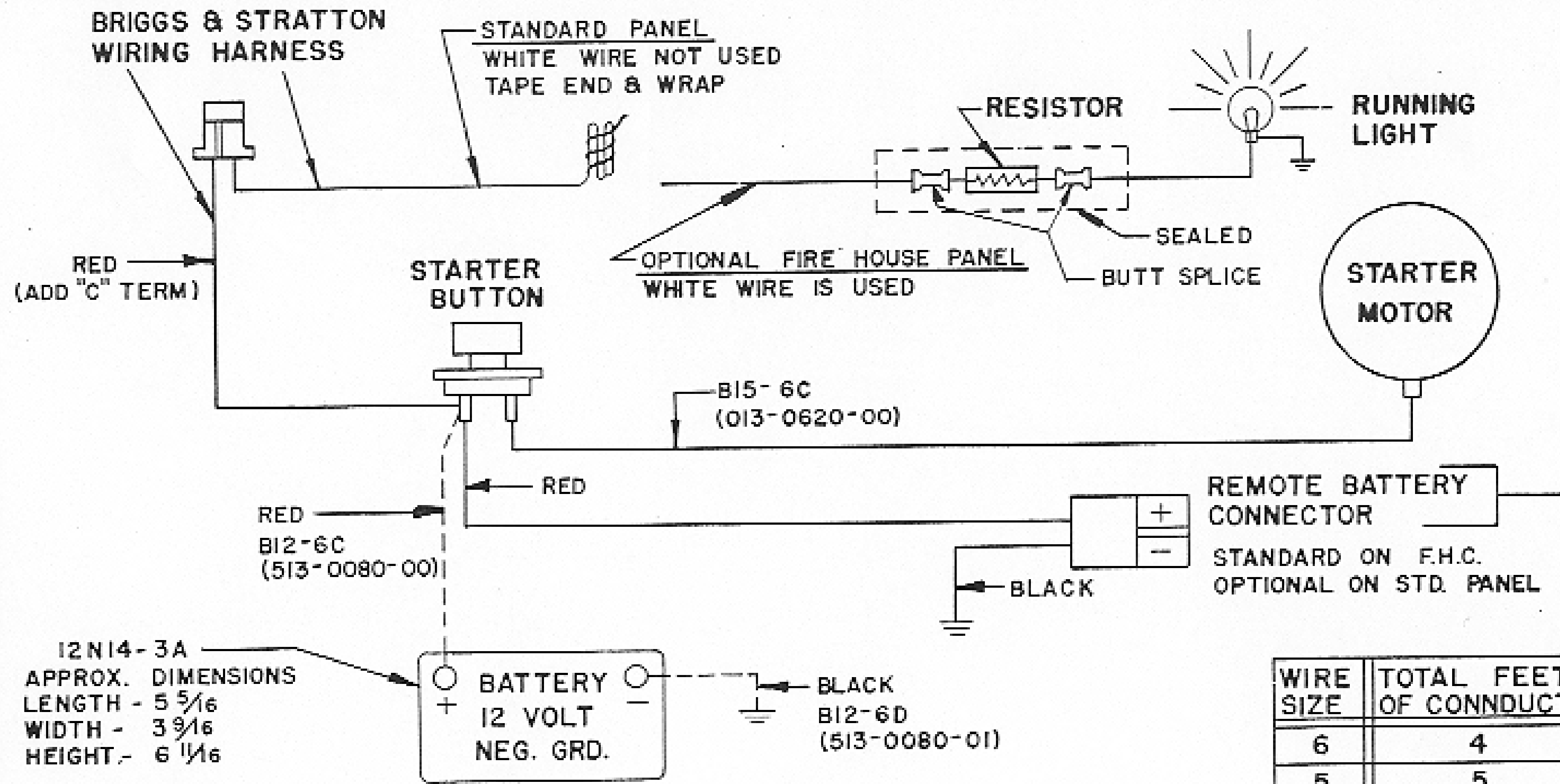
Briggs & Stratton 25 C.I.D. Gasoline Engine with Hale Type 25FB, 30FB Series Pumps

Part No.	Quantity	Description
512-0220-00	1	Holddown battery
097-0160-00	2	Washer, #10 steel lock
110-1100-00	2	Nut, #10-32 steel hex
513-0080-00	1	Cable, battery pos. (red) B-12-6-C
513-0080-01	1	Cable, battery neg. (black) B-12-6-D
013-0740-00	1	Boot, positive battery cable terminal
	Exhaust Priming System	
503-0170-04	1	Exhaust priming system 25/30FB std. assy.
	Priming System Common Parts	
082-0620-01	1	Nipple, 1" NPT x 4-1/2 lg. T.O.E.
108-0231-02	1	Tank, priming weldment assy.
012-0501-04	1	Handle, exhaust valve
012-0810-00	1	Priming handle grip
005-0500-00	1	Disc, exhaust valve
064-0818-02	2	Pin, clamp handle pivot
242-0300-15	1	Clamp, muffler
538-0840-50	1	Ejector assembly, priming
082-0206-08	1	Fitting, 1/4 NPT x 3/8 tube compression
604-0033-00	.85 ft.	Tubing, 3/8 OD x .032 wall copper
038-1130-00	1	Valve, priming 1/4 NPT
097-0560-01	1	Washer, 5/16 lock
110-1400-02	1	Nut, 5/16-18
082-0231-09	1	Elbow, 45°, 1/4 NPT x 3/8 tube
538-0840-50	1	Ejector Assy — priming, consists of:
007-0900-00	1	Nozzle ejector
046-0850-00	1	Gasket
038-0500-00	1	Body, ejector
018-1210-02	2	Screw, 1/4-20 x 1" lg.stl. hex hd cad. pl.
097-0300-01	2	Washer, 1/4 steel lock
110-1200-02	2	Nut, 1/4-20 steel hex cad. pl.
	Mounting Assemblies	
547-0181-13	1	Skid rail mounting assembly, consists of
547-0181-12	2	Skid rail
097-0520-00	4	Pad, rubber foot
018-1406-00	4	Screw, 5/16-18 x 3/4 lg. stl. hex
110-1406-02	4	Nut, 5/16-18 cad pl. hex uni-torque lock
547-0180-15	1	Skid rail w/handles mtg. assy, consists of
547-0180-14	2	Skid w/handles
097-0520-00	4	Pad, rubber foot
018-1406-00	4	Screw, 5/16-18 x 3/4 lg. stl. hex

Unit Parts List No. U-1344B

Briggs & Stratton 25 C.I.D. Gasoline Engine with Hale Type 25FB, 30FB Series Pumps

Part No.	Quantity	Description
110-1406-02	4	Nut, 5/16-18 cad. pl. hex uni-torque lock
512-0160-00	1	Rubber hand grips (set of 4: 012-0220-00)
547-7021-00	1	Frame mounting assembly, consists of:
007-1070-07	2	Tube, bottom frame
047-0131-10	1	Base, frame
018-1213-42	12	Screw, 1/4-20 x 1-3/8 stl.rd.hd.chrome pl.
097-0520-00	4	Pad, rubber foot
018-1215-42	2	Screw, 1/4-20 x 1-5/8 stl.rd.hd.pl.
110-1204-00	14	Nut, 1/4-20 steel hex lock
512-0080-00	4	Handle assembly
047-0270-00	4	Spring, handle
097-0420-00	4	Washer, steel plain flat
012-0220-00	4	Grip, rubber hand
007-1070-06	2	Tube, frame top
007-1080-02	2	Tube, frame tie
064-0822-02	4	Pin, roll 1/4" dia. x 1-3/8" lg. sst



WIRE SIZE	TOTAL FEET OF CONNDUCTOR
6	4
5	5
4	6

⚠ CAUTION - ELECTRICAL SYSTEM
12 VOLT NEGATIVE GRD.

- - - - - - DASH LINES DENOTES OPTIONAL WIRING

NO.	CHANGED FROM	BY	DATE	NO.	CHANGED FROM	BY	DATE

REPORT ERRORS & CHANGES
REMOVE ALL SHARP EDGES
TOLERANCE ON FRACTIONS
± 1/64 FINISHED TO FINISHED SURFACES
± 1/32 FINISHED TO CAST SURFACES

HALE FIRE PUMP COMPANY
CONSHOHOCKEN, PA. 19428

NAME WIRING DIAGRAM B25

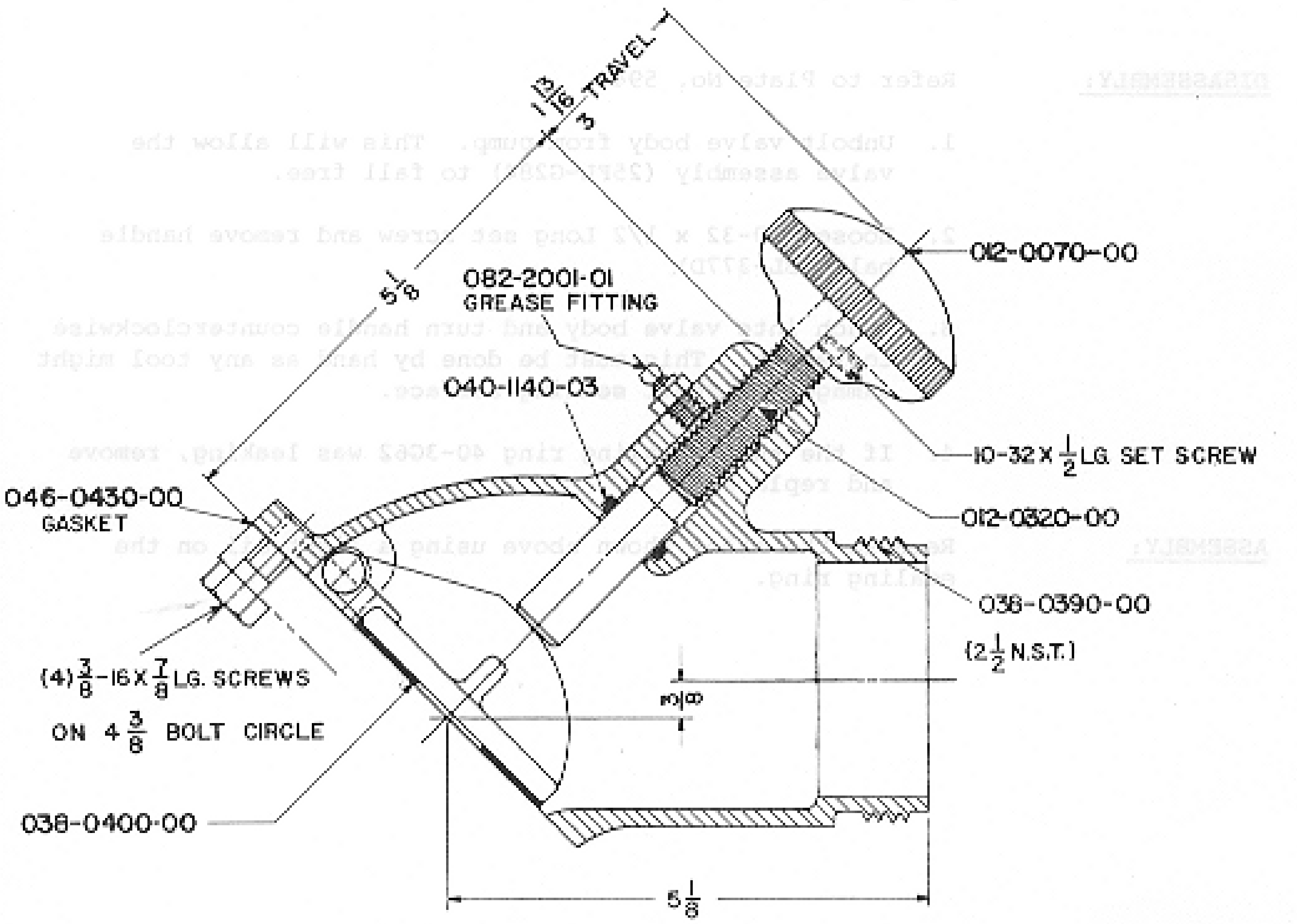
MATERIAL

DWG. NO. ___ OF ___	SCALE	DRAWN	DATE
		D.E.J.	4-28-80

FIRST USED ON

PART NO. 4- B25- 349 A

PART NO.		NAME OF PART	NO.REQD.
012-0070-00	BL-377D	Ball-Handle	1
012-0320-00	25FL-681	Handle-Check Valve	1
018-1104-50		Screw-#10-32 x 1/2 Lg. Socket Hd. Cup Pt. Set Nylon Locking	1
018-1607-02		Screw-3/8-16 x 7/8 Lg. Hex Hd. Zinc Pl. Stl.	4
038-0390-00	25FL-373	Body-Check Valve	1
038-0400-00	25FL-G284	Valve-Assembly	1
040-1140-03	40-3G62	Ring-Seal	1
046-0430-00	25FL-W422	Gasket	1
082-2001-01	82S	Fitting-Grease	1
101-0570-00		Decal-Grease Fitting Location	1



HALE TYPE 25FL LOCKABLE CHECK VALVE

PLATE NO. 594

ATR 12-13-84

CARE AND OPERATION OF THE HALE TYPE 25FL LOCKABLE CHECK VALVE

PLATE NO. 594

OPERATION: To open valve, turn handle counterclockwise; to close turn handle clockwise.

LUBRICATION: Grease handle thread fitting as necessary with a multi-purpose grease.

DISASSEMBLY: Refer to Plate No. 594.

1. Unbolt valve body from pump. This will allow the valve assembly (25FL-G284) to fall free.

2. Loosen 10-32 x 1/2 Long set screw and remove handle ball (BL-377D).

3. Reach into valve body and turn handle counterclockwise to remove. This must be done by hand as any tool might damage the shaft sealing surface.

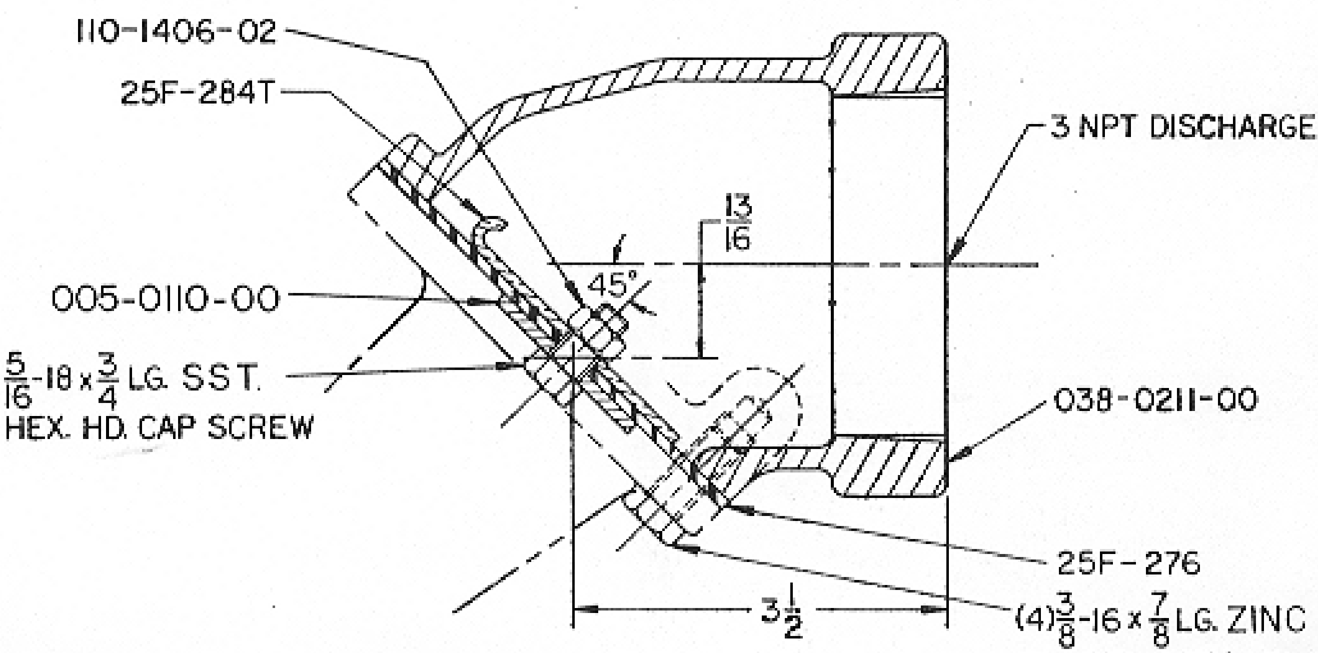
4. If the shaft sealing ring 40-3G62 was leaking, remove and replace.

ASSEMBLY: Reverse the order shown above using a light oil on the sealing ring.

PARTS LIST HALE TYPE 30FB CHECK VALVE

PLATE NO. 657

PART NO.		NAME OF PART	NO.REQ.
538-1000-00		Valve-Assembly, 30FB Check	1
005-0110-00	25F-284B	Plate-Check Valve Top	1
005-0120-00	25F-284T	Plate-Check Valve Top	1
018-1406-12		Screw-5/16-18 x 3/4 Lg. SST Hex Head	1
018-1607-02		Screw-3/8-16 x 7/8 Lg. Zinc Pl. Stl. Hex Hd.Cap	4
038-0211-00		Body-Check Valve (3NPT)	1
046-5160-00	25F-276	Valve-Check Valve	1
110-1406-02		Nut-Zinc Pl. Stl. Lock	1



ASS'Y. PART NO.	NAME
538-1000-00	30FB CHECK VALVE

HALE TYPE 30FB CHECK VALVE

CONSHOHOCKEN, PA.

PLATE NO. 657

5-28-85 KSB.

MOBILE EQUIPMENT SALES CATALOG

Foam

s

HALE

Class 1

FoamLogix 2.1A
Foam Proportioning System

FOAMLOGIX

FoamLogix 2.1-A is a true electronic discharge side proportioning unit in a cost effective, compact package. It has full function digital control with a Class 1 flowsensor.

FEATURES AND BENEFITS

- Computer controlled, accurate Class A foam proportioning at a value price.
- Push button proportioning.
- Arrow buttons allow changing foam percentage from 0.1% to 1.0%.
- Reliable and accurate Class 1 Flow Sensor. Measures water flow and FoamLogix injects the corresponding proper amount of Class A foam concentrate.
- Operator Pre-Set — Digital control means the operator presses one (1) button for precise foam delivery every time. Departments can set the system up to run the percentage of foam they require.
- System integration — Available fully integrated onto a new Hale pump or in kits to fit other pump brands. Wide range of flow sensor options from pipe saddle clamps to stainless steel weld-on fittings are available

Hale Products Inc. • *Fire Suppression Division* • *A Unit of IDEX Corporation* • *700 Spring Mill Avenue*
Conshohocken, PA 19428 • *Phone: (610) 825-6300* • *Fax: (610) 825-6440* • *www.haleproducts.com*
Class 1 • *Fire Suppression Division* • *A Unit of IDEX Corporation* • *607 NW 27th Avenue*
Ocala, FL 34475 • *Phone: (352) 629-5020* • *Fax: (352) 629-2902* • *www.class1.com*

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MiniCAFSPro™
Compressed Air Foam System

CAFSPRO SYSTEM

Special Features

- Fully integrated module
- Simple operation
- Very compact for installation in tight spaces
- Separate control panel can be remotely mounted.
- Easy, quick installation
- Just add water

The Hale MiniCAFSPro system is an independent Compressed Air Foam module capable of operating from any vehicle fire pump. Ideal for brush trucks and mini-tankers, the Hale MiniCAFSPro system offers reliable and efficient compressed air foam production through multiple lines. A remote mountable control panel and measurement/mixture unit make the MiniCAFSPro truly adaptable and flexible to your needs. Water is supplied either by vehicle mounted pump or portable pump depending on your requirements. Simple operation in a easily deployed unit.

TECHNICAL SPECIFICATIONS

- Briggs and Stratton 4 stroke 18 HP motor with electric start and integral fuel tank. Includes supplementary manual start.
- Water cooled screw compressor offering up to 50 CFM of air flow for CAFS
- Hale V-Series 1.0V foam proportioning system offering foam proportioning from 0.25% to 1.0%
- Operating pressure - 100 PSI
- Dimensions including control panel and measurement/mixture unit
  - Length - 38 inches
  - Width - 20 inches
  - Height - 37 inches

Features and Benefits

- **Independent CAFS unit** — Can be used in a variety of situations and configurations including training and retrofits.
- **Simple to use**
- **Mixers included in manifold for high quality foam**
- **Control panel and foam proportioner manifold unit can be disconnected —** Enables unit to be incorporated in various vehicle designs with remote mounting
- **Safety interlocks —** Ensures security of operation
- **Compact unit—** Can be installed in tight spaces
- **Variable foam mix rates—** Ranges from 0.25% to 1.0% for Class A fires.
- **Makes wet, medium, and dry foam**

Hale Products Inc. ● *Fire Suppression Division* ● *A Unit of IDEX Corporation* ● *700 Spring Mill Avenue Conshohocken, PA 19428* ● *Phone: (610) 825-6300* ● *Fax: (610) 825-6440* ● *www.haleproducts.com*
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HALE

Bulletin #964 Rev 1 5/03●

ISO 9001 CERTIFIED

6/25/2003

FoamLogix™

MODEL 2.1A CLASS A ELECTRONIC FOAM PROPORTIONING SYSTEM

DESCRIPTION, INSTALLATION AND OPERATION MANUAL

Hale FoamLogix System Serial Number: ______________________________

Date Unit Placed in Service: ______________________________

Fire Department: ______________________________

Engine Number: ______________________________

Calibration Factors:

Water Flow Factor: ______________________________

Class A Foam Factor: ______________________________

NOTICE: This manual is divided into four sections for clarity and ease of use. **Section I: DESCRIPTION**; Provides an introduction to the Hale foam proportioning system along with guidelines for designing and ordering a complete system. **Section II: INSTALLATION**; Provides information to assist the OEM with installation and initial set-up of Hale foam proportioning systems on an apparatus. **Section III: SET-UP AND CALIBRATION**; Is used by the installer and end user for start-up and calibration of the Hale foam proportioning system. **Section IV: OPERATION**; Is primarily used by the apparatus user for proper operation and maintenance of the Hale foam proportioning system. Each manual section can be a stand alone section or can be used in conjunction with each other.

All Hale products are quality components: ruggedly designed, accurately machined, precision inspected, carefully assembled and thoroughly tested. In order to maintain the high quality of your unit, 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 unit. ALWAYS INCLUDE THE UNIT SERIAL NUMBER IN CORRESPONDENCE.

ECO NO	REV	CHANGED FROM	BY	DATE	APVD
03-110	A	RELEASED FOR PRINTING	PRW	6/1/2003	MAL
03-215	B	UPDATED FOR DESIGN CHANGES	PRW	6/30/2003	MAL

HALE PRODUCTS, INC. ● A Unit of IDEX Corporation ● 700 Spring Mill Avenue ● Conshohocken, PA 19428 ● TEL: 610-825-6300 ● FAX: 610-825-6440

MANUAL P/N 029-0020-74-0, REV B,

IDEX CORPORATION

HALE PRODUCTS INC. ISO 9001 Certificate A4026

TABLE OF CONTENTS

System installer must provide two copies of this Hale Foam System Description, Installation and Operation Manual to the end user of the equipment. If additional manuals are required, contact Hale Products Inc. Communications Department at (610) 825-6300.
Ask for Manual P/N 029-0020-74-0.

ISO 9001 CERTIFIED

FoamLogix™

MODEL 2.1A CLASS A ELECTRONIC FOAM PROPORTIONING SYSTEM

DESCRIPTION, INSTALLATION AND OPERATION MANUAL

SECTION I

DESCRIPTION

NOTICE: This manual section provides a general description of the Hale foam proportioning system along with guidelines for designing and ordering a complete system. This manual section can be used as a stand alone section or in conjunction with other sections of the complete manual.

HALE PRODUCTS, INC. ● A Unit of IDEX Corporation ● 700 Spring Mill Avenue ● Conshohocken, PA 19428 ● TEL: 610-825-6300 ● FAX: 610-825-6440

IDEX CORPORATION

HALE PRODUCTS INC. ISO 9001 Certificate A4026

SAFETY

Hale Foam systems are designed to provide reliable and safe foam concentrate injection. Before installing or operating a Hale Foam system read all safety precautions and follow carefully to ensure proper installation and personnel safety.

WARNINGS

1. Do not permanently remove or alter any guard or insulating devices or attempt to operate the system when these guards are temporarily removed.
2. To prevent electrical shock always disconnect the primary power source before attempting to service any part of the Hale Foam system.
3. All electrical systems have the potential to cause sparks during service. Take care to eliminate explosive or hazardous environments during service/repair.
4. To prevent system damage or electrical shock the main power supply wire will be the last connection made to the Hale Foam proportioner distribution box.
5. Release all pressure then drain all concentrate and water from the system before servicing any of its component parts.
6. Rotating drive line components can cause injury. When working on components of the Hale Foam system be careful of rotating components.

CAUTIONS

1. A foam tank low level sensor must be utilized to protect the Hale Foam proportioner from dry running. Failure to use a low level sensor with the Hale Foam system will void warranty.
2. Do not operate system at pressures higher than the maximum rated pressure.
3. Use only pipe, hose, and fittings from the foam pump outlet to the injector fitting, which are rated at or above the maximum pressure rating at which the water pump system operates.
4. Hale Foam proportioning systems are designed for use on negative ground direct current electrical systems only.
5. Do not mount radio transmitter or transmitter cables in direct or close contact with the FoamLogix control unit.
6. Before connecting the cordsets and wiring harnesses inspect the seal washer in the female connector. If the seal washer is missing or damaged, water can enter the connector causing corrosion of the pins and terminals resulting in possible system failure.
7. Always disconnect the power cable, ground straps, electrical wires and control cables from the control unit or other Hale Foam system equipment before electric arc welding at any point on the apparatus. Failure to do so could result in a power surge through the unit that could cause irreparable damage.
8. **DO NOT** connect the main power lead to small leads that are supplying some other device such as a light bar or siren. The Hale FoamLogix Model 2.1A requires 40 AMP minimum current.
9. When operating the Hale FoamLogix in Simulated Flow mode an outlet for the foam concentrate must be provided to prevent excessive pressure buildup in discharge piping or hoses.
10. Make sure the foam tank and foam concentrate suction hoses are clean before making final connection to foam pump. If necessary flush tank and hoses prior to making connection.

NOTES

1. Check all hoses for weak or worn conditions after each use. Ensure that all connections and fittings are tight and secure.
2. Ensure that the electrical source of power for the unit is a negative ground DC system, of correct input voltage, with

a reserve minimum current available to drive the system.

3. The in-line strainer/valve assembly is a low pressure device and WILL NOT withstand flushing water pressure.
4. When determining the location of Hale Foam system components keep in mind piping runs, cable routing and other interferences that will hinder or interfere with proper system performance.
5. Always position the check valve/injector fitting at a horizontal or higher angle to allow water to drain away from the fitting. This will avoid sediment deposits or the formation of an ice plug.
6. The cordsets provided with each Hale Foam system are indexed so they only go in the correct receptacle and they can only go in one way. When making cordset connections DO NOT force mismatched connections as damage can result in improper system operation.
7. The system can only perform when the electrical connections are sound, so make sure each one is correct.
8. The cables shipped with each Hale Foam system are 100% tested at the factory with that unit. Improper handling and forcing connections can damage these cables which could result in other system damage.
9. There are no user serviceable parts inside Hale Foam system electrical/electronic components. Opening of the distribution box or control unit will void warranty.
10. Use mounting hardware that is compatible with all foam concentrates to be used in the system. Use washers, lockwashers and capscrews made of brass or 300 series stainless steel.
11. When making wire splice connections make sure they are properly insulated and sealed using an adhesive filled heat shrink tubing.
12. **ALWAYS** connect the primary positive power lead from the terminal block to the master switch terminal or the positive battery terminal using minimum 8 AWG type SGX (SAE J1127) chemical resistant battery cable and protect with wire loom.
13. Prevent corrosion of power and ground connections by sealing these connections with silicone sealant provided.
14. Prevent possible short circuit by using the rubber boot provided to insulate the primary power connection at the Hale FoamLogix distribution box.

SYSTEM DESCRIPTION

The Hale FoamLogix 2.1A Foam proportioning system is a completely engineered, factory matched foam proportioning system that provides reliable,consistent foam concentrate injection for Class A foam operations. Hale FoamLogix Foam systems accurately deliver from 0.1% to 10.0% foam concentrate through a check valve/injector fitting directly into the water discharge stream. It is then fed as foam solution into a standard fog nozzle, an air aspirated nozzle, or CAFS equipment, through the apparatus discharge piping. A properly configured and installed foam system with Hale recommended components virtually eliminates contamination of the booster tank, fire pump and relief valve with foam concentrate.

The heart of the Hale FoamLogix 2.1A Foam system is an electric motor driven rotary plunger pump. The pump is constructed of anodized aluminum and stainless steel and is compatible with most Class A foam concentrates. The pump is close coupled to the electric motor thereby eliminating maintenance of an oil filled gearbox. A relief valve mounted on the foam pump, constructed of brass, protects the foam pump and foam concentrate discharge hoses from overpressurization and damage.

The control unit, mounted on the operator panel, is the single control point for the Hale Foam system. Depressing the **ON** button starts foam concentrate injection. A super bright digital LED display shows the water flow rate, total water flowed, foam concentrate injection percentage and total foam concentrate used depending on the display mode selected. A bargraph on the control unit provides indication of the approximate system capacity being used. Adjustment of foam concentrate injection rate can be accomplished by pushing the appropriate button while the system is operating. The control unit display also warns the operator when errors or abnormal operations occur in the system.

Foam concentrate injection rate is controlled by a computer chip in the control unit for accurate, repeatable, reliable foam concentrate injection. A water flowsensor constantly monitors water flow through the discharge piping. The information from the flowsensor is provided to the control unit by a shielded cable. When the Hale Foam system is activated at the control unit a signal is sent from the control unit through the control cable to the distribution box to begin foam concentrate injection. The distribution box then provides power to the electric motor. As the motor rotates the pump, foam concentrate flows through the foam pump discharge to the one piece check valve/injector fitting into the water discharge stream.

A feedback sensor in the foam pump discharge measures foam concentrate flow. The water flow rate and foam concentrate flow rate are constantly compared by the computer chip in the control unit. The motor speed is constantly adjusted to maintain the operator selected foam concentrate injection rate. Since the system is flow based, injection rate remains constant regardless of changes in system pressure or the number of discharges open.

The maximum rated foam concentrate flow in gallons per minute is denoted by the model number. Table 1 shows system capacity at various foam concentrate injection rates for the Hale FoamLogix 2.1A.

The Hale FoamLogix 2.1A Foam system configuration is shown in figure 1-1 at the end of this section.

A low pressure foam concentrate strainer is mounted at the inlet of the foam pump.

Table 1. Maximum Foam Solution Flows

	MAXIMUM FOAM SOLUTION FLOW	
INJECTION RATE (%)	GPM	LPM
0.1	2100	7949
0.2	1050	3974
0.3	700	2650
0.5	420	1590
1.0	210	795

This strainer protects the foam pump from debris that might accumulate in the foam concentrate tank. The strainer/valve assembly has a composite nonmetallic housing with stainless steel mesh strainer element. It is provided with a service shutoff valve. The valve inlet has 1/2 NPT threads and is supplied with a fitting for connection of 1/2 inch (12 mm) ID foam concentrate suction hose. The strainer and valve are low pressure devices and are designed for installations where the strainer IS NOT subject to flushing water pressure.

All Hale FoamLogix Foam systems require a flowsensor for operation.

Ordering of Hale FoamLogix 2.1A Foam system is simple. Using the current Hale FoamLogix 2.1A Foam System Price List and Order Form helps ensure a <u>complete matched</u> system is provided to the end user.

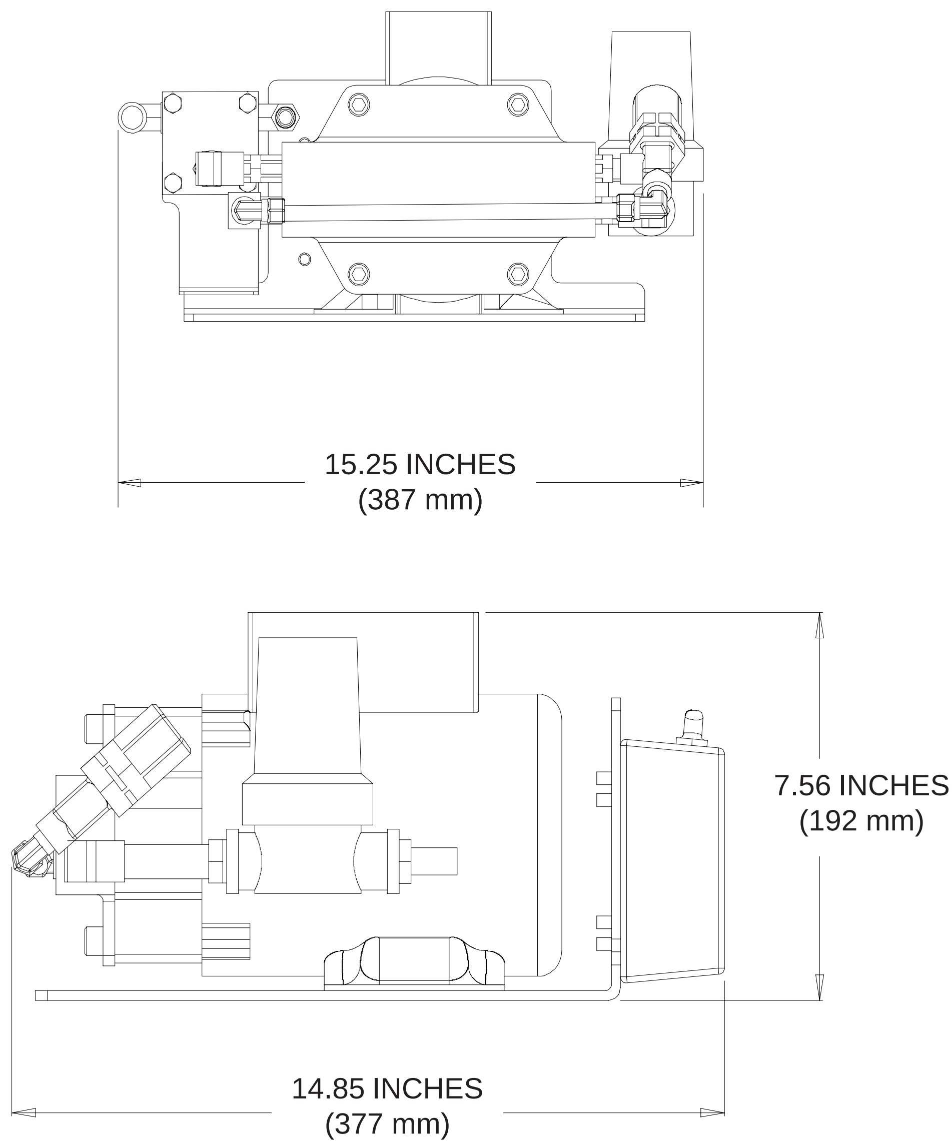
Use the following procedure when ordering a Hale FoamLogix 2.1A Foam system. Following all the steps ensures a complete system will be ordered:

1. Check Hale Foam system product information update (Bulletin 961) for the latest information and advice for foam system selection.
2. Determine the Class A foam concentrate to be used in the system and ensure system compatibility by referring to the Hale Foam Concentrate Compatibility list (Bulletin #650).
3. Consult the current Hale FoamLogix 2.1A Price List and Order Form for ordering of the system. The Hale FoamLogix 2.1A can be ordered as one of two packages that include the pump and motor assembly, control unit, flowsensor cable, stainless steel check valve and injection manifold and an installation kit. Package "A" includes the dual check valve manifold and package "B" includes single check valve manifold. (Note that if package "B" is selected an additional check valve is required where the foam manifold attaches to the pump discharge for NFPA compliance)
4. The Hale FoamLogix 2.1A may also be ordered "a-la-carte" if one of the standard packages does not meet end user requirements. When ordering the system "a-la-carte" for a complete system the Pump and motor assembly, a flowsensor and mount, flowsensor cable, low tank sensor and check valve injector fitting must be ordered at the least.
5. Additional Hale components available to enhance system operation and ease installation include Control Cable Extension, Waterway Check Valves, Manifolds, Flanges, and Foam Tanks

System components are shown in the following system configuration section. All components listed have been engineered and tested with Hale Foam systems to provide optimum system performance. Using the information provided in this manual section and the detailed ordering procedures on the option order form ensures a complete Hale Foam system is ordered thus eliminating delays caused by missing components.

HALE FOAM SYSTEM SPECIFICATIONS

Foam Pump .... Piston
Maximum Foam Concentrate Output .... 2.1 GPM (8 LPM)
Maximum System Operating Pressure .... 250 PSI (17 BAR)
Maximum Operating Temperature .... 160^{O}F (71 C)
Pump Motor .... 0.44 HP (0.3kW), 12 VDC
Operating Ampere Draw .... 20 AMPS @ 12 VDC
Maximum Ampere Draw .... 40 AMPS @ 12 VDC



Foam Pump Installation Envelope Dimensions

SYSTEM CONFIGURATION

"Package A"

Part Number: 501-4190-01-0

Description: FoamLogix 2.1A Kit (12 Volt) with *dual* stainless steel valve manifold (recommended for NFPA backflow prevention compliance):

Includes the following:

(1) FoamLogix full function digital display control that displays flow, foam %, total flow and total foam
(1) 2.1 GPM foam pump assembly with strainer bypass and service valves.
(1) 11 feet of cable between display and pump and 10 feet of cable between display and flow sensor
(1) Foam manifold assembly with dual waterway check valves, flow sensor and foam injection check valve installed. 3" grooved Victaulic connections. Flow range 30 - 750 GPM
(1) Installation kit includes clear reinforced foam inlet hose, hose clamps, positive and ground terminal insulation kit, and low foam level switch (side mount).
(2) Operation and Installation manuals.
(1) Single tank system instruction placard.

"Package B"

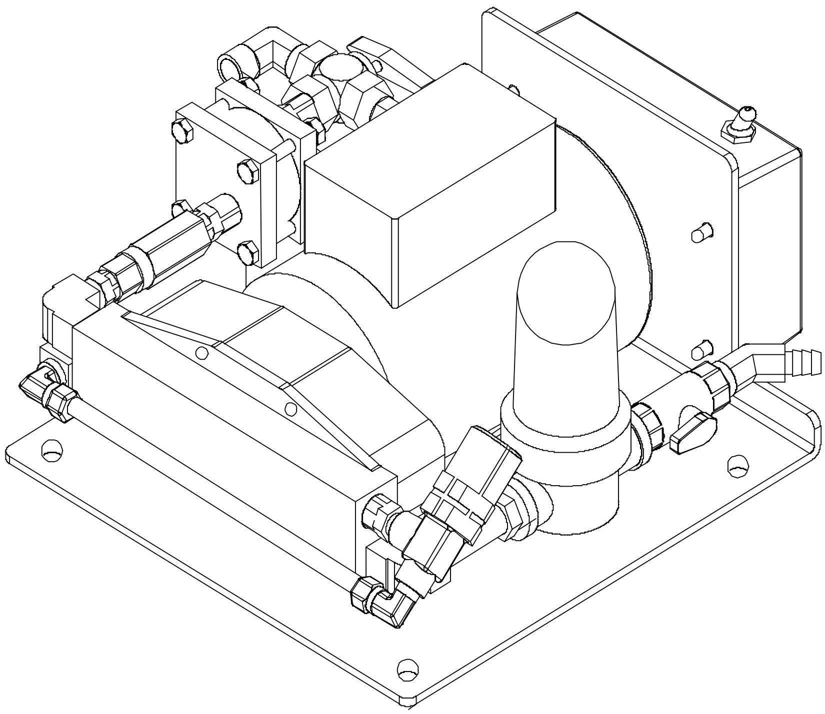
Part Number: 501-4190-02-0

Description: FoamLogix 2.1A Kit (12 Volt) with single stainless steel check valve manifold

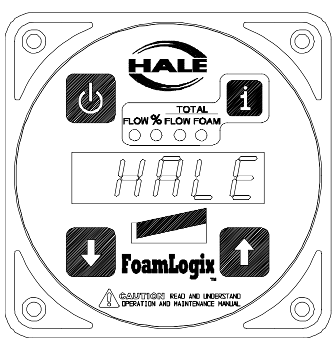
Includes the following:

(1) FoamLogix full function digital display control that displays flow, foam %, total flow and total foam
(1) 2.1 GPM foam pump assembly with strainer bypass and service valves.
(1) 11 feet of cable between display and pump and 10 feet of cable between display and flow sensor
(1) Compact foam manifold assembly with a single waterway check valve, flow sensor and foam injection check valve installed. 3" grooved victaulic connections. Flow range 30 - 750 GPM
Note: A second check valve is recommended to avoid pump/water tank contamination. (See additional options page for loose check valves.)
(1) Installation kit includes clear reinforced foam inlet hose, hose clamps, positive and ground terminal insulation kit, and low foam level switch (side mount).
(2) Operation and Installation manuals.
(1) Single tank system instruction placard.

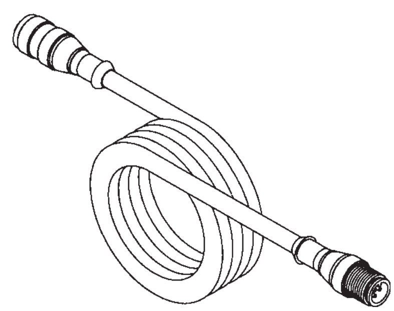
Hale FoamLogix 2.1A Foam Proportioner System
All Hale FoamLogix 2.1A systems include: Foam Pump/Motor Assembly and Control Unit



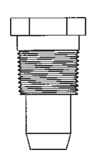
FoamLogix 2.1A Base Unit Foam Pump/Motor Assembly (P/N 501-4190-00-0)



Control Unit
P/N 107064



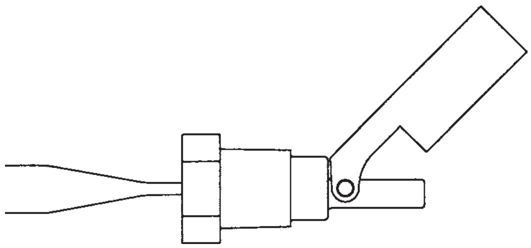
Optional 6-Pin Extension Cable
16.5 Feet (P/N 013-2020-05-0)
6.5 Feet (P/N 013-2020-02-0)



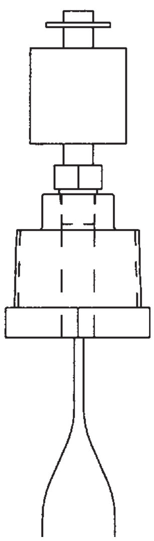
Check Valve/Injector Fitting
P/N 038-1790-00-0

Low Tank Level Sensor Options

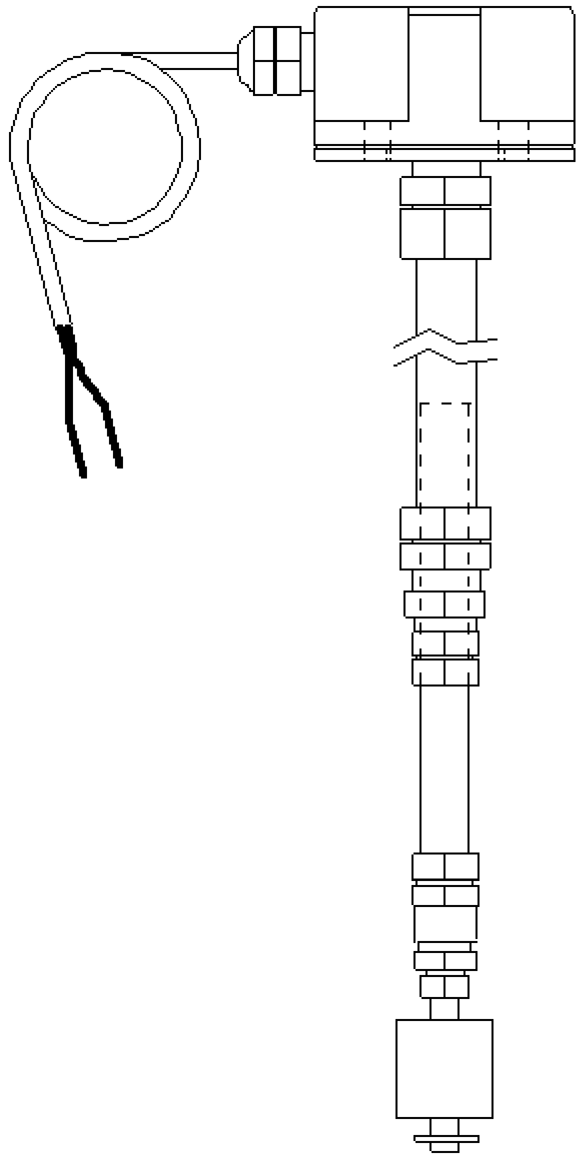
(One Low Tank Level Sensor is Required)



Side Mount Low Tank Level Sensor
(P/N 200-2110-02-0)
(½ Inch NPT Threaded Bushing to Mount From Outside Foam Tank)



Brass Bottom Mount Low Tank Level Sensor
(P/N 200-2110-04-0)
(1 Inch NPT Threaded Bushing to Mount From Outside Foam Tank)

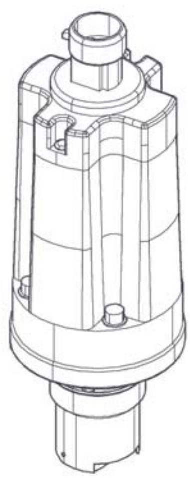


Top Mount Low Tank Level Sensor Assembly
(P/N 200-2110-06-0)
(Extends From 2-½ Feet to 5 Feet Long. May be Cut Shorter)

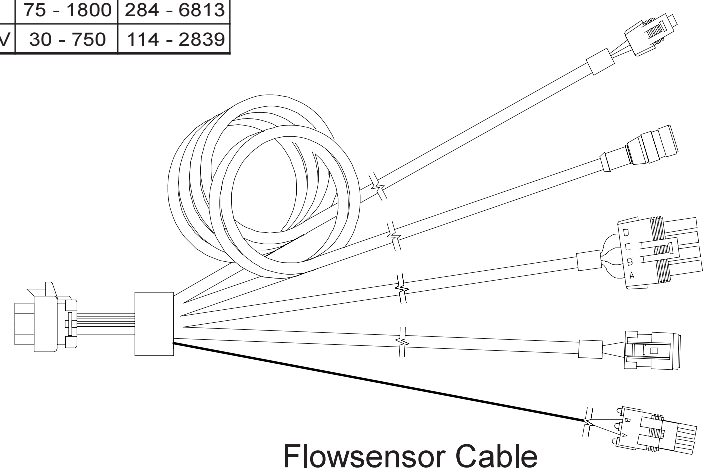
Flowsensors

Each Hale foam system requires a flowsensor to operate. Pipe size must be selected based on the minimum and maximum water flow in the foam capable discharge. Following is a list of pipe size and rated flow range along with flowsensor saddle clamp part number: In all instances a weld fitting may be substituted for the saddle clamp.

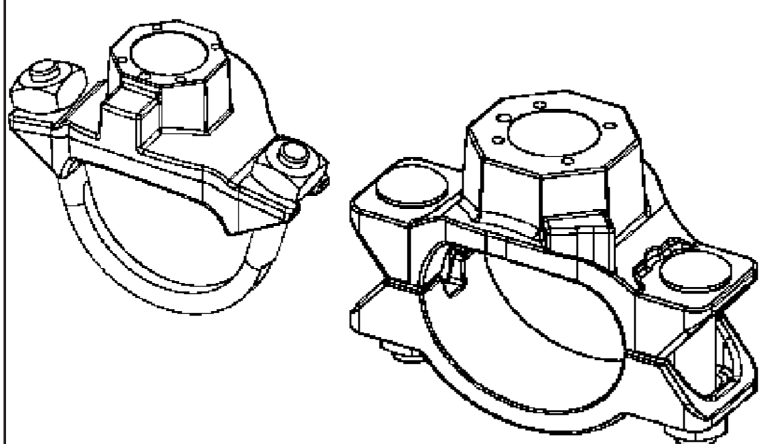
PIPE SIZE	FLOW RANGE	
	GPM	LPM
1-1/2 INCH	10 - 330	38 - 1249
2 INCH	20 - 550	76 - 2082
2-1/2 INCH	30 - 800	114 - 3028
3 INCH	50 - 1250	189 - 4731
4 INCH	75 - 1800	284 - 6813
SCV or DCV	30 - 750	114 - 2839



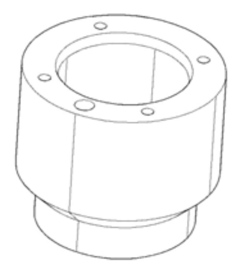
Flowsensor Paddlewheel
P/N 102714



Flowsensor Cable
10 Feet P/N 107400
20 Feet P/N 107362
30 Feet P/N 107401



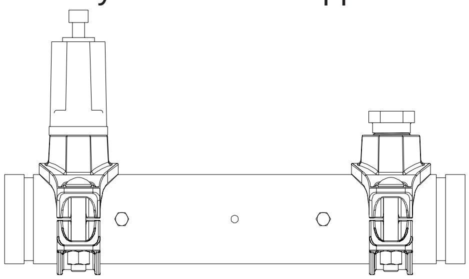
Flowsensor Saddle Clamp
2 INCH P/N 4842010
2-1/2 INCH P/N 4843010
3 INCH P/N 4844010
4 INCH P/N 4846010



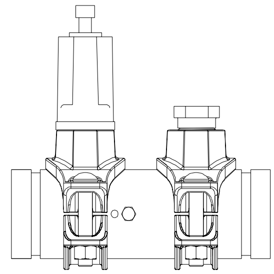
Flowsensor Weld Fitting
Stainless Steel P/N 082-3060-00-0
Steel P/N 309020
Aluminium P/N 309010

Check Valve Manifolds

The check valve manifolds include Flowsensor, Check Valve/Injector fitting and single or dual waterway check valve flappers. End connections for the manifolds are 3 inch victaulic.

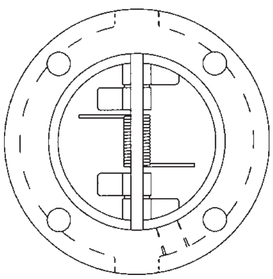


DUAL CHECK VALVE (DCV) MANIFOLD
P/N 108751

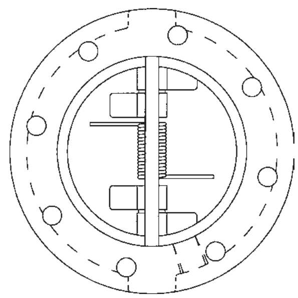


SINGLE CHECK VALVE (SCV) MANIFOLD
P/N 108893

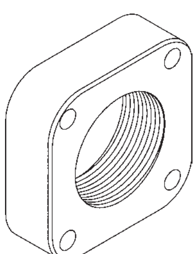
Check Valves, Flanges and Gaskets



3 Inch "115" Check Valve
(P/N 038-1570-00-0)

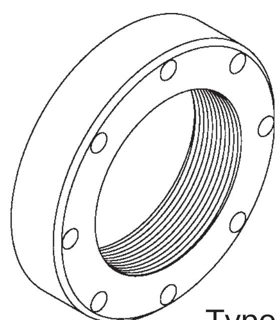


4 Inch "2433D" Check Valve
(P/N 038-1570-04-0)



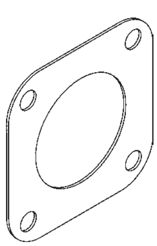
THREADS	PART NUMBER
3 INCH NPT	115-0080-00-0
2-1/2 INCH NPT	115-0070-00-0
2 INCH NPT	115-0060-00-0
BLANK	115-0050-00-0

Type 115 Flange
Use 3 and 2-½ inch NPT with 3 inch check valves.
Also available with 1-½ and 2 inch NPT threads.

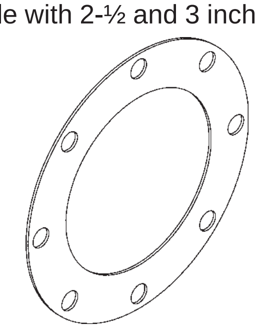


THREADS	PART NUMBER
4 INCH NPT	115-0040-00-0
3 INCH NPT	115-0030-00-0
2-1/2 INCH NPT	115-0020-00-0
BLANK	115-0010-00-0

Type 2433D Flange
Use 4 inch NPT with 4 inch check valves.
Also available with 2-½ and 3 inch NPT threads.

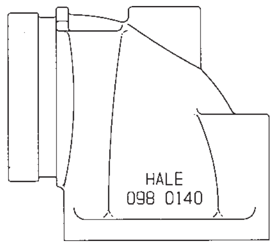


115 GASKET
(P/N 046-0050-00-0)

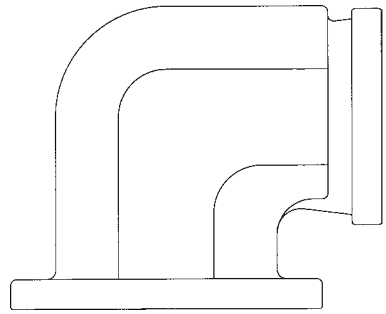


2433D GASKET
(P/N 046-0040-00-0)

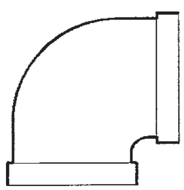
Elbows and Mini Manifold



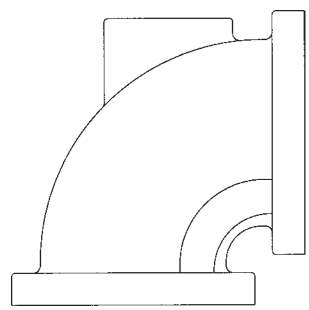
Close Fit Flanged Elbow
(P/N 098-0140-00-0)
115 flange inlet with 3 inch Victaulic outlet.



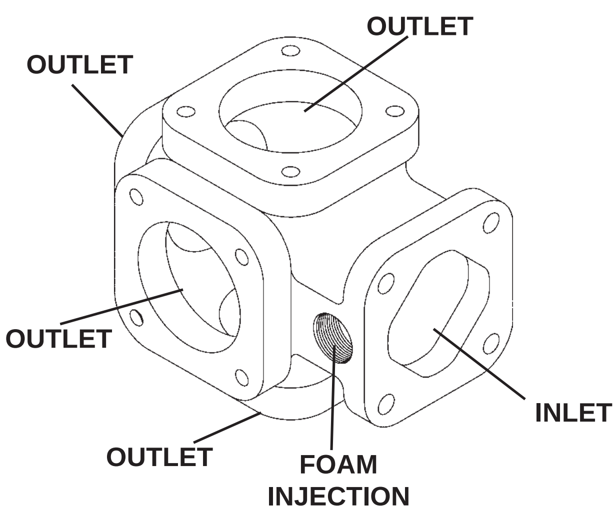
Close Fit Flanged Elbow
(P/N 098-0190-00-0)
2433D flange inlet with 3 inch female NPT and 4 inch Victaulic outlet.



Close Fit Flanged Elbow
(P/N 098-0050-00-0)
115 flange inlet with 2-½ inch female NPT outlet.



Close Fit Flanged Elbow
(P/N 098-0020-00-0)
115 flange inlet with 115 flange outlet.



Mini Manifold
(P/N 178-0320-02-0)

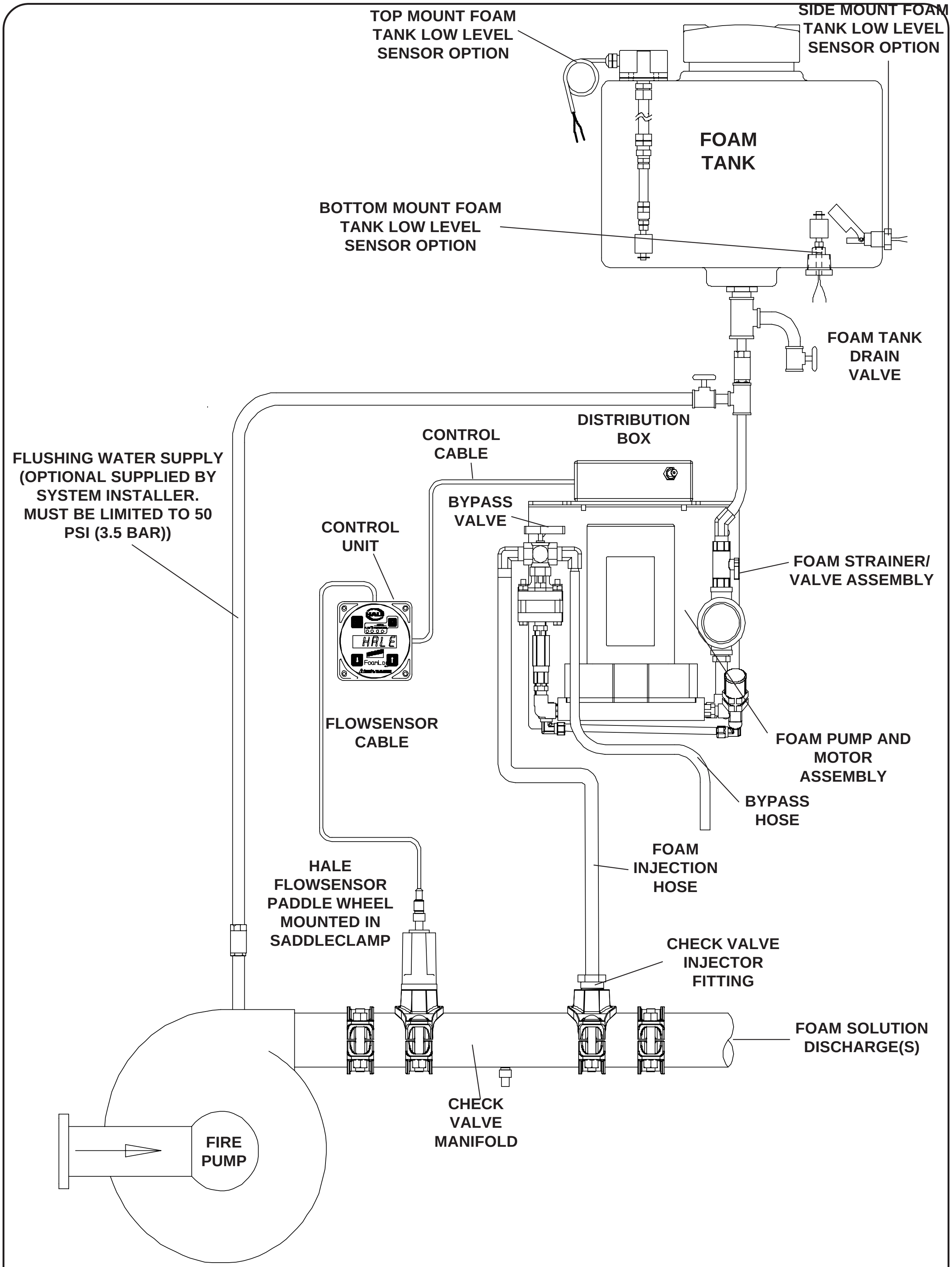


Figure 1-1. Typical Hale FoamLogix 2.1A System Layout

HALE Class 1

ISO 9001 CERTIFIED

FoamLogix™

MODEL 2.1A CLASS A ELECTRONIC FOAM PROPORTIONING SYSTEM

DESCRIPTION, INSTALLATION AND OPERATION MANUAL

SECTION II

INSTALLATION

NOTICE: This manual section provides information to assist the OEM with installation and initial set-up of Hale foam proportioning systems on an apparatus. This manual section can be used as a stand alone section or in conjunction with other sections of the complete manual.

HALE PRODUCTS, INC. ● A Unit of IDEX Corporation ● 700 Spring Mill Avenue ● Conshohocken, PA 19428 ● TEL: 610-825-6300 ● FAX: 610-825-6440

IDEX CORPORATION

HALE PRODUCTS INC. ISO 9001 Certificate A4026

SAFETY

Hale FoamLogix systems are designed to provide reliable and safe foam concentrate injection. Before installing or operating a Hale FoamLogix system read all safety precautions and follow carefully to ensure proper installation and personnel safety.

WARNINGS

1. Do not permanently remove or alter any guard or insulating devices or attempt to operate the system when these guards are temporarily removed.
2. To prevent electrical shock always disconnect the primary power source before attempting to service any part of the Hale Foam system.
3. All electrical systems have the potential to cause sparks during service. Take care to eliminate explosive or hazardous environments during service/repair.
4. To prevent system damage or electrical shock the main power supply wire will be the last connection made to the Hale Foam proportioner distribution box.
5. Release all pressure then drain all concentrate and water from the system before servicing any of its component parts.
6. Rotating drive line components can cause injury. When working on components of the Hale Foam system be careful of rotating components.

CAUTIONS

1. A foam tank low level sensor must be utilized to protect the Hale Foam proportioner from dry running. Failure to use a low level sensor with the Hale Foam system will void warranty.
2. Do not operate system at pressures higher than the maximum rated pressure.
3. Use only pipe, hose, and fittings from the foam pump outlet to the injector fitting, which are rated at or above the maximum pressure rating at which the water pump system operates.
4. Hale Foam proportioning systems are designed for use on negative ground direct current electrical systems only.
5. Do not mount radio transmitter or transmitter cables in direct or close contact with the FoamLogix control unit.
6. Before connecting the cordsets and wiring harnesses inspect the seal washer in the female connector. If the seal washer is missing or damaged, water can enter the connector causing corrosion of the pins and terminals resulting in possible system failure.
7. Always disconnect the power cable, ground straps, electrical wires and control cables from the control unit or other Hale Foam system equipment before electric arc welding at any point on the apparatus. Failure to do so could result in a power surge through the unit that could cause irreparable damage.
8. **DO NOT** connect the main power lead to small leads that are supplying some other device such as a light bar or siren. The Hale FoamLogix Model 2.1A requires 40 AMP minimum current.
9. When operating the Hale FoamLogix in Simulated Flow mode an outlet for the foam concentrate must be provided to prevent excessive pressure buildup in discharge piping or hoses.
10. Make sure the foam tank and foam concentrate suction hoses are clean before making final connection to foam pump. If necessary flush tank and hoses prior to making connection.

NOTES

1. Check all hoses for weak or worn conditions after each use. Ensure that all connections and fittings are tight and secure.
2. Ensure that the electrical source of power for the unit is a negative ground DC system, of correct input voltage, with

a reserve minimum current available to drive the system.

3. The in-line strainer/valve assembly is a low pressure device and WILL NOT withstand flushing water pressure.
4. When determining the location of Hale Foam system components keep in mind piping runs, cable routing and other interferences that will hinder or interfere with proper system performance.
5. Always position the check valve/injector fitting at a horizontal or higher angle to allow water to drain away from the fitting. This will avoid sediment deposits or the formation of an ice plug.
6. The cordsets provided with each Hale Foam system are indexed so they only go in the correct receptacle and they can only go in one way. When making cordset connections DO NOT force mismatched connections as damage can result in improper system operation.
7. The system can only perform when the electrical connections are sound, so make sure each one is correct.
8. The cables shipped with each Hale Foam system are 100% tested at the factory with that unit. Improper handling and forcing connections can damage these cables which could result in other system damage.
9. There are no user serviceable parts inside Hale Foam system electrical/ electronic components. Opening of the distribution box or control unit will void warranty.
10. Use mounting hardware that is compatible with all foam concentrates to be used in the system. Use washers, lockwashers and capscrews made of brass or 300 series stainless steel.
11. When making wire splice connections make sure they are properly insulated and sealed using an adhesive filled heat shrink tubing.
12. **ALWAYS** connect the primary positive power lead from the terminal block to the master switch terminal or the positive battery terminal using minimum 8 AWG type SGX (SAE J1127) chemical resistant battery cable and protect with wire loom.
13. Prevent corrosion of power and ground connections by sealing these connections with silicone sealant provided.
14. Prevent possible short circuit by using the rubber boot provided to insulate the primary power connection at the Hale FoamLogix distribution box.

APPARATUS INSTALLATION PLANNING

To simplify installation selection of one of the two packages described in Section 1 should be ordered. While the package provides most of the components required for installation the following guidelines are provided.

Differences in apparatus plumbing and foam system configuration make it impractical to show exactly how the Hale FoamLogix 2.1A system is installed on a particular apparatus. The information contained in this section, however, will apply to most situations and should be used when designing and installing a Hale FoamLogix 2.1A system. A system plumbing and electrical diagram is provided at the end of this installation section to assist the apparatus manufacturer with installation of the Hale FoamLogix system.

The following subsections provide the system installer with guidelines for a complete system installation. Before proceeding with system installation carefully review the procedures that follow to ensure the system is properly designed. This section lists components that have been tested with Hale FoamLogix and provide the best system performance. Use of the recommended materials and specified parts will ensure a virtually maintenance free installation.

The Hale FoamLogix system is supplied with six major components that must be located on the apparatus. The major components of the Hale FoamLogix system are:

- Foam pump and motor assembly
- Control unit
- Instruction/system diagram placard
- Flowsensor
- Check valve injector fitting

Optional components to enhance system installation and operation that require mounting on the apparatus include:

- Mini Manifold
- Flanged elbows
- Foam tank

IMPORTANT: When determining the locations of Hale FoamLogix components being installed keep in mind piping runs, cable routing and other interferences that will hinder or interfere with proper system performance.

FOAM PUMP and MOTOR ASSEMBLY: Ideally the foam pump and motor assembly should be located in an area that is protected from road debris and excessive heat buildup. The foam system master power switch, bypass valve, strainer and shutoff valve are located on the foam pump and motor assembly and access to these components must be provided.

The foam pump and motor assembly should be mounted below the discharge of the foam tank to provide for gravity feed to the foam pump. The foam tank must be located where refilling can be easily done with 5 gallon (19 liter) pails and other methods suitable to the end user. Most water tank manufacturers will build the foam tank into the booster tank. When specifying foam tank make sure provisions are made for installation of the low tank level sensor as well as foam suction connections, tank drainage and proper fill openings per NFPA requirements.

CONTROL UNIT and INSTRUCTION/SYSTEM DIAGRAM PLACARD: Determine a location on the operator panel of the apparatus for the control unit and instruction/system diagram placard. These components must be located at the main pump operator position in close proximity to each other. Consideration must be given for routing the control cable from the control unit to the distribution box on the foam pump and motor assembly. If necessary, order longer or shorter cable assemblies to suit the location demands.

INSTALLER SUPPLIED COMPONENT RECOMMENDATIONS

Due to the many differences in apparatus configuration and apparatus design requirements the Hale FoamLogix system installer must supply components such as mounting brackets, piping, hoses, fittings and some electrical wiring. The following guidelines are recommendations for selection of these additional components for a complete system installation. The recommendations made reflect those materials and components that have been tested extensively with Hale FoamLogix systems and provide proven reliable performance.

FOAM CONCENTRATE SUCTION HOSE

The Hale FoamLogix 2.1A foam system is provided with 15 Feet (4.6 M) of 1/2 inch (12 mm) ID reinforced PVC foam concentrate suction hose. The system installer may need to supply additional fittings and hose from the foam tank to the inlet of the foam pump. All components selected will transfer foam concentrate therefore they must be compatible with the foam concentrates being used in the system. Hoses for Class A foam concentrates have minimum 1/2 inch (12 mm) inside diameter.

Hoses for the foam concentrate suction must have a rating of 23 in (584.2 mm) Hg vacuum and 50 PSI (3 BAR) pressure or greater.

NFPA requires that foam concentrate suction hose be clear to observe foam concentrate flow during foam pump operation.

RECOMMENDED COMPONENTS:

Hose: PVC, Kuriyama Kuri-Tec K3130 or K7130 series

Fittings: Hose Barb Type; Brass, Stainless Steel or Nylon

A foam tank shut-off valve is provided. A drain valve should be provided in the foam tank suction hose to allow strainer service, tank drainage and easier priming. These components are subject to the same material characteristics and pressure ratings as stated above. The foam concentrate strainer has a shut-off valve included. This valve is used to shut off foam concentrate flow to service the strainer. An additional valve and drain should be installed at the foam concentrate tank.

FOAM CONCENTRATE DISCHARGE HOSE

The system installer must supply fittings and hoses from the foam pump inject connection to the check valve/injector fitting inlet. All components selected will transfer foam concentrate therefore they must be compatible with the foam concentrates being used in the system.

The foam pump discharge connection has a 1/2 inch compression fitting and the check valve injector fitting connection has ½ inch NPT threads. Hoses and fittings of ½ inch (13 mm) minimum inside diameter rated at 500 PSI (34 BAR) working pressure or maximum discharge pressure of the fire pump must be used. Fittings and hoses must be compatible with all foam agents to be used.

RECOMMENDED COMPONENTS:

Hose: Aeroquip 2580-8 or Equivalent Reinforced Hydraulic Hose.

Fittings: Brass or Stainless Steel Hose End Crimp or Reusable Type (Aeroquip 412-9-8 or Equivalent)

FOAM CONCENTRATE BYPASS HOSE

The foam concentrate bypass hose connection has a ½ inch hose barb connection. Hoses and fittings of nominal ½ inch (13 mm) minimum diameter should be used as bypass hose. Since the bypass hose is used for calibration and draining the system it will not see high operating pressures, therefore, a hose with a lower pressure rating than the inject hose can be used. Fittings and hoses used must be compatible with all foam agents expected to be used. Use fittings made of brass or 300 series stainless steel compatible with all foam concentrates.

RECOMMENDED COMPONENTS:

Hose: Low Pressure Hydraulic Hose or Air Brake Tubing

Fittings: Brass or Stainless Steel

The foam concentrate bypass hose should be long enough to extend past the apparatus running board making foam pump setup and calibration simpler.

CHECK VALVES

Check valves must be installed on apparatus with foam systems to prevent contamination of the foam concentrate with water and contamination of the fresh water tank with foam. (Refer to figure 1-1) When a Hale FoamLogix 2.1A foam injection system and related components are properly installed the required check valves are integral parts of the component parts.

NFPA standards require a check valve in the foam concentrate injection line at the injection point. The Hale P/N 038-1790-00-0 Integral Check Valve/Injector fitting, a standard component included with the Hale FoamLogix 2.1A system installed when a manifold kit is ordered, meets these requirements and threads directly into the foam injection port on Hale manifolds.

Check valves must be installed in all water piping locations where foam concentrate could drain back into pumps or other components of the fire apparatus. As a minimum one check valve must be installed where the water piping that will supply foam solution connects to the fire pump discharge. To more effectively keep foam contamination out of the fire pump and water tank double check valves should be used. Separate two check valves by at least 6 to 8 inches (152 to 203 mm) of piping to form a dead zone between the check valves. Individual drain lines should be used on each check valve. The waterway check valves should be rated for 500 PSIG (34 BAR) test pressure.

FLUSHING WATER HOSE

If a Hale approved Class A foam concentrate is used flushing of the Hale FoamLogix 2.1A system is not necessary. If a flushing water hose is desired to flush the foam pump it must have a pressure reducer/regulator that limits the flush water pressure to 50 PSI (3.5 BAR). The tubing and fittings used must be compatible with foam concentrates being used in the system.

When provision for flushing is desired the system installer must provide proper hose, shutoff valve, check valve, reducer/ regulator and connections for flushing water for the system to be NFPA compliant.

FOAM DISCHARGE DRAINS

Drains must be provided from foam capable discharge piping components to prevent freezing in cold weather. When designing the drain system care must be taken to prevent contamination of the water system with foam and the foam concentrate with water. Some multiple drain systems that allow individual drain lines to communicate also allow foam to bypass the installed check valves causing contamination of fire pump and the water or foam concentrate storage tanks.

Hale has an optional 6 port drain valve, Model MMD6 (Hale P/N 104961) that provides individual drains with a single control to use for applications where a single point for multiple drains is required. If a Hale MMD6 drain valve is not used then individual drain lines and valves for foam capable discharge piping are recommended. Alternatively an air operated 6 port drain valve is available.

ELECTRICAL REQUIREMENTS

The system installer must provide the primary power wire and a ground strap for the Hale FoamLogix system.

Primary power must be supplied from the main apparatus battery to the distribution box on the foam pump and motor assembly. The Hale FoamLogix 2.1A requires minimum 40 AMP electrical service.

Primary electrical power must be supplied directly from the battery or the battery master disconnect switch or solenoids to the Hale FoamLogix. Other electrical components must not be supplied from this wire. DO NOT connect the primer and Hale FoamLogix to the same power wire.

The toggle switch on the Hale FoamLogix distribution box should be left in the **ON** position at all times. So the Hale FoamLogix system is ready for immediate operation when the operator places the apparatus in pump mode, and to prevent battery power drain when the apparatus is not running, the primary power connection must be made so power is supplied to the Hale FoamLogix when the main apparatus electrical system is energized and the pump is in gear. Use of a solenoid with a 200 AMP peak, 100 AMP continuous rating is recommended. Figure 2-1 shows the recommended wiring of this relay.

With Hale FoamLogix 2.1A, cable lengths up to 6 feet (1.8 meters) require minimum 8 AWG type SGX (SAE J1127) battery cable. Use solder lugs on cable ends with a 5/16 inch (8 mm) diameter hole. Refer to the following table for the recommended battery cable size. When planning cable runs make sure the primary wires are routed by the shortest most direct route.

RECOMMENDED PRIMARY POWER CABLE SIZES	
Models 3.3 & 5.0	**Maximum Length**
8 AWG (8.4 mm^2)	6 Ft (1.8 M) or Less
4 AWG (21.2 mm^2)	6 Ft (1.8 M) to 15 Ft (4.6 M)
0 AWG (53.5 mm^2)	15 Ft (4.6 M) or Longer

A braided flat ground strap connected to the apparatus chassis is recommended for the ground connection to limit the RFI/EMI interference encountered with radios, computers or other sensitive electronic equipment. The ground strap should be a minimum of 1-¼ inches (32 mm) wide and be no longer than 18 inches (457 mm). The ground strap must have soldered flat lug ends with 3/8 inch (10 mm) diameter holes. If the ground strap length exceeds 18 inches (457 mm), a wider ground strap should be used or use a double thickness of 1-¼ inches (32 mm) wide ground strap.

When making the ground strap connection make sure the connection is made to the chassis. Use minimum 5/16 inch (8 mm) diameter bolt or mounting stud for this connection.

Make sure the ground is attached directly to the chassis frame and not to the apparatus body work. Before making ground connection remove all paint, grease and coatings from the connection area. After making connection seal against corrosion. When a flat ground strap is not available use a battery cable one size larger than the power cable used.

NOTE: When an inline current shunt ammeter is installed on the apparatus it is necessary to install a power filter kit (Hale P/N 546-1870-00-0) on the Hale FoamLogix foam pump.

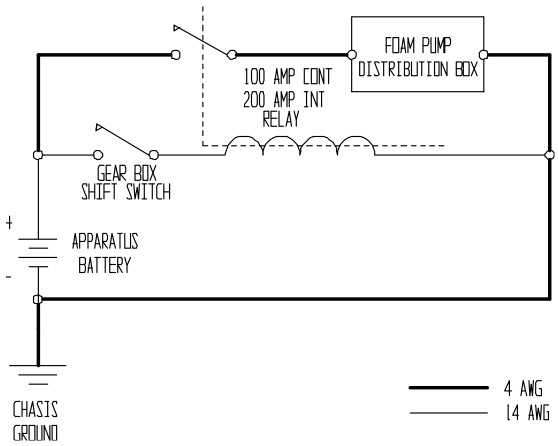


Figure 2-1. Recommended Relay Wiring Schematic

FOAM CONCENTRATE TANK

A foam concentrate tank must be supplied to suit the capacity required for the apparatus application. The tank must meet NFPA minimum standards for their design capacity, including filler size, vapor pressure venting, baffling and drain facilities.

FOAM PUMP MOUNTING

Position the foam pump and motor assembly in the desired location on the apparatus. When installing the foam pump and motor assembly, the assembly should be kept in a **horizontal** position with the base plate on the bottom (see figure 2-2). Although the system is sealed and designed to be resistant to the harsh environment of fire fighting apparatus, a compartment with easy operator access is the recommended installation location.

The base plate of the foam pump and motor assembly must be anchored to a surface or structure that is rigid and of adequate strength to withstand the vibration and stresses of apparatus operation. Figures 2-3 provides the mounting envelope dimensions for the Hale FoamLogix foam pump and motor assembly.

Position the foam pump so the ON/OFF switch and bypass valve are easily accessible. When the Hale FoamLogix system is ordered without the ADT option, a separate bypass valve is included that may be removed from the foam pump and mounted on a truck panel for easier access. When the Hale FoamLogix system is ordered with the ADT option, the operating knob can be removed from the bypass valve actuator and an extension rod can be installed to permit remote operation. In either instance the foam pump and motor assembly must be located to permit proper operation of the bypass valve.

Make sure the foam concentrate hoses can be properly routed to the inlet and outlet on the foam pump. Foam concentrate must gravity feed to the foam pump inlet from the foam tank(s). The foam pump must be mounted in an area to avoid excessive engine exhaust system or accessory heat buildup.

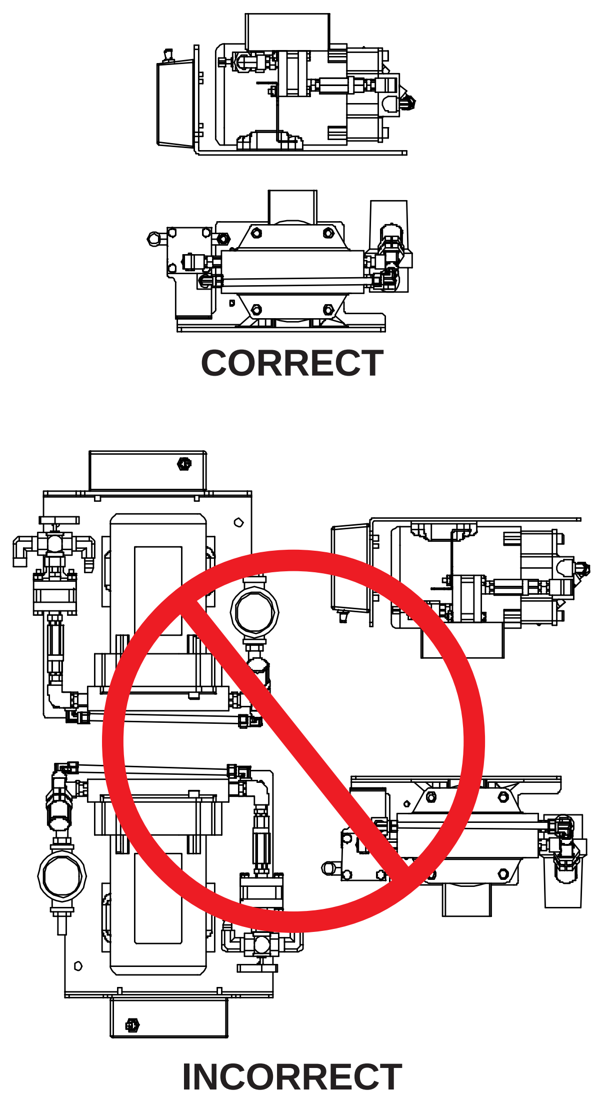


Figure 2-2. Hale FoamLogix Installation

The base of the foam pump and motor assembly has predrilled mounting holes. These holes will accept $^{5}/_{16}$ inch (8 mm) diameter bolts and the apparatus mounting location needs to be drilled accordingly. The base plate can be used as a template to mark mounting hole location or a mounting hole layout drawing is provided as figure 2-4.

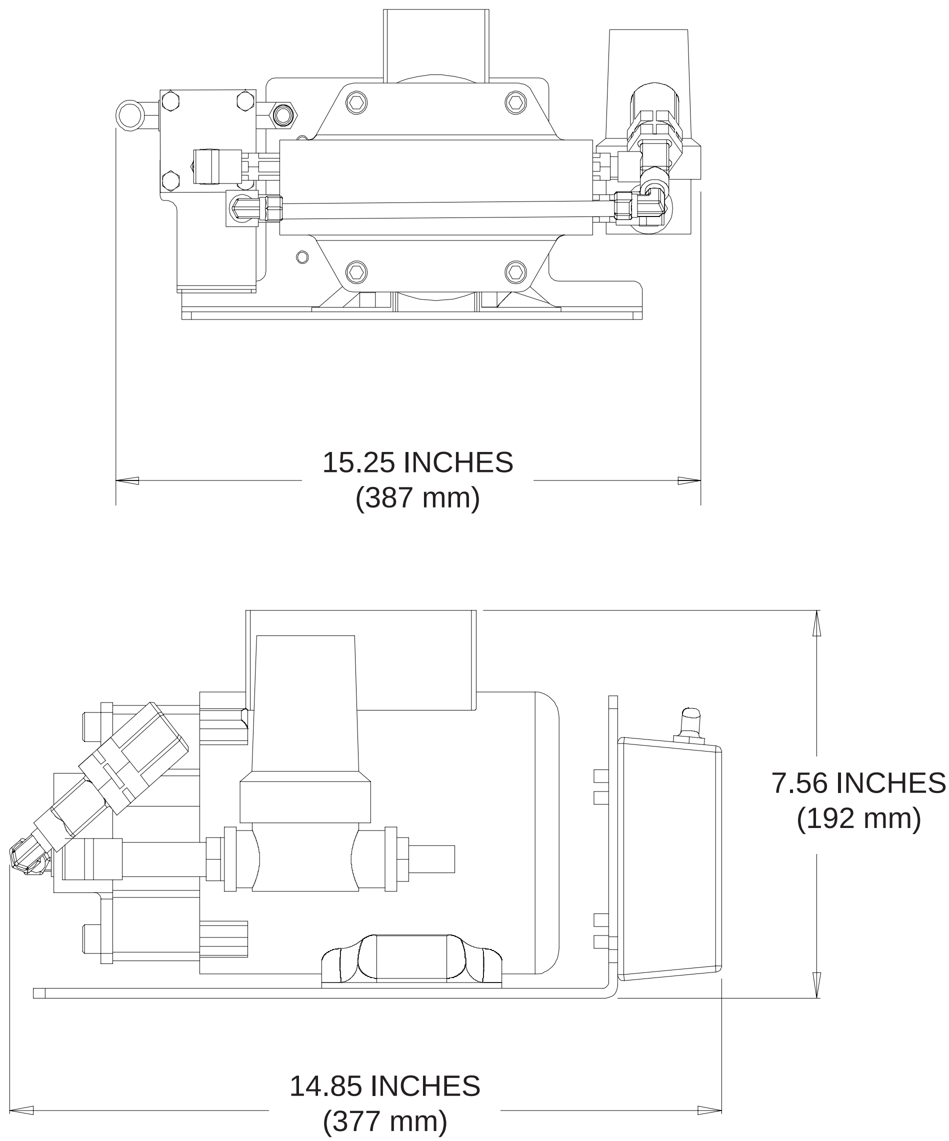


Figure 2-3. Foam Pump Installation Envelope Dimensions

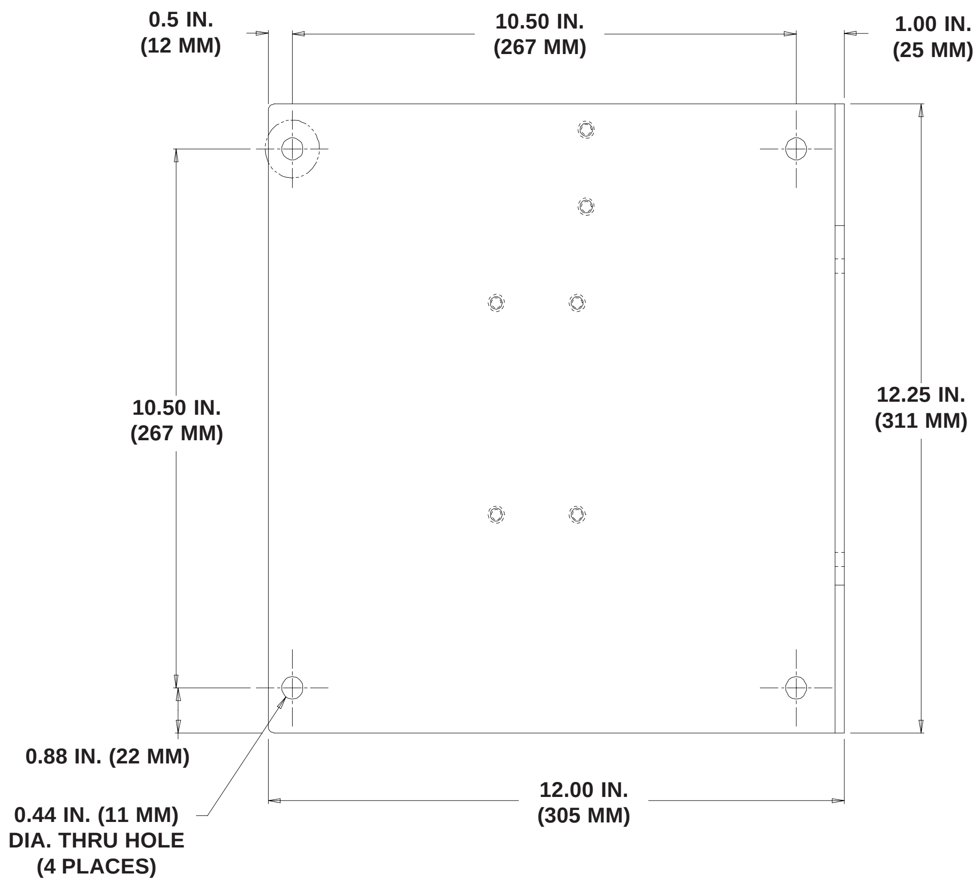


Figure 2-4. Hale FoamLogix Foam Pump and Motor Assembly Base Plate Dimensions and Mounting Hole Locations

PLUMBING COMPONENT INSTALLATION

Hale FoamLogix System plumbing diagrams are located at the end of this manual section. The diagrams provide recommended guidelines for the installation of system components that handle water, foam concentrate and foam solution. The sequence in which the plumbing installation is completed depends on the individual installation.

WATER AND FOAM SOLUTION PLUMBING

When making water and foam solution piping runs use the best industry practices to install this piping. When making threaded pipe connections use a suitable pipe sealing compound at all joints.

CHECK VALVE MANIFOLD

Hale recommends using the premade stainless steel foam manifold available in kits that eliminates extra labor and leaks from large pipe thread connections. The manifolds use 3 inch Victaulic connections and are available in single or dual check valve configurations.

Figure 2-5 shows installation of the check valve manifold. Note that when the manifold is installed there is a drain tap on the manifold that must be placed in the down position and plummed to an individual drain. When properly mounted the flowsensor and check valve/injector fitting will be on the side of the manifold. Refer to figures 2-8 and 2-12 for the maximum permissible angle of the flow sensor and check valve/injector fitting.

OPTIONAL HALE PIPING COMPONENTS

Hale piping components such as 3 inch and 4 inch wafer type check valves, 115 and 2433 series flanges, mini manifold, etc. can simplify installation of water and foam solution discharge piping. The arrangement shown in figure 2-6 provides accurate proportioning across a wide range for up to four discharges from the mini manifold. The dual check valve arrangement helps to ensure that no foam concentrate will

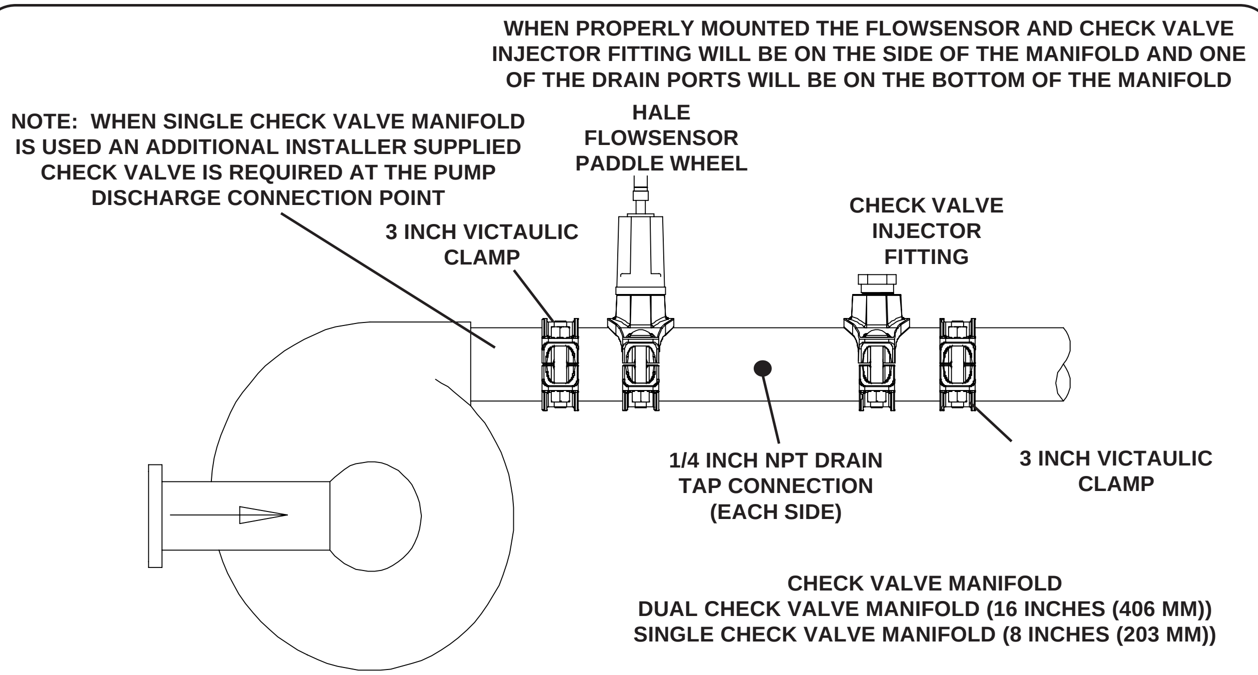


Figure 2-5. Check Valve Manifold Installation

contaminate the pump water. The Hale mini manifold provides a 1 inch NPT tap for installation of the check valve/injector fitting. The Hale mini manifold and elbow components use 4-3/8 inch diameter bolt circles and minimize fabrication and pipe work. After installation of the plumbing is complete make sure all pipes, hoses and tubes are supported using the best industry practices.

Figure 2-7 shows a suggested installation arrangement using Hale 4 inch check valves, Hale 2433 flanges and 4 inch pipe.

WATERWAY CHECK VALVES

Check valves in the waterway, rated at 500 PSI (34 BAR), are required to keep foam solution out of the main pump and allow pump priming without drawing foam into the piping. Using double check valves, separated by at least 8 inches (203 mm) of pipe before the foam injection point, helps ensure that pump and tank water remain uncontaminated.

FLOWSENSOR

Hale FoamLogix flowsensor is specially designed to make inspection and maintenance of the flow sensor easy. The flowsensor paddlewheel is installed on a saddle clamp or weld fitting on the foam capable discharge piping of the apparatus. In horizontal piping runs, the flowsensor should be mounted as close to upright as possible within the range shown in figure 2-8. DO NOT let the flowsensors rotate more than 85° in either direction for proper operation.

When selecting flowsensor it is important to consider the minimum and maximum flow requirements during operation. Refer to the flowsensor selection chart in Section I of this manual for proper pipe size for flow range desired.

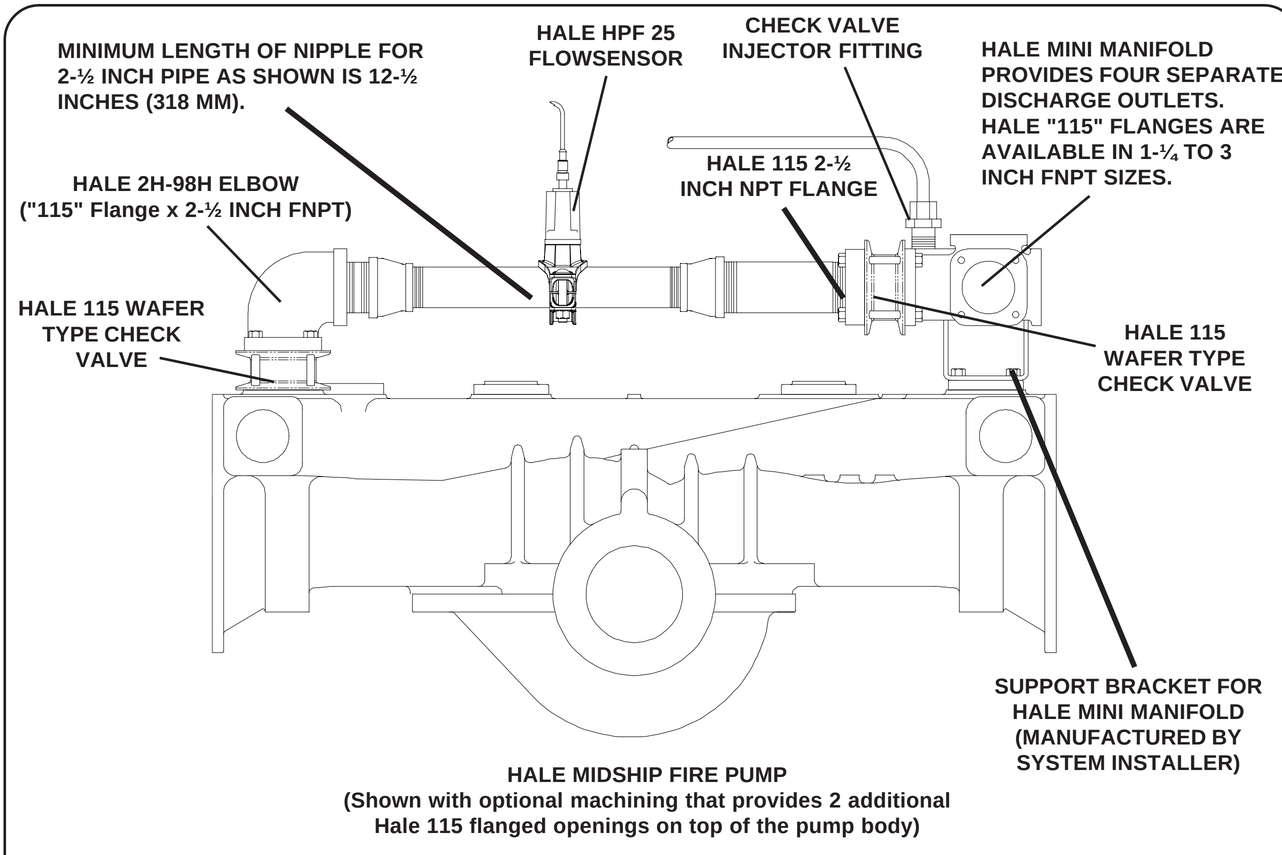


Figure 2-6. Typical Midship Pump Installation

The flowsensor is installed in the piping before the foam concentrate injection point.

Some applications may require flowsensor accuracy that is not within the range specified for the discharge piping. This is true in applications where the foam system needs to supply a 3 inch deck gun as well as a 1 inch booster line. Since the flow through the deck gun will exceed the capacity of the foam pump, pipe size for flowsensor mounting should be selected to provide accuracy at the lower flows. Mounting the flowsensor in a short section of pipe one pipe size smaller (4 inch to 3 inch, 3 inch to 2-½ inch, 2-½ inch to 2 inch or 2 inch to 1-½ inch) provides better accuracy at the lower flows. Refer to the flowsensor selection chart in Section I of this manual for pipe size. Selection of the next smaller pipe permits reducing the straight pipe run the required distance prior to the flowsensor paddlewheel then increasing the pipe size on the flowsensor outlet. In the short length of reduced pipe pressure loss will be minimal and there will be minimal pressure loss through elbows and fittings. Figure 2-9 shows a typical reduced piping run installation.

Excessive turbulence in the flowsensor may produce unstable and inaccurate flow readings. The length of straight pipe prior to the flowsensor must be sufficient to reduce the turbulence in the pipe. The following installation guidelines will help attain the best readings, and maintain the accuracy of the Hale FoamLogix system.

a. A minimum **6 times the pipe diameter** of straight run pipe without any fittings is necessary prior to the flowsensor paddlewheel (see figure 2-10). Minimum required straight pipe run:

Pipe Size	Minimum Recommended Straight Run Pipe
1-½ in. (38 mm)	9 in. (191 mm)
2 in. (50 mm)	12 in. (254 mm)
2-½ in. (64 mm)	15 in. (317 mm)
3 in. (76 mm)	18 in. (381 mm)
4 in. (102 mm)	24 in. (508 mm)

b. The downstream piping length is not as critical but there should be a short length of straight pipe with no fittings or valves immediately after the flowsensor paddlewheel.

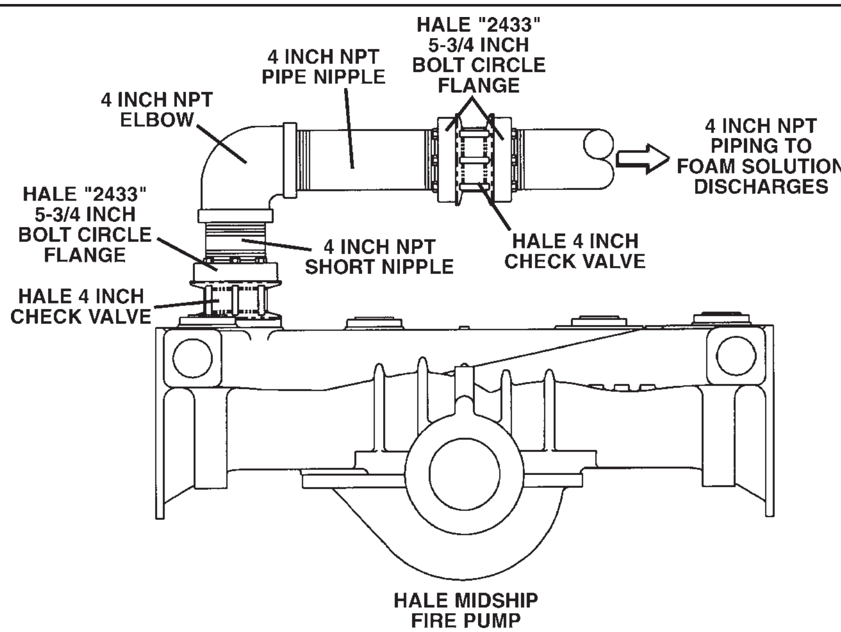


Figure 2-7. Typical 4 Inch Check Valve Installation on Midship Pump

c. **Do not mount a flowsensor directly after an elbow or valve.** Valves create severe turbulence when they are "gated".

SADDLE CLAMP INSTALLATION

Installation of the Paddlewheel Flowsensor using a saddle clamp requires a 1.385/1.390 inch bored hole in the pipe. A minimum of six times the pipe diameter of straight run pipe without any fittings is necessary prior to the position of the hole.

For proper installation, the flowsensor requires the use of a spacer and eight stainless steel internal hex head screws.

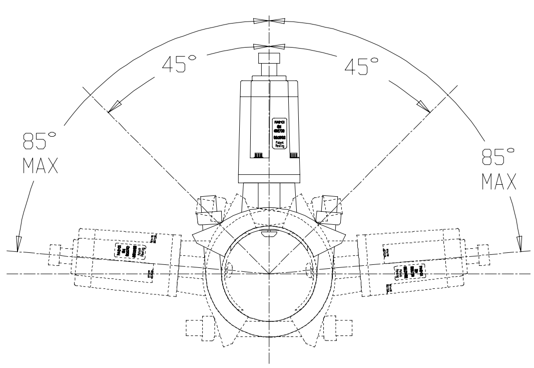


Figure 2-8. Flowsensor Tee Position Range in Horizontal Piping Runs

Four 6 – 32 x ½ inch screws attach the spacer to the saddle clamp mount, and four 6 – 32 x ¾ inch screws with lockwashers attach the paddlewheel to the spacer.

Align the spacer to the saddle clamp mount by arranging the indexing pin of the saddle clamp with the indexing hole of the spacer. Use four ½ inch machine screws without lockwashers to secure the two pieces. Torque to 8.5 inch pounds.

Align the paddlewheel indexing pin to the indexing hole in the spacer, secure using four ¾ inch screws and lockwashers. Torque to 7.5 inch pounds.

Apply a small amount of grease to the saddle clamp gasket before the final installation of the assembly onto the pipe. Tighten the saddle clamp onto the pipe firmly.

The paddlewheel should be installed as close to upright as possible within the range shown in figure 2-8. Do not let the flowsensor rotate more than 85 degrees in either direction for proper operation.

FOAM PUMP FLUSH SYSTEM

Flushing water hose should have a minimum of ½ inch (12 mm) inside diameter. The

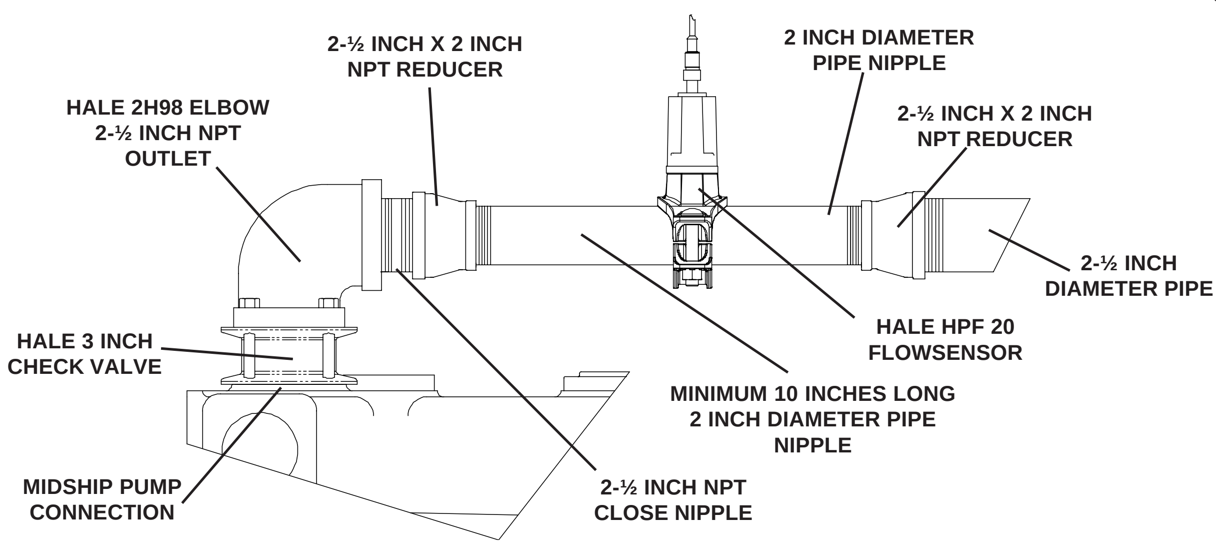


Figure 2-9. Typical Reduced Flowsensor Piping Arrangement

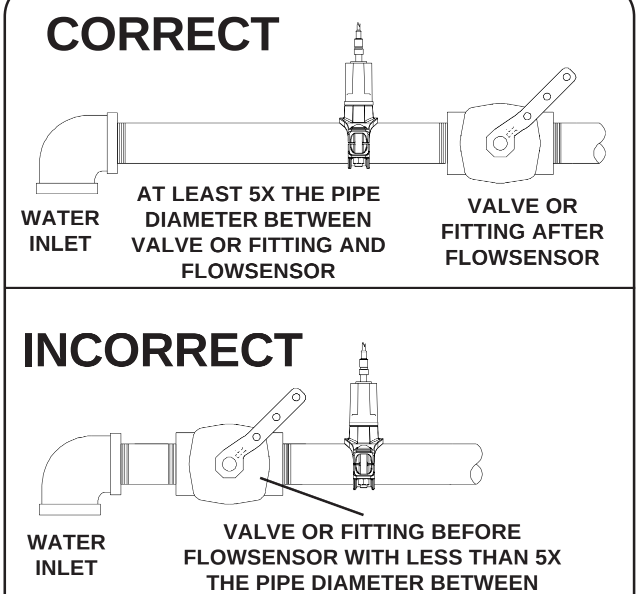


Figure 2-10. Flowsensor Placement

flush water supply should be provided from one of the pressure taps on the discharge of the fire pump and must be reduced to 50 PSI (4 BAR). It is recommended that a check valve be installed at the pressure tap to prevent contamination.

FOAM CONCENTRATE PLUMBING

Foam concentrate plumbing consists of the foam concentrate suction hose, foam strainer, foam concentrate discharge hose and check valve/injector fitting.

CAUTION: Make sure the foam tank and foam concentrate suction hoses are clean before making final connection to foam pump. Flush tank and hoses prior to making connections.

NOTE: Foam concentrate gravity fed.

FOAM STRAINER CONNECTION

CAUTION: The foam concentrate strainer assembly, mounted on the foam pump inlet is a low pressure device and WILL NOT withstand flushing water pressure. If flushing water is to be provided then the pressure must be limited to 50 PSI (3.5 BAR).

The strainer/valve assembly has 1/2 inch NPT female threaded ports. A 1/2 hose barb fitting is supplied for connection of the 1/2 inch (12 mm) ID hose provided with the Hale FoamLogix 2.1A installation kit.

The hose from the foam tank to the strainer should have adequate wall stiffness to withstand the vacuum of the foam pump while it is operating [23 inches (584 mm) Hg and 50 PSI (3 BAR)] (Kuriyama, Kuri-tec K-3130 or K-7130 series or equal).

After the foam pump is mounted on the apparatus connect the PVC hose provided to the strainer inlet.

Install the clear plastic hose from the foam tank outlet to the inlet of the strainer/valve assembly. The inlet of the strainer/valve assembly is on the valve end. Wetting the ends of the hose and fittings will make the installation on the hose fittings easier.

CAUTION: Make sure the foam tank and foam concentrate suction hoses are clean before making final connection to foam pump. If necessary flush tank and hoses prior to making connection.

CHECK VALVE/INJECTOR FITTING

The Hale check valve/injector fitting supplied with the Hale FoamLogix system meets NFPA requirements for a non-return device in the foam injection system to prevent back flow of water into the foam concentrate tank. When properly installed the brass and stainless steel construction check valve/injector fitting ensures foam concentrate is injected into the center of the water flow for better mixing.

NOTE: Always position the check valve/injector fitting at a horizontal or higher angle to allow water to drain away from the fitting (see figure 2-12). This will avoid sediment deposits or the formation of an ice plug.

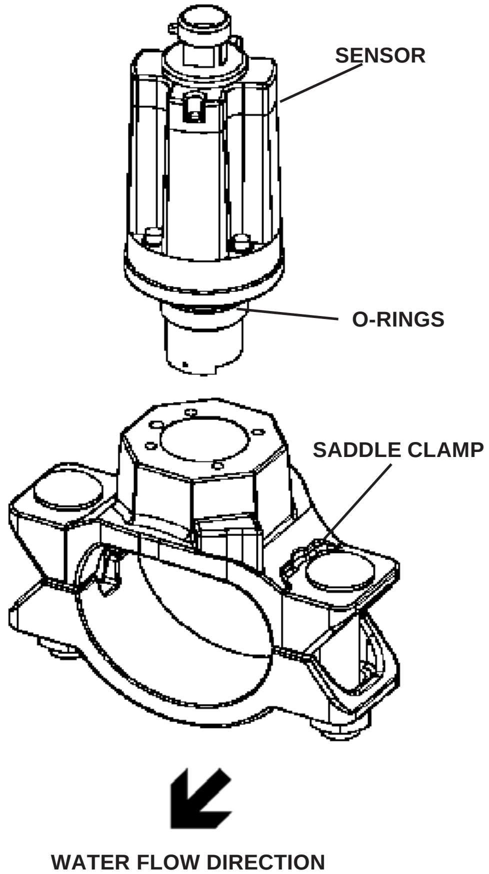


Figure 2-11. Flowsensor Sensor Service

The check valve/injector fitting MUST be mounted in a location that is common to all discharges which require foam concentrate (see figure 2-14). The Hale FoamLogix system does not permit a separate injection point for each foam capable discharge.

The check valve/injector fitting has 1 inch NPT threads on the outside to fit into the 1 inch NPT threaded connection on the Hale mini manifold, a pipe tee or a 1 inch NPT weld fitting installed in the discharge piping of the fire pump (see figure 2-13). The inlet connection of the check valve/injector fitting has ½ inch NPT female threads.

FOAM CONCENTRATE INJECTION HOSE

Connect hose from the foam pump inject port (see figure 2-14) to the inlet of the check valve injector fitting. The hose and fittings from the INJECT port to the check valve injector fitting should have minimum ½ inch (13 mm) inside diameter and be rated at 500 PSI (34 BAR) working pressure (Aeroquip 2580-10 or equal).

BYPASS HOSE CONNECTION

A bypass valve is mounted on the discharge of the foam pump. The bypass handle shall be accessible by the pump operator during normal operations.

The bypass valve is a 3-way directional valve that selects where the output of the foam pump will go. Determine which port is the INJECT port (see figure 2-14) and which port is the BYPASS port.

Bypass hose connections are ½ inch. Hose fittings compatible with all foam concentrates to be used must be provided. The hose from the BYPASS port is plumbed to the atmosphere and should not receive high pressures. This hose is used for calibrating the foam pump, pumping the concentrate into a container to empty the foam tank or to assist in priming of the foam pump. The hose from the BYPASS port must be long enough to reach a container outside the truck. This hose must be coiled for storage when not in use.

If the handle is removed from the bypass valve for repairs or to facilitate remote mounting make sure it is installed on the

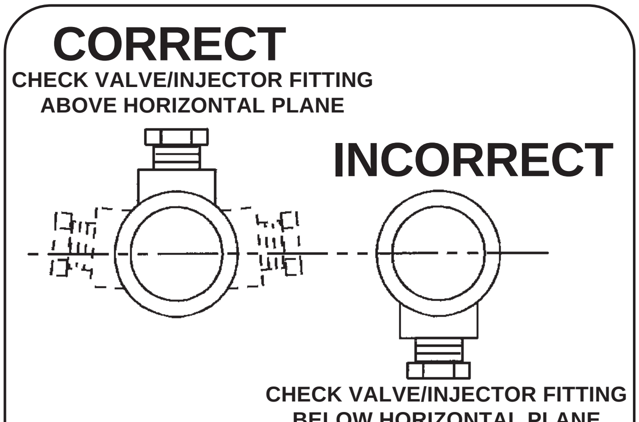


Figure 2-12. Check Valve/Injector Fitting Position

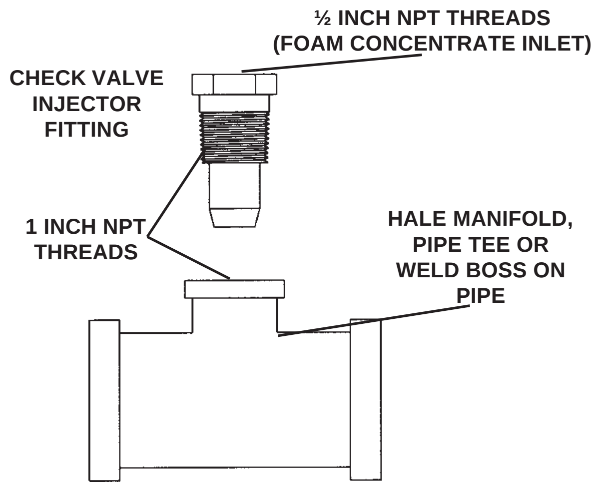


Figure 2-13. Check Valve Injector Fitting Installation

valve correctly.

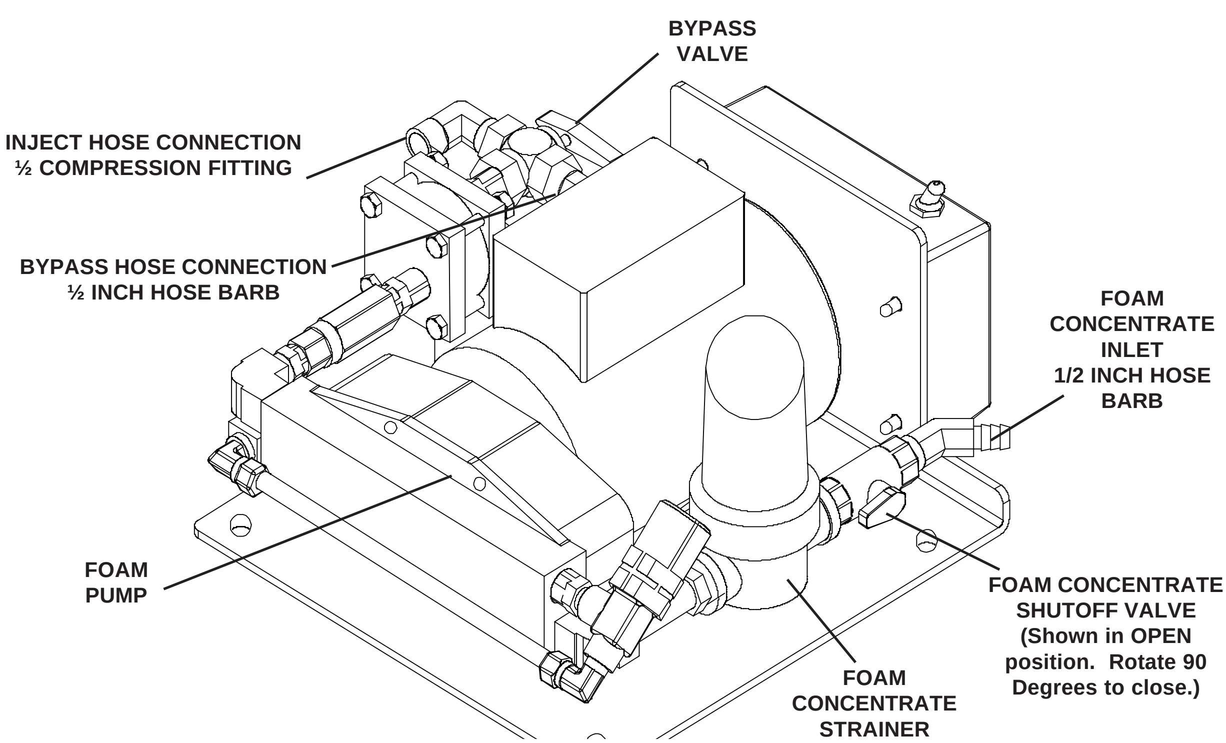


Figure 2-14. Injection and Bypass Hose Connections

IMPORTANT: When provision for flushing is specified by the end user the installer must provide the fittings necessary for flushing the foam system to be NFPA compliant. These components are:

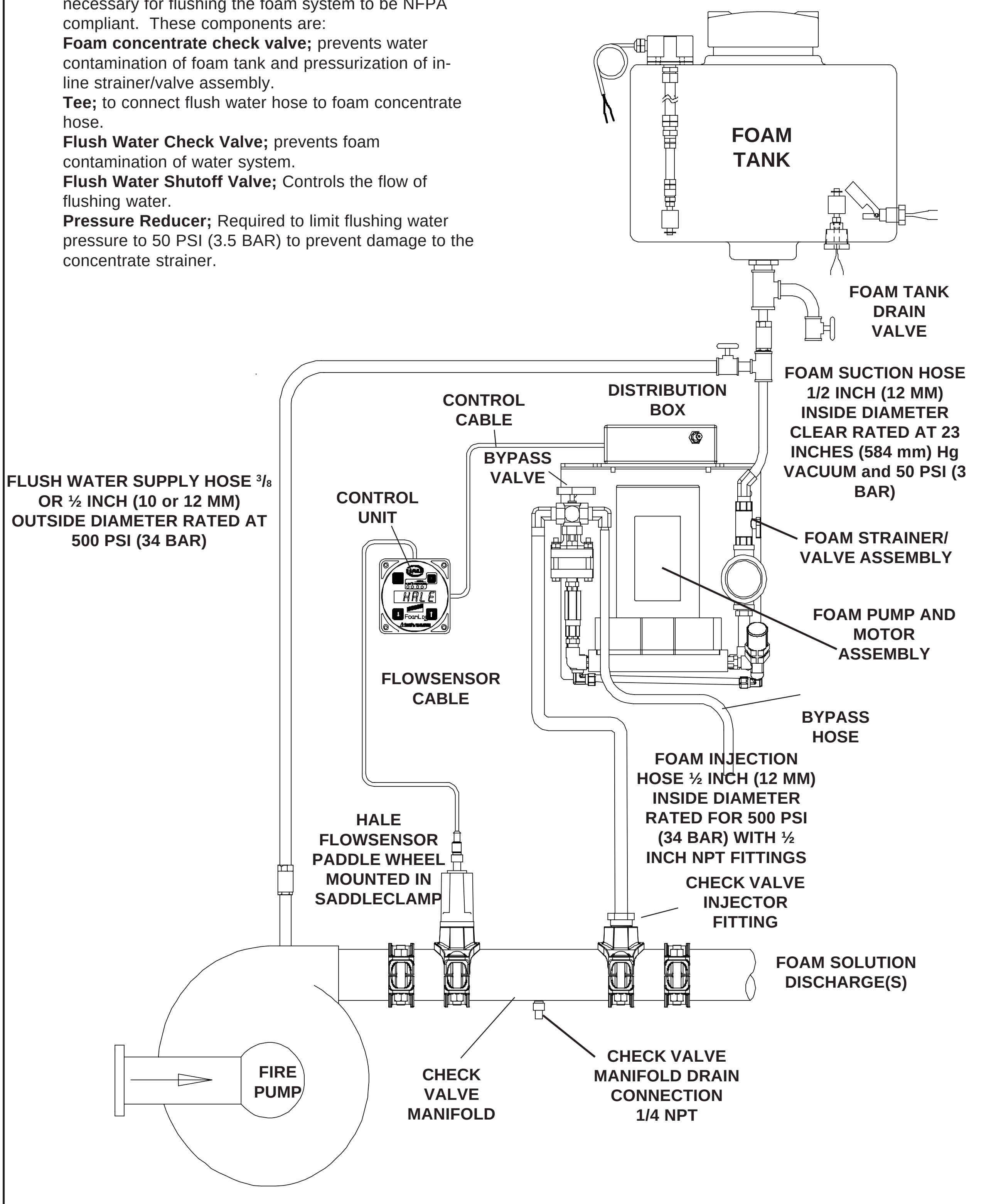
Foam concentrate check valve; prevents water contamination of foam tank and pressurization of in-line strainer/valve assembly.

Tee; to connect flush water hose to foam concentrate hose.

Flush Water Check Valve; prevents foam contamination of water system.

Flush Water Shutoff Valve; Controls the flow of flushing water.

Pressure Reducer; Required to limit flushing water pressure to 50 PSI (3.5 BAR) to prevent damage to the concentrate strainer.



Hale FoamLogix 2.1A System Plumbing Diagram

ELECTRICAL INSTALLATION

ELECTRICAL CONNECTIONS

Complete system electrical diagrams are provided at the end of this manual section. Refer to these diagrams for proper hookup of each of the electrical components. The Hale FoamLogix system is designed to be installed with a minimum of electrical connections. Complete electrically shielded cables are provided with each Hale FoamLogix system to make the flowsensor, control unit and distribution box connections. The system installer must supply primary power wire, low tank level sensor wire and flat braided ground straps.

ELECTRICAL INSTALLATION CAUTIONS

- To prevent system damage or electrical shock the main power supply wire will be the last connection made to the Hale FoamLogix distribution box.

- The cables provided with each Hale FoamLogix system are shielded assemblies. Never attempt to shorten or lengthen the cables. If necessary order longer or shorter cables from Hale Products to suit the particular installation.

- The cables are indexed so they only go in the correct receptacle and they can only go in one way. When making cable connections DO NOT force mismatched connections as damage can result in improper system operation.

- The system can only perform when the electrical connections are sound, so make sure each one is correct.

- Hale FoamLogix systems are designed for use on direct current, negative ground apparatus electrical systems only.

- Do not mount radio transmitter or transmitter cables in direct or close contact with the Hale FoamLogix unit.

- Before connecting the cables inspect the o-ring seal in the female connector. If the seal washer is missing or damaged, water can enter the connector causing corrosion of the pins and terminals resulting in possible system failure.

- The cables shipped with each Hale FoamLogix system are tested at the factory with that unit. Improper handling and forcing connections can damage these cables which could result in other system damage.

- The ground strap must be a minimum of 1-¼ inches (32 mm) wide and no longer than 18 inches (457 mm). A longer ground strap must be wider or a double thickness strap must be used. Make sure the ground strap is attached to the chassis frame. Grounding to the body IS NOT acceptable.

- Always disconnect the power cable, ground straps, electrical wires and cables from the control unit or other Hale FoamLogix equipment before electric arc welding at any point on the apparatus. Failure to do so will result in a power surge through the unit that could cause irreparable damage.

- There are no user serviceable parts inside Hale FoamLogix system electrical/ electronic components. Opening of these components (distribution box or control unit) will void warranty.

- When an inline current shunt ammeter is installed on the apparatus power filter kit (Hale P/N 546-1870-00-0) on the Hale FoamLogix foam pump.

CONTROL UNIT

The control unit mounts in the operator panel of the apparatus. The display is secured with four #10 socket head screws in the four holes in the face (See figure 2-15 for mounting dimensions). The display requires 7 inches (178 mm) minimum clearance from the back of the operator panel to allow proper connection of cables. Once the control unit is mounted on the operator panel, attach the 14 pin AMP connector on the flow sensor cable assembly to the back of the display. Referring to figures 2-16 and 2-17 make connections to the distribution box and flow sensor.

NOTE: Ensure that the panel where the control unit is mounted has an adequate ground. For stainless steel and vinyl coated panels a ground strap ½ inch (12 mm) wide must be attached from one of the four screws holding the control unit in place to the frame of the fire truck to ensure adequate grounding.

FOAM TANK LOW LEVEL SENSOR INSTALLATION

The foam tank low tank level sensor must be installed and wired to monitor foam concentrate level. Mount the low tank level sensor in the foam tank as follows. Refer to figure 2-18 for low tank level sensor mounting options.

CAUTION: A Foam tank low level sensor must be utilized to protect the Hale FoamLogix from dry running. Failure to use a low level sensor with the Hale FoamLogix system will void warranty.

SIDE MOUNT LOW LEVEL SENSOR INSTALLATION

1. A side mount low tank level sensor is supplied standard with Hale FoamLogix Model 2.1A foam system. The side mount low tank level sensor has ½ inch NPT threads. If tank design and construction allows, the side mount sensor can be threaded directly into the side of the tank at the proper height. Also the sensor can be mounted on the foam tank using a ½ x 1 inch NPT bushing and a bulkhead fitting with 1 inch FNPT threads (see figure 2-19). The center of the switch must be located at least 1-½ to 2 inches (38 to 51 mm) from the bottom of the foam tank with the float positioned on top of the switch to move up and down.

NOTE: When the side mount low tank level sensor senses a low concentrate condition the system will operate for one minute unless the foam concentrate level is restored. If the foam concentrate level is

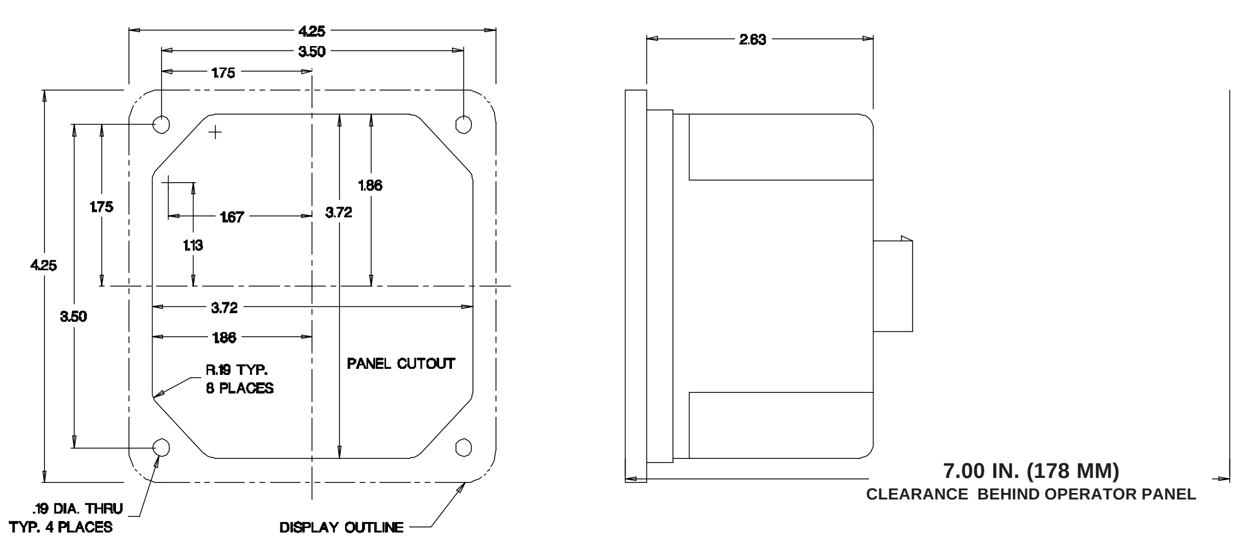


Figure 2-15. Control Unit Mounting Dimensions

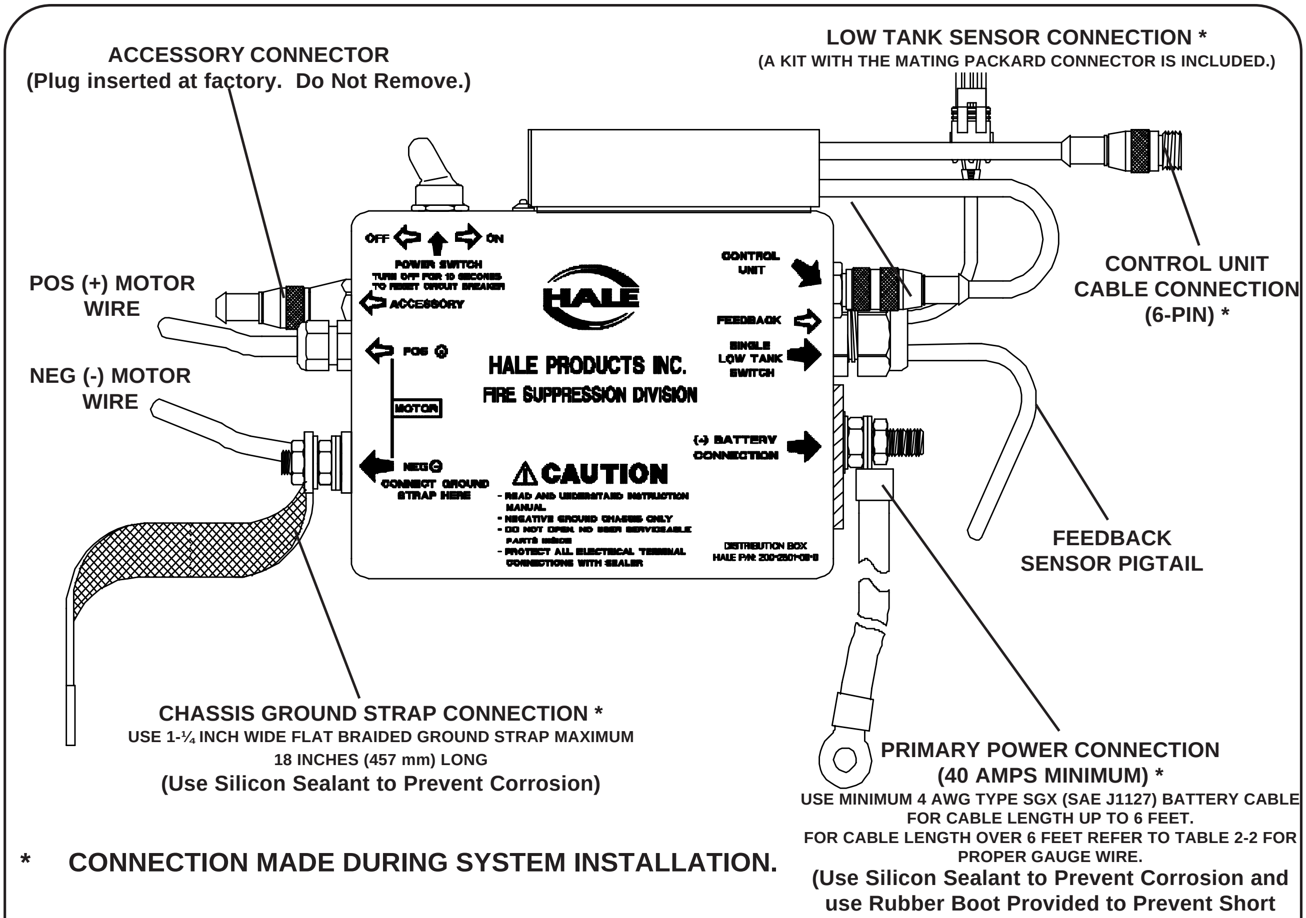


Figure 2-16. Distribution Box Connections

not restored the Hale FoamLogix system will shut down. When locating the side mount low tank level sensor on the foam tank sufficient foam concentrate should be present for one minute of operation at rated flow.

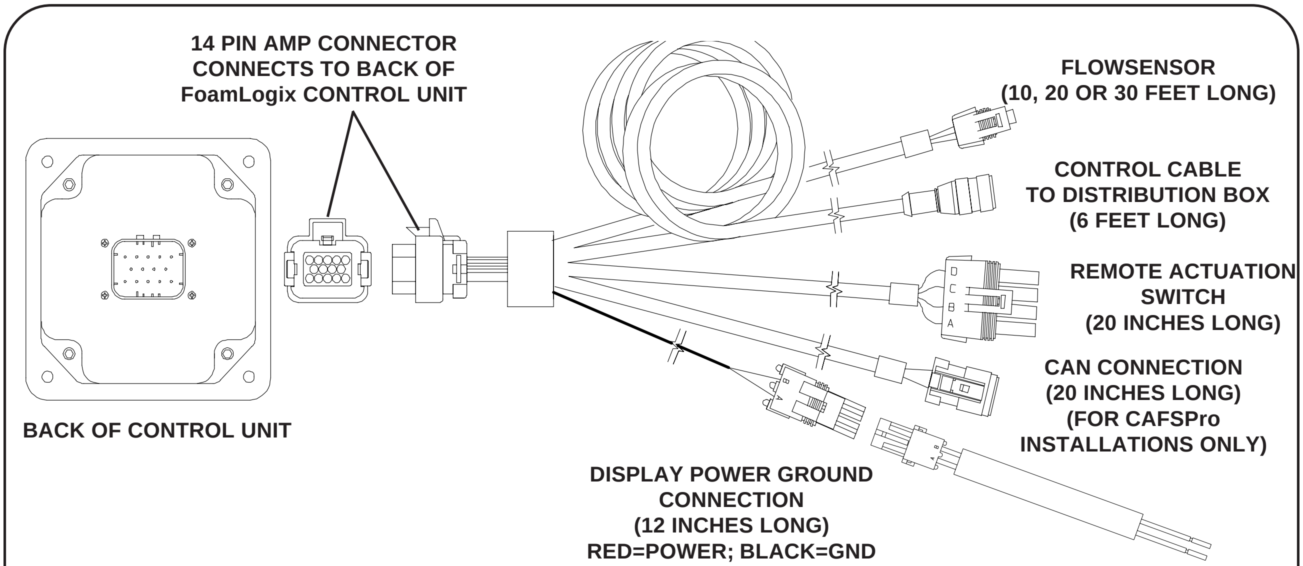


Figure 2-17. Control Unit Cable Connection

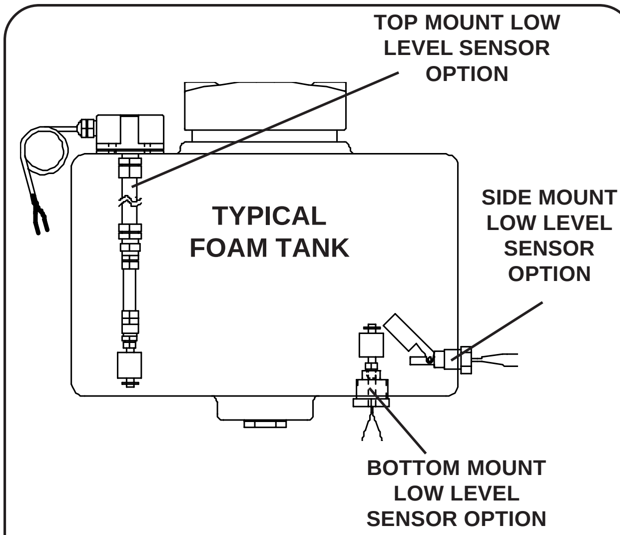


Figure 2-18. Foam Tank Low Level Sensor Mounting Options

2. Coat the threads of the low tank sensor with suitable sealant and insert into tank fitting. Tighten sensor making sure the float is on the top of the sensor.

3. After installation, check operation of the side mount low tank level sensor with a powered test light. With no foam in the tank, the light should be on. If light does not illuminate, rotate the side mount low tank level sensor until the test light is on.

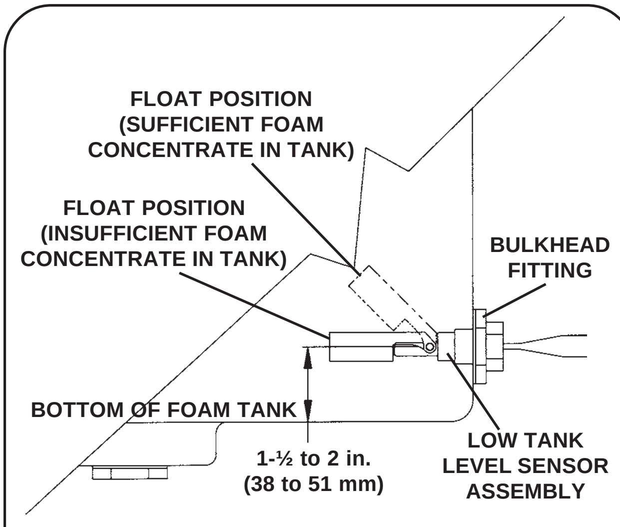


Figure 2-19. Side Mount Foam Tank Low Level Sensor Installation

BOTTOM MOUNT LOW LEVEL SENSOR INSTALLATION

1. The bottom mount foam tank low level sensor must be mounted into the bottom of the foam tank. The sensor, as supplied, is threaded into a bushing that has 1 inch NPT threads. The sensor is designed to be installed from the outside of the foam tank through a bulkhead fitting or boss with 1 inch FNPT threads. Mount the sensor in the bottom of the foam tank in an upright position. Use suitable sealant to prevent concentrate leakage.

NOTE: There must be sufficient space under the foam tank for the low tank level sensor wires to be routed to the foam pump/motor assembly. Be sure not to remove the float from the shaft on the low tank level sensor assembly. If the float is installed in the reverse position, "*lo A*" will appear on the control unit and the system will automatically shut down even if there is foam in the tank.

2. Check low tank level sensor operation with a powered test light. With no foam in the tank, the light should be on. If this is not the case, remove the clip from the end of the sensor. Remove float and reinstall 180° out of position. Reinstall clip.

TOP MOUNT LOW LEVEL SENSOR INSTALLATION

A top mount low level sensor assembly is available for installations where the sides or bottom of the foam tank are not accessible or sensor service is required without draining the foam tank. The sensor assembly is flange mounted in an access hole at the top of the foam tank. The two section telescoping assembly permits adjustment of low tank level sensor position for various foam tank depths from 31-½ to 60 inches (800 to 1524 mm). Flange cutout dimensions are shown in figure 2-20. The flange gasket can also be used as a template to mark hole location.

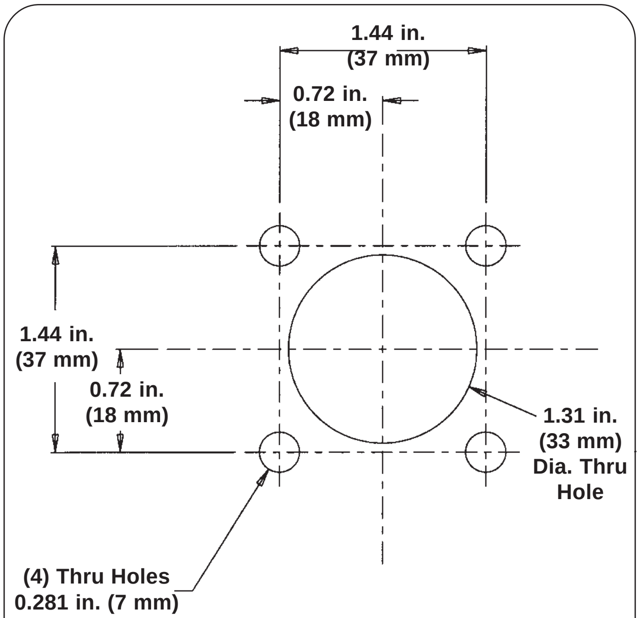


Figure 2-20. Top Mount Low Tank Switch Mounting Flange Cutout Dimensions

1. Using dimensions in figure 2-20, layout and drill holes in the top of the foam tank. The center of the sensor should be located at least 1-½ to 2 inches (38 to 51 mm) from the sides of the foam tank.

NOTE: The minimum depth of foam tank for installation of the top mount sensor without cutting the tube sections is 31-½ inches (800 mm). If the tank depth is less than 31-½ inches (800 mm) cut the tubing as described in step c.

2. Determine the approximate length of the top mount low tank sensor extension by measuring from the top of the foam tank at the flange opening to the bottom of the tank. When properly installed the center of the sensor float should be 1-½ to 2 inches (38 to 51 mm) above the bottom of the foam tank.

3. Slide the flange to the top of the 5/8 inch diameter tube and adjust the telescoping section until the desired length is achieved as measured from the bottom of the flange to the bottom of the sensor. Tighten the compression fittings on the union to lock length.

CAUTION: Use mounting hardware that is compatible with all foam concentrates to be used in the system. Use washers, lockwashers and capscrews made of brass or 300 series stainless steel.

4. Insert sensor assembly through the 1.31 inch (33 mm) hole and align the screw holes on the flange and gasket with the holes on the tank. Secure the assembly in place using four ¼-20 UNC x 1 inch long cap screws, ¼ inch washers and ¼ inch lockwashers.

5. Make final adjustment to the sensor position by pulling the tubing sections up through the flange until sensor is 1-½ to 2 inches (38 to 51 mm) from the bottom of the tank. Tighten the 5/8 tube compression nut on the flange.

6. Close strain relief to the 900 position making sure it snaps shut. Tighten strain relief gland nut to seal out water and contamination.

RESIZING THE LOW LEVEL SENSOR

Some applications may require the top mounted sensor to be shorter than factory length. Use the following procedure only if the tube sections are too long otherwise proceed to step d.

Refer to figure 2-21, disassemble and cut the tube sections as follows:

1) Loosen and remove the 3/8 FNPT x 5/8 tube fitting and strain relief from the top of the sensor assembly. Carefully slide the sensor wire out of the strain relief gland.

2) Loosen and remove the ¼ FNPT x ½ tube fitting and sensor from the bottom of the sensor assembly. DO NOT remove the ½ inch tube from the 5/8 inch tube.

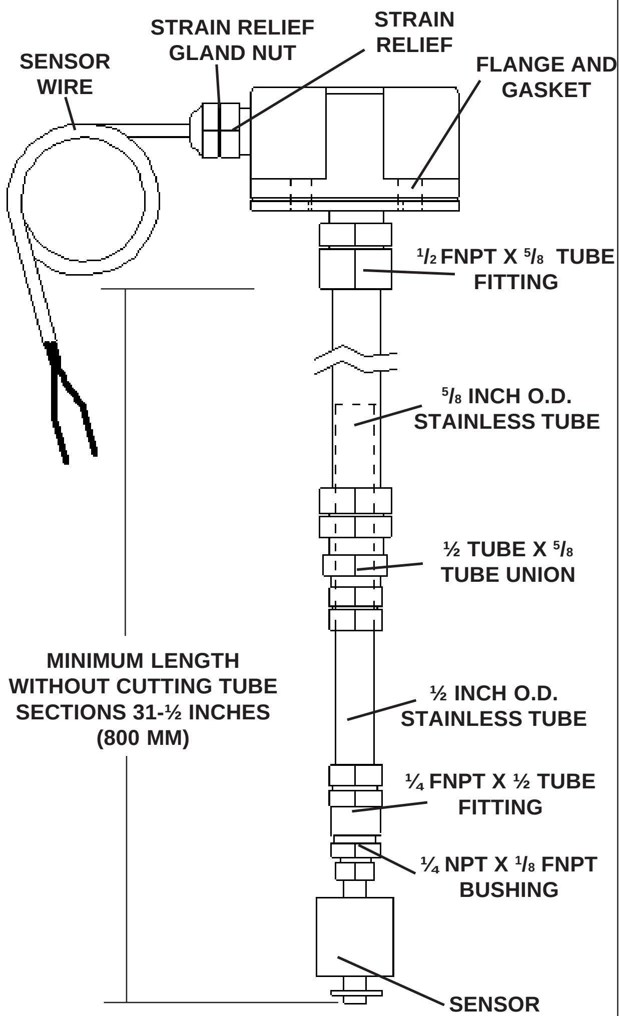


Figure 2-21. Top Mount Low Tank Switch Assembly Component Identification

3) Using a tubing cutter, remove the required length of tube from the end of each tube. Deburr the cuts when complete.

4) Install a new ½ compression ferrule on the end of the tube. Carefully thread the sensor wire through the tube assembly and attach the ¼ FNPT x ½ tube fitting with sensor attached to the end of the tube. Tighten the ½ tube compression nut.

5) Install a new 5/8 compression ferrule on the end of the tube. Carefully thread the sensor wire through the 3/8 FNPT x 5/8 tube fitting and strain relief gland. Attach the 3/8 FNPT x 5/8 tube fitting and strain relief to the end of the tube. Tighten the 5/8 tube compression nut.

6) Slide the flange to the top of the 5/8 inch diameter tube and adjust the telescoping section until the desired length is achieved as measured from the bottom of the flange to the bottom of the sensor. Tighten the compression fittings on the union to lock length.

CAUTION: When extending the low tank sensor wires make sure the splices are properly sealed using an adhesive filled heat shrink tubing.

LOW LEVEL SENSOR WIRING

CAUTION: When extending the low tank sensor wires make sure the splices are properly sealed using an adhesive filled heat shrink tubing.

Use minimum 16 AWG Type SXL or GXL (SAE J1128) wire to extend the low tank sensor wire to allow connection to the 2-wire Packard WeatherPack connector on the distribution box (see figure 2-16). The low tank level sensor is not polarity sensitive therefore terminal connections are not specific.

If necessary, when making splices to extend the low tank sensor wires make sure the splices are sealed using an adhesive filled heat shrink tubing. Where two wires exit the heat shrink tubing pinch the tubing while heating the tubing to make sure the adhesive seals around both wires.

A connector kit (Hale P/N 546-1780-00-0) is included that contains a Packard WeatherPack 2-contact shroud half, two (2) 14-16 gage male terminals and two (2) 14-16 gage cable seals. Assemble these components to the end of the low tank sensor wires. Snap the two halves of the Packard WeatherPack connector together making sure they are sealed.

DISPLAY UNIT POWER AND GROUND CONNECTIONS

Power must be connected directly to the display unit. The power and ground connection is the 2 pin packard connector on the 12 inches long pigtail on the flow sensor harness (see figure 2-17). The mating harness provided is approximately 18 inches long. If additional wire length is required, use minimum 16 AWG type SXL, or GXL (SAE J1128) wire.

Using the harness provided, connect the black (B) wire to a chassis ground stud. Protect the ground connection from corrosion.

Connect the red (A) wire to the power supply. Idealy this power wire should be connected to a minimum 5 AMP fused dedicated circuit. If a dedicated circuit is not available then the power lead can be connected to a terminal where there is not a high current load. Acceptable additional components powered from this terminal include ENFO IV, Governor, Tank Level Gauge, Etc.

DISTRIBUTION BOX GROUND AND PRIMARY POWER CONNECTIONS

CAUTION: Connect the primary positive lead from the terminal block to the master switch terminal or relay terminal using minimum 8 AWG type SGX (SAE J1127) chemical resistant battery cable and protect with wire loom.

CAUTION: Prevent corrosion of power and ground connections by sealing these connections with silicone sealant provided.

GROUND CONNECTION

Be sure the Hale FoamLogix system is grounded to the chassis. Use a short length of wide flat ground strap at least 1-¼ inches (32 mm) wide and less than 18 inches (457 mm) long to reduce the potential of RFI emitted by this connection. A stud labeled **NEG (—)** is located on the distribution box to attach the chassis ground strap to the Hale FoamLogix system. (See figure 2-17) When making the ground strap connections make sure lugs are attached to the strap ends for trouble free connections.

When the length of the ground strap exceeds 18 inches (457 mm) use a wider strap or a double thickness strap.

CAUTION: DO NOT connect the main power lead to small leads that are supplying some other device such as a light bar or siren. The Hale FoamLogix Model 2.1A requires 40 AMP minimum current.

PRIMARY POWER SUPPLY CONNECTION

Make sure adequate switched electrical power from the battery + terminal to the battery connection stud on the distribution box (see figure 2-17) is provided. Use 4 AWG minimum type SGX (SAE J1127) battery cable directly to the battery, battery switch or solenoids for cable runs up to 6 feet (1.8 meters) long. Longer wire runs may require larger battery cable for proper operation. DO NOT connect power to the same connection as the pump primer. The following table provides recommended cable size for various lengths of cable run.

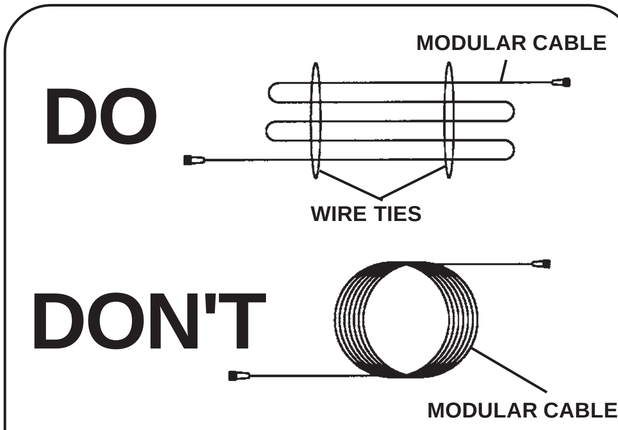


Figure 2-22. Extra Cable Storage

Table 2-1

REQUIRED PRIMARY POWER CABLE SIZES	
	Maximum Length
8 AWG (8.4 mm^2)	6 Ft (1.8 M) or Less
4 AWG (21.2 mm^2)	6 Ft (1.8 M) to 15 Ft (4.6 M)
0 AWG (53.5 mm^2)	15 Ft (4.6 M) or Longer

RFI/EMI

Electrically shielded cables for control unit and flowsensor are provided with the Hale FoamLogix system. The cables are 100% electrically shielded to eliminate the potential problem of EMI/RFI. Proper installation of system components and cables along with proper grounding will limit radio interference caused by the Hale FoamLogix system. Additionally, make sure radio cables and hardware are not located in the immediate area where Hale FoamLogix equipment is mounted.

Making round coils of extra control and flowsensor cables in the pump compartment can act as an antenna. While the control and flowsensor cables cannot be shortened, various lengths of cable are available to minimize the "extra" cable in the truck. When routing control and flowsensor cables take care to avoid routing them next to antenna wires, radio power lines and radio components. When there is extra cable, double the cable back on itself and secure with plastic wire ties in a flat bundle instead of making a round coil. (See Figure 2-22)

START-UP CHECKLIST

Before energizing the apparatus and Hale FoamLogix system for the first time make sure the following items are checked:

Electrical

- ❑ Tank level sensor wires connected to distribution box and sealed from moisture.
- ❑ Tank level sensor functions properly.
- ❑ Control cable connection at distribution box correct and tight.
- ❑ Flowsensor cable properly connected.
- ❑ All cables and wires are secured and protected from damage during operation.
- ❑ Control and flowsensor cables properly folded and secured; radio antennas, power lines and equipment away from cables.
- ❑ Foam Pump and motor assembly properly grounded using flat ground strap.
- ❑ Correct voltage provided. Direct current, negative ground.
- ❑ Adequate current, 40 AMPS minimum, available. Main power direct to battery, battery switch or solenoid without primer or other accessories tied in.
- ❑ Primary electrical and ground connections tight and protected from corrosion with silicone sealant.
- ❑ Splices in wires sealed from moisture using adhesive filled heat shrink tubing.
- ❑ Hale FoamLogix system ON/OFF switch on the distribution box is in the ON position.

Liquid

- ❑ Flowsensor mounted with flow arrow in the correct direction for water flow.
- ❑ Check valves are properly mounted in water and foam concentrate lines.
- ❑ Strainer mounted for proper concentrate flow direction in foam tank to pump hose.
- ❑ Foam tank to foam pump valve is in place and open.
- ❑ Check valve/injector fitting lines are proper size and connections are tight.
- ❑ BYPASS valve is properly mounted and oriented for direction of concentrate flow.
- ❑ Foam concentrate gravity feeds to foam pump from foam concentrate tank.
- ❑ All hoses free of kinks and sharp bends.
- ❑ No sharp bends that can trap air exist in system.
- ❑ Flush water connections correct and tight.
- ❑ Discharge piping hydro tested in accordance with NFPA/UL requirements.
- ❑ Bypass valve handle is in the INJECT position.

Foam Pump

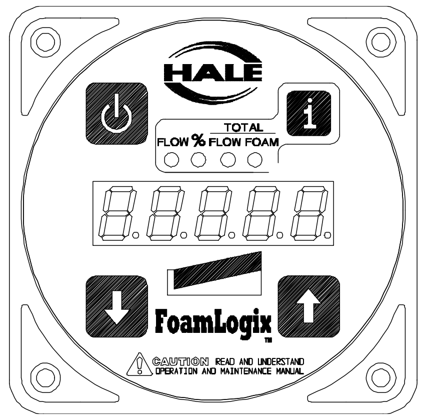
- ❑ Foam pump and motor assembly mounted in horizontal position with base plate down.
- ❑ Foam pump and motor assembly properly secured using proper mounting hardware.
- ❑ Foam pump suction and discharge hoses connected to proper ports.
- ❑ Foam pump suction and discharge hose fittings tight.

SYSTEM INSTALLER START-UP

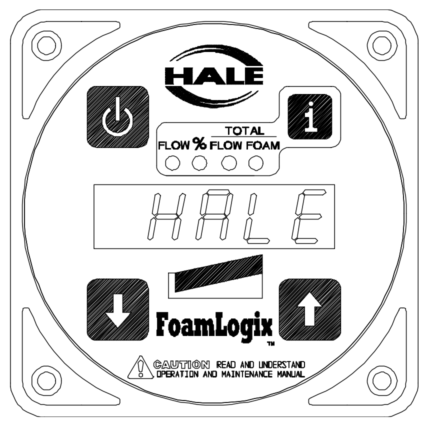
When energizing the Hale FoamLogix system at the system installer facility for the first time the following procedures shall be used.

INITIAL SYSTEM POWER CHECK

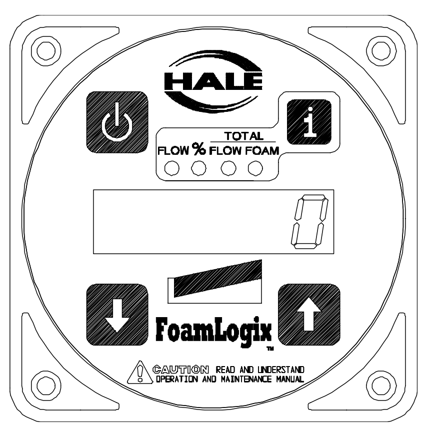
Observe the display on the control unit while energizing the apparatus electrical system and turn the foam pump distribution box power switch to **ON**. Check the control unit readout — **FLOW, TOTAL FLOW, % FOAM, TOTAL FOAM** and all bargraph LEDs will light along with "*88888*" for several seconds. "*HALE CLASS 1* 2002" will scroll across the display while the system checks itself followed by the default display. The default display is zero on the digital readout (if no water is flowing) and FLOW LED (See figure 2-23). If default display does not appear refer to TROUBLESHOOTING for possible causes and solutions.



INITIAL POWER-UP



WARM-UP/SYSTEM CHECKING



SYSTEM READY

Figure 2-23. Control Unit Ready Indication

INITIAL SYSTEM OPERATION CHECK

After initial system power-up, low tank level sensor operation, foam pump operation and flowsensor calibration must be checked. Use the following procedures to complete these system checks.

CAUTION: Water is used at the system installer facility to verify low tank level sensor operation and foam pump operation as the end user specified foam concentrates may not be readily available. DO NOT pump water with the Hale FoamLogix foam pump for more than one minute per foam tank. DO NOT attempt to calibrate foam pump feedback sensor with other than end user specified foam concentrate. Make sure the bypass valve is in the BYPASS position when pumping water with the foam pump.

1. Upon initial power-up with the foam tanks empty the display on the control unit will alternate between "*0*" and "*Lo A*" indicating the foam tank is empty. Fill foam concentrate tank with water. The "*Lo A*" indication should disappear from the control unit display indicating the

low tank level sensor is operating properly.

2. Place the BYPASS valve to the **BYPASS** position to check foam pump operation. Place a calibrated five gallon container at the discharge of the bypass hose.

3. Place the system in simulated flow mode by selecting the **FLOW** display and depressing both up 🡅 and down 🡇 buttons simultaneously. Set simulated flow value to 100 GPM by pressing up 🡅 or down 🡇 button. Display will show "*S*" at the left most position to indicate the simulated flow (See figure 2-24).

4. Depress the **SELECT DISPLAY** button until the LED under **% FOAM** lights. Set foam concentrate injection rate to "*1.0*" by pressing up 🡅 or down 🡇 button.

5. Depress the **SELECT DISPLAY** button until the LED under **TOTAL FOAM** lights. Depress **ON** button to energize Hale FoamLogix system. Observe the discharge of the bypass hose to make sure the foam pump is operating. After one minute depress the **ON** button to stop the foam pump. There should be approximately one gallon of water in the container and the **TOTAL FOAM** display on the control unit should read approximately "*1.0*".

6. After foam pump operation has been checked exit simulated flow mode by selecting the **FLOW** display and depressing both up 🡅 and down 🡇 buttons simultaneously.

7. Drain water from foam tanks and concentrate lines and return the bypass valve to the **INJECT** position.

8. Verify operation of and calibrate flowsensor as required using flowsensor calibration procedures in the user calibration section.

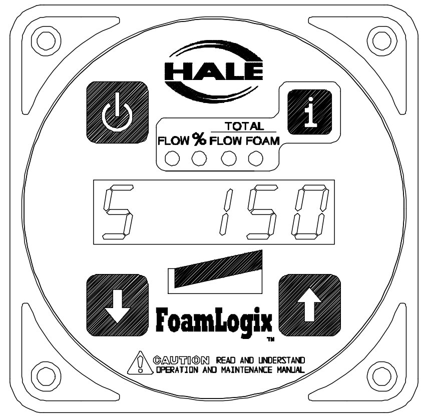


Figure 2-24. Simulated Flow Display

This completes the Hale FoamLogix system operation checks that can be accomplished at the system installer facility. Foam pump feedback calibration along with setting of user specified default simulated flow and concentrate injection rates should be accomplished upon delivery to the end user using actual end user specified foam concentrates and default values.

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FoamLogix™

MODEL 2.1A CLASS A ELECTRONIC FOAM PROPORTIONING SYSTEM

DESCRIPTION, INSTALLATION AND OPERATION MANUAL

SECTION III

SET-UP AND CALIBRATION

NOTICE: This manual section is used by the installer and end user for setting up and calibrating the Hale foam proportioning system. This manual section also provides procedures for the end user to change default values and verify calibration if different foam concentrates are used. This manual section can be used as a stand alone section or in conjunction with other sections of the complete manual.

HALE PRODUCTS, INC. ● A Unit of IDEX Corporation ● 700 Spring Mill Avenue ● Conshohocken, PA 19428 ● TEL: 610-825-6300 ● FAX: 610-825-6440

IDEX CORPORATION

HALE PRODUCTS INC.
ISO 9001
Certificate A4026

SAFETY

Hale FoamLogix systems are designed to provide reliable and safe foam concentrate injection. Before installing or operating a Hale FoamLogix system read all safety precautions and follow carefully to ensure proper installation and personnel safety.

WARNINGS

1. Do not permanently remove or alter any guard or insulating devices or attempt to operate the system when these guards are temporarily removed.
2. To prevent electrical shock always disconnect the primary power source before attempting to service any part of the Hale Foam system.
3. All electrical systems have the potential to cause sparks during service. Take care to eliminate explosive or hazardous environments during service/repair.
4. To prevent system damage or electrical shock the main power supply wire will be the last connection made to the Hale Foam proportioner distribution box.
5. Release all pressure then drain all concentrate and water from the system before servicing any of its component parts.
6. Rotating drive line components can cause injury. When working on components of the Hale Foam system be careful of rotating components.

CAUTIONS

1. A foam tank low level sensor must be utilized to protect the Hale Foam proportioner from dry running. Failure to use a low level sensor with the Hale Foam system will void warranty.
2. Do not operate system at pressures higher than the maximum rated pressure.
3. Use only pipe, hose, and fittings from the foam pump outlet to the injector fitting, which are rated at or above the maximum pressure rating at which the water pump system operates.
4. Hale Foam proportioning systems are designed for use on negative ground direct current electrical systems only.
5. Do not mount radio transmitter or transmitter cables in direct or close contact with the FoamLogix control unit.
6. Before connecting the cordsets and wiring harnesses inspect the seal washer in the female connector. If the seal washer is missing or damaged, water can enter the connector causing corrosion of the pins and terminals resulting in possible system failure.
7. Always disconnect the power cable, ground straps, electrical wires and control cables from the control unit or other Hale Foam system equipment before electric arc welding at any point on the apparatus. Failure to do so could result in a power surge through the unit that could cause irreparable damage.
8. **DO NOT** connect the main power lead to small leads that are supplying some other device such as a light bar or siren. The Hale FoamLogix Model 2.1A requires 40 AMP minimum current.
9. When operating the Hale FoamLogix in Simulated Flow mode an outlet for the foam concentrate must be provided to prevent excessive pressure buildup in discharge piping or hoses.
10. Make sure the foam tank and foam concentrate suction hoses are clean before making final connection to foam pump. If necessary flush tank and hoses prior to making connection.

NOTES

1. Check all hoses for weak or worn conditions after each use. Ensure that all connections and fittings are tight and secure.
2. Ensure that the electrical source of power for the unit is a negative ground DC system, of correct input voltage, with a reserve minimum current available to

drive the system.

3. The in-line strainer/valve assembly is a low pressure device and WILL NOT withstand flushing water pressure.
4. When determining the location of Hale Foam system components keep in mind piping runs, cable routing and other interferences that will hinder or interfere with proper system performance.
5. Always position the check valve/injector fitting at a horizontal or higher angle to allow water to drain away from the fitting. This will avoid sediment deposits or the formation of an ice plug.
6. The cordsets provided with each Hale Foam system are indexed so they only go in the correct receptacle and they can only go in one way. When making cordset connections DO NOT force mismatched connections as damage can result in improper system operation.
7. The system can only perform when the electrical connections are sound, so make sure each one is correct.
8. The cables shipped with each Hale Foam system are 100% tested at the factory with that unit. Improper handling and forcing connections can damage these cables which could result in other system damage.
9. There are no user serviceable parts inside Hale Foam system electrical/ electronic components. Opening of the distribution box or control unit will void warranty.
10. Use mounting hardware that is compatible with all foam concentrates to be used in the system. Use washers, lockwashers and capscrews made of brass or 300 series stainless steel.
11. When making wire splice connections make sure they are properly insulated and sealed using an adhesive filled heat shrink tubing.
12. **ALWAYS** connect the primary positive power lead from the terminal block to the master switch terminal or the positive battery terminal using minimum 8 AWG type SGX (SAE J1127) chemical resistant battery cable and protect with wire loom.
13. Prevent corrosion of power and ground connections by sealing these connections with silicone sealant provided.
14. Prevent possible short circuit by using the rubber boot provided to insulate the primary power connection at the Hale FoamLogix distribution box.

INSTALLATION AND DELIVERY CHECKLIST

After the Hale FoamLogix system has been installed the following check list should be used to verify installation and ensure proper system set-up when apparatus is delivered to the end user. Use procedures in referenced manual sections.

INSTALLATION

DATE	INITIALS	
_______	_______	❑ System properly installed according to installation section of manual. (SECTION II; START-UP CHECKLIST)
_______	_______	❑ Tank level sensor function verified. (SECTION II; SYSTEM INSTALLER START-UP)
_______	_______	❑ Foam pump operation checked. (SECTION II; SYSTEM INSTALLER START-UP)
_______	_______	❑ Foam tank and hoses drained of water. (SECTION II; SYSTEM INSTALLER START-UP)
_______	_______	❑ Flowsensor function checked and flowsensor calibrated as necessary. (SECTION III; USER CALIBRATION)

DELIVERY

DATE	INITIALS	
_______	_______	❑ Foam tank filled with user specified foam concentrate. (SECTION III; INITIAL END USER SET-UP)
_______	_______	❑ Foam pump priming checked. (SECTION III; INITIAL END USER SET-UP)
_______	_______	❑ Flowsensor calibration verified with pitot. (SECTION III; USER CALIBRATION)
_______	_______	❑ Default simulated flow value set to end user specification. (SECTION III; USER CALIBRATION)
_______	_______	❑ Default foam concentrate injection rate set to end user specification. (SECTION III; USER CALIBRATION)
_______	_______	❑ Foam concentrate feedback value verified and calibrated with end user specified foam concentrate. (SECTION III; USER CALIBRATION)
_______	_______	❑ Proper Hale FoamLogix system operation demonstrated to end user in accordance with manual procedures. (SECTION IV; OPERATING INSTRUCTIONS)
_______	_______	❑ End user trained in proper operation of Hale FoamLogix system in accordance with manual procedures. (SECTION IV; OPERATING INSTRUCTIONS)
_______	_______	❑ Warranty registration card filled out by end user and mailed to Hale Products Inc.
_______	_______	❑ Two copies of Description, Installation and Operation manual provided to end user.

INITIAL END USER SET-UP

When the apparatus is delivered to the end user facility the foam tank must be filled with the specified foam concentrate. The system must then be adjusted to operate with the end user foam concentrate for best accuracy.

SYSTEM POWER CHECK

Observe the display on the control unit while energizing the apparatus electrical system and turn the foam pump distribution box power switch to **ON**. Check the control unit readout — **FLOW, TOTAL FLOW, % FOAM, TOTAL FOAM** and all bargraph LEDs will light along with "*88888*" for several seconds. "*HALE CLASS 1* 2003" followed by the software revision level (r x.x) will scroll across the display while the system checks itself followed by the flow display. The flow display is zero on the digital readout (if no water is flowing) and FLOW LED (See figure 2-33). If flow display does not appear refer to TROUBLESHOOTING for possible causes and solutions.

PRIMING FOAM PUMP

After the foam tank is filled and the system is powered up foam concentrate flow must be checked to verify the foam pump is primed.

> **CAUTION:** When operating the Hale FoamLogix in Simulated Flow mode an outlet for the foam concentrate must be provided to prevent excessive pressure buildup in discharge piping or hoses.

1. Make sure the bypass valve is in the **BYPASS** position. Route the bypass hose into a suitable container to collect the discharged foam concentrate.
2. Make sure there is foam concentrate in foam tank.
3. Place the system in simulated flow mode by selecting the **FLOW** display and

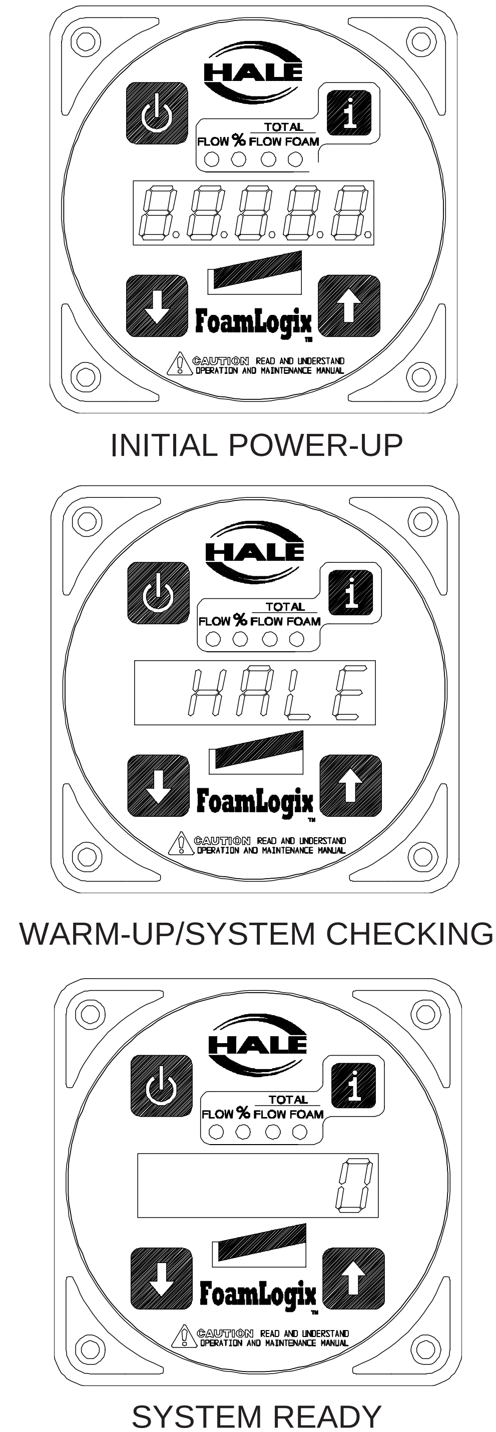

Figure 3-1. Control Unit Ready Indication

depressing both up ↑ and down ↓ buttons simultaneously. Increase simulated flow value by pressing ↑ button to permit easier priming (above factory default value of 150 GPM). Display will show "*S*" at the left most position to indicate the simulated flow (See figure 3-2).

4. Engage the Hale FoamLogix system by pressing the red **ON** button. The left LED on the horizontal bargraph will illuminate to indicate the system is on. As the foam pump begins to run the bargraph LEDs to the right light indicating foam concentrate is being pumped. If no concentrate is flowing the pump will increase to maximum speed in an attempt to prime itself. All LEDs will light and flash. The pump will run at full speed until a feedback signal is indicated or for 30 seconds. If no feedback signal is present after 30 seconds the system will shut down and the display will show "*noPri*" (no prime). Repeat this step one more time to attempt to prime the pump.

   If the foam pump does not prime after the second try do the following:

   - Make sure all foam concentrate valves are open.

   - Make sure there are no restrictions in the hose from the foam concentrate tank to the inlet of the foam pump.

   - Make sure there are no air traps in the hose from the foam concentrate tank to the inlet of the foam pump.

   - Make sure there are no leaks in the plumbing where air can enter the pump.

5. If the system has been installed properly, foam concentrate should flow readily to the pump. Observe the clear foam suction line to verify if foam is flowing.

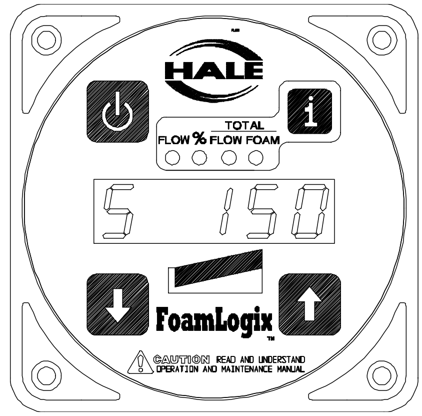

Figure 3-2. Simulated Flow Display

6. Once foam flow is established, turn the system off and turn the bypass valve back to the **INJECT** position.

Proceed with user calibration procedures as system calibration must now be verified with the end user foam concentrate.

USER CALIBRATION

The complete Hale FoamLogix System; foam pump and motor assembly, control unit and flowsensor, is tested and calibrated at the factory before shipping to the installer. Each component of the matched system is assigned the same serial number to ensure they remain together. If the Hale FoamLogix system is properly installed, further calibration WILL NOT be necessary until delivery to customer. The system is designed to permit easy checking of component calibration to assure accurate operation. The calibration verification process will verify component calibration and allow adjustments to the flowsensor and feedback sensor display readings to allow for variations in apparatus piping configuration and end user selected foam concentrate. Default values for simulated flow and foam concentrate injection rate can be set to end user specifications while in the calibration mode.

> **NOTE:** The Hale FoamLogix system is calibrated at the factory to U.S. measurement (GPM, PSI, GALLONS, etc.) units. The system may be calibrated to any unit of measure, i.e. U.S., Metric, Imperial, etc. The same unit of measurement must be used throughout the calibration process to ensure proper proportioning by the system.

Recalibration of the system should be required ONLY after major repairs or component changes to the Hale FoamLogix foam system or if different viscosity foam concentrates are used.

ENTERING PASSWORDS

Entering passwords is accomplished by using the control unit function buttons.

To enter passwords press and hold the **DISPLAY** button. The display will show PASS then go blank. While continuing to hold the display button press the ↑ or ↓ button to enter the password.

MODE	PASSWORD
USER CALIBRATION	↑ ↑ ↑ ↑
RESTORE FACTORY VALUES	↑ ↑ ↓ ↑

RESTORE FACTORY DEFAULT VALUES

At times it may be necessary to return the simulated flow rate, concentrate injection rate(s) and calibration factors to the original factory default values.

To return to the factory default values enter the restore factory values password (↑↑↓↑) as previously described. Once the password is entered correctly the unit will display "*FAC*" and return to normal operation. Proceed with calibration after performing this reset.

Factory default values are:
- Simulated Flow: 150 GPM (568 LPM)
- % FOAM: 0.5% Class A

CALIBRATION

To perform calibration the unit must be placed in calibration mode with the proper password.

To enter calibration password press and hold the **DISPLAY** button. The display will show "*PASS*" then go blank. While continuing to hold the display button enter the calibration password (↑↑↑↑).

The display will show "*CAL*" (See figure 3-3) for several seconds followed by "*C 0*" and **FLOW** LED (Water Flowsensor Calibration). (See figure 3-4)

WATER FLOWSENSOR CALIBRATION

> **NOTE:** The flowsensor is calibrated at

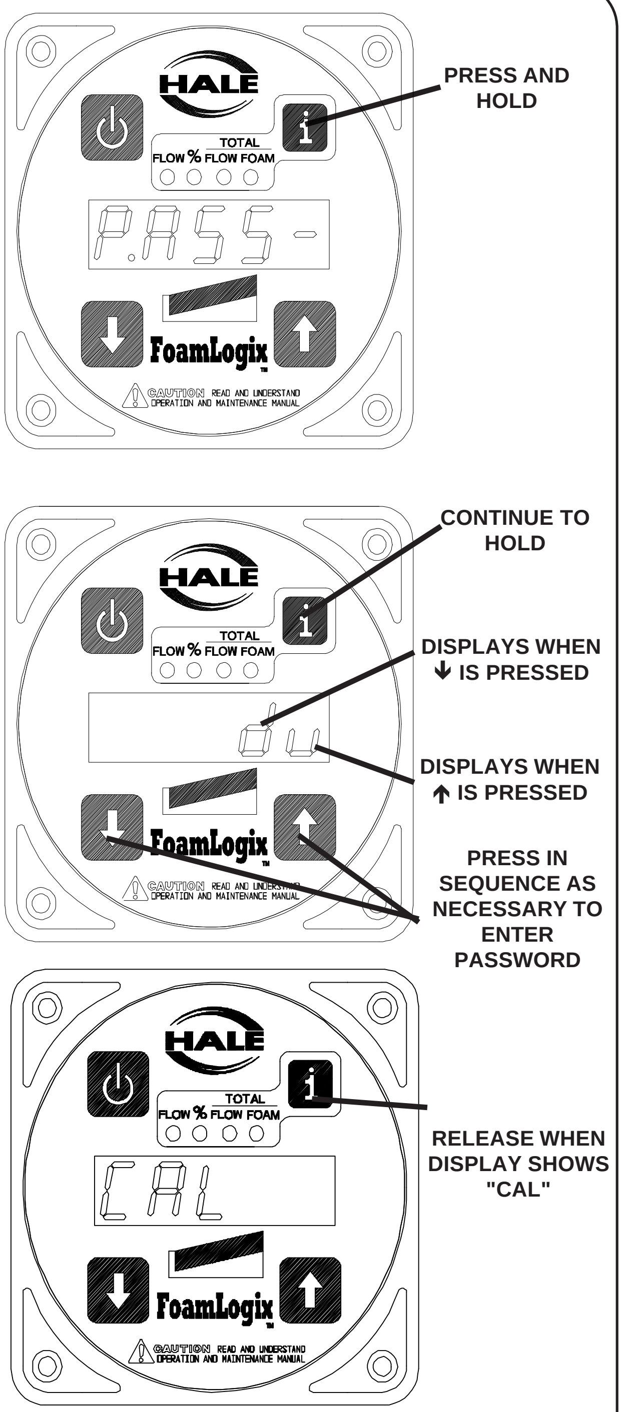

Figure 3-3. Entering Calibration Mode

Hale Products Inc. and matched to the control unit. If the system is installed properly only minor adjustments should be necessary to flowsensor reading. Flowsensor calibration should be verified during NFPA/UL testing of apparatus and delivery to end user.

NOTE: An accurate flow measuring device must be used to measure the water flow when calibrating the flowsensor. Use a suitable size smooth bore nozzle and an accurate Pitot Gauge instrument. Hand held pitot gauges are usually not very accurate. Make sure the system is calibrated with an accurate flow measuring device.

Determine the water flow normally expected from the discharge outlet and establish flow. Make sure the water flow established is within the range of the flowsensor monitoring the discharge. For example, actually establish a flow of 150 GPM (568 LPM) of water through a nozzle and Pitot system. Compare the calculated flow value to the value shown on the control unit digital display.

Press the ↑ or ↓ button to set the reading to match the actual flow calculated from the Pitot gauge reading. Decrease fire pump pressure by approximately ½ and recalculate water flow rate. Verify the reading on the control unit is within 5% of the actual value. Stop the water flow when the reading adjustments are completed.

RECORD WATER FLOWSENSOR CALIBRATION FACTOR

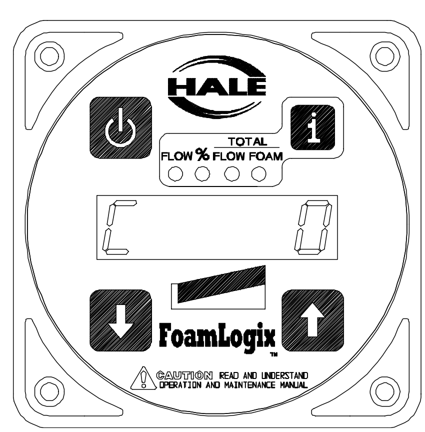

Figure 3-4. Flowsensor Calibration Display

Depress and release the DISPLAY button. The display will show "*F xx.x*" which is the water flowsensor calibration factor (See figure 3-5). Record this value for future reference. This factor can be programmed into the display if the display ever requires replacement.

WATER FLOWSENSOR CALIBRATION FACTOR: ______________________

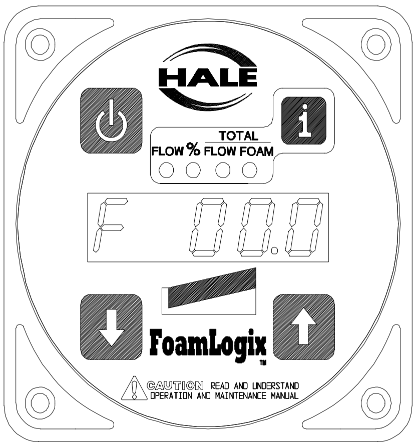

Figure 3-5. Flowsensor Calibration Factor Display

SIMULATED FLOW

The default Simulated Flow value is factory set to 150 GPM (568 LPM) and, if necessary, the default value can be adjusted while in user calibration mode. Press the **DISPLAY** button. The default simulated flow rate will be displayed as shown in figure 3-6. Adjust the setting by pressing the ↑ or ↓ buttons to set the desired rate, i.e., "*S 150*".

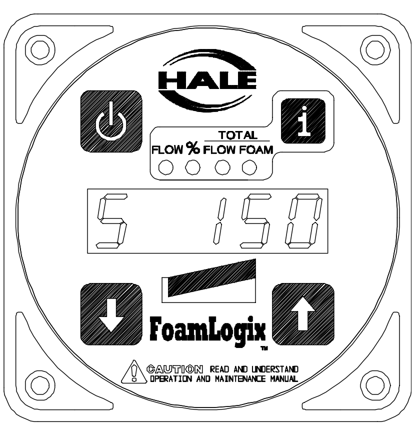

Figure 3-6. Simulated Flow Calibration Display

FOAM CONCENTRATE INJECTION RATE

When the Hale FoamLogix system power is turned on, the foam concentrate injection rate in memory will be the default injection rate setting. The user specific default concentrate injection rate can be adjusted in calibration mode.

Press the **DISPLAY** button. The display will show the current default concentrate injection rate stored in the computer memory for the selected foam concentrate tank (see figure 3-7). If the factory default values have not been changed the display will show "*PA 0.5*". The ↑ or ↓ buttons can be used to set the user specified default concentrate injection rate.

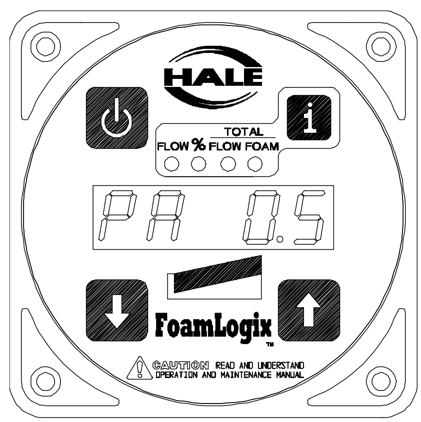

Figure 3-7. Foam Concentrate Injection Rate Default Value Set Display

FOAM PUMP FEEDBACK CALIBRATION

NOTE: Foam pump feedback is calibrated at Hale Products Inc. Calibration after installation is necessary to verify values with the actual foam concentrate(s) being used. Only calibrate using actual foam concentrates. DO NOT use water, training or test foams for feedback calibration verification.

Press the **DISPLAY** button. The control unit display will show "*A x.xx*" indicating the total volume of foam concentrate pumped during the last calibration run (See figure 3-8).

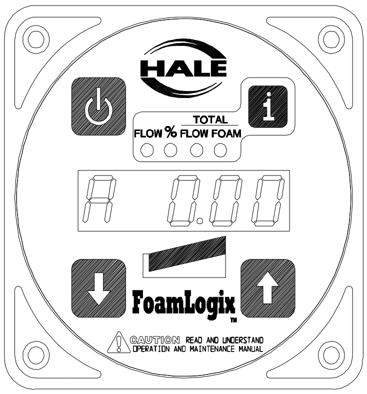

Figure 3-8. Foam Pump Feedback Calibration Display

Set the bypass valve to the BYPASS position and place a graduated measure container at the outlet of the bypass hose that can contain the expected volume of foam concentrate, 5 gallons (19 liters) minimum (figure 3-9).

> **NOTE:** If an accurate calibrated container is not available an accurate scale can be used to weigh the foam concentrate pumped. The total volume of foam concentrate can then be calculated from this weight and the density of the foam concentrate from the MSDS sheet.

Start the Hale FoamLogix foam pump by pressing the red **ON** button. The LEDs on the horizontal bargraph will light and the foam pump will operate at approximately $^{2}/_{3}$ speed to pump foam concentrate into the container. The display will show the volume of foam concentrate pumped. Stop the foam pump and measure precisely the amount of foam concentrate collected.

Adjust the reading on the display to the volume actually pumped by pressing the ↑ or ↓ button.

Repeat the procedure to verify the setting is correct.

Set the bypass valve handle back to INJECT position.

RECORD FOAM PUMP FEEDBACK CALIBRATION FACTOR

Depress and release the DISPLAY button. The display will show "*FAxxx*" (See figure 3-10). This is the foam pump feedback calibration factor. Record this value for future reference. This factor can be

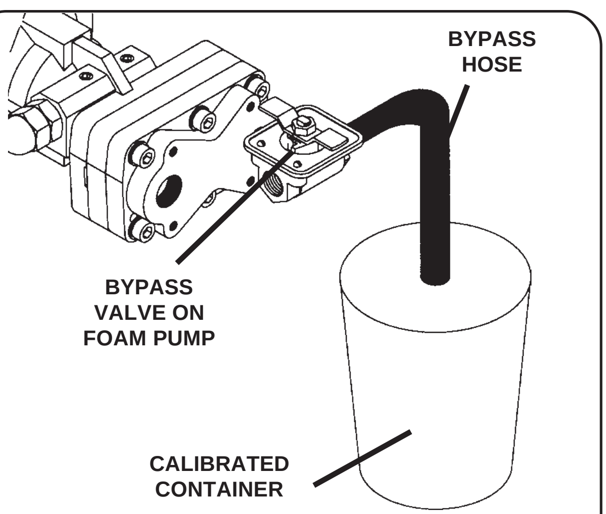

Figure 3-9. Foam Concentrate Collection

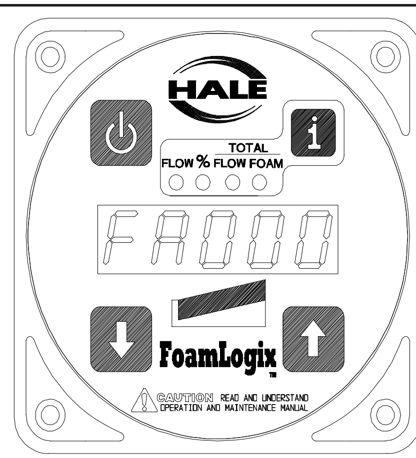

Figure 3-10. Foam Pump Feedback Calibration Factor

programmed into the display if the display ever requires replacement.

FOAM PUMP FEEDBACK CALIBRATION FACTOR: ______________________

EXITING AND SAVING CALIBRATION

To exit calibration and save the set values press and hold the **DISPLAY** button. The display will show "*PASS*" then go blank. While continuing to hold the display button enter the password (↑↑↑↑).

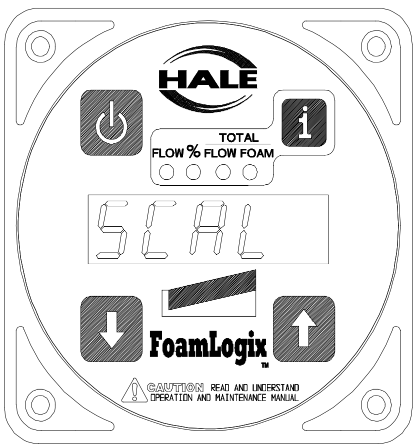

Figure 3-11. Exiting and Saving Calibration

The display will show "*SCAL*" (See figure 3-11) for several seconds then cycle through the start-up sequence followed by the flow display "*0*".

The above procedures complete verification and adjustment of the system. The Hale FoamLogix system is now ready to be placed in service.

RELIEF VALVE

The pressure relief valve (see figure 3-12) is factory tested and set to 300 PSI (21 BAR). During normal installation and operation the relief valve will not require adjustment. If adjustment is necessary in field installation contact Hale Products Inc for Relief Valve Service bulletin.

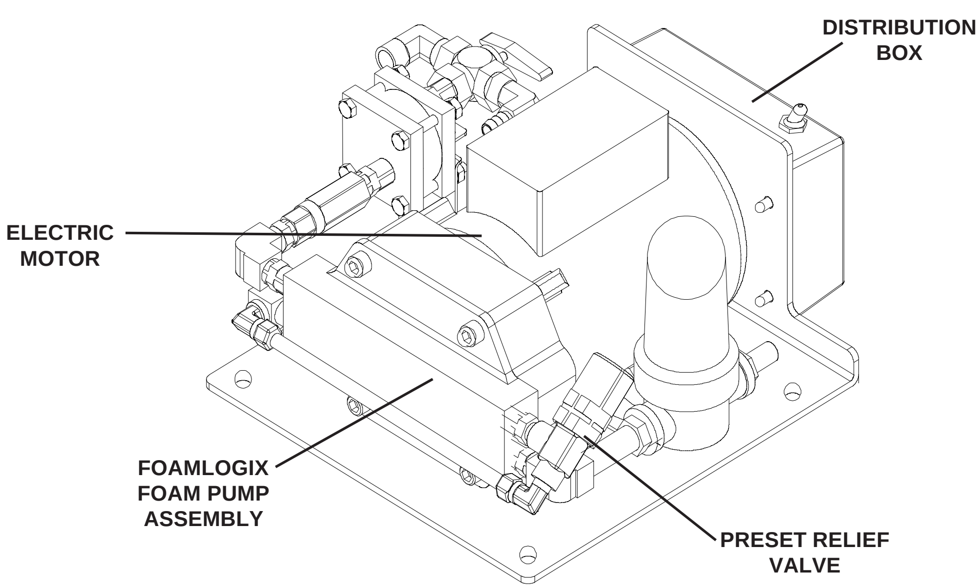

Figure 3-12. Relief Valve

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FoamLogix™

MODEL 2.1A CLASS A ELECTRONIC FOAM PROPORTIONING SYSTEM

DESCRIPTION, INSTALLATION AND OPERATION MANUAL

SECTION IV

OPERATION

NOTICE: This manual section is primarily used by the apparatus end user for proper operation and maintenance of the Hale foam proportioning system. This manual section can be used as a stand alone section or in conjunction with other sections of the complete manual.

HALE PRODUCTS, INC. ● A Unit of IDEX Corporation ● 700 Spring Mill Avenue ● Conshohocken, PA 19428 ● TEL: 610-825-6300 ● FAX: 610-825-6440

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HALE PRODUCTS INC.
ISO 9001
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SAFETY

Hale FoamLogix systems are designed to provide reliable and safe foam concentrate injection. Before installing or operating a Hale FoamLogix system read all safety precautions and follow carefully to ensure proper installation and personnel safety.

WARNINGS

1. Do not permanently remove or alter any guard or insulating devices or attempt to operate the system when these guards are temporarily removed.
2. To prevent electrical shock always disconnect the primary power source before attempting to service any part of the Hale Foam system.
3. All electrical systems have the potential to cause sparks during service. Take care to eliminate explosive or hazardous environments during service/repair.
4. To prevent system damage or electrical shock the main power supply wire will be the last connection made to the Hale Foam proportioner distribution box.
5. Release all pressure then drain all concentrate and water from the system before servicing any of its component parts.
6. Rotating drive line components can cause injury. When working on components of the Hale Foam system be careful of rotating components.

CAUTIONS

1. A foam tank low level sensor must be utilized to protect the Hale Foam proportioner from dry running. Failure to use a low level sensor with the Hale Foam system will void warranty.
2. Do not operate system at pressures higher than the maximum rated pressure.
3. Use only pipe, hose, and fittings from the foam pump outlet to the injector fitting, which are rated at or above the maximum pressure rating at which the water pump system operates.
4. Hale Foam proportioning systems are designed for use on negative ground direct current electrical systems only.
5. Do not mount radio transmitter or transmitter cables in direct or close contact with the FoamLogix control unit.
6. Before connecting the cordsets and wiring harnesses inspect the seal washer in the female connector. If the seal washer is missing or damaged, water can enter the connector causing corrosion of the pins and terminals resulting in possible system failure.
7. Always disconnect the power cable, ground straps, electrical wires and control cables from the control unit or other Hale Foam system equipment before electric arc welding at any point on the apparatus. Failure to do so could result in a power surge through the unit that could cause irreparable damage.
8. **DO NOT** connect the main power lead to small leads that are supplying some other device such as a light bar or siren. The Hale FoamLogix Model 2.1A requires 40 AMP minimum current.
9. When operating the Hale FoamLogix in Simulated Flow mode an outlet for the foam concentrate must be provided to prevent excessive pressure buildup in discharge piping or hoses.
10. Make sure the foam tank and foam concentrate suction hoses are clean before making final connection to foam pump. If necessary flush tank and hoses prior to making connection.

NOTES

1. Check all hoses for weak or worn conditions after each use. Ensure that all connections and fittings are tight and secure.
2. Ensure that the electrical source of power for the unit is a negative ground DC system, of correct input voltage, with a reserve minimum current available to drive the system.

3. The in-line strainer/valve assembly is a low pressure device and WILL NOT withstand flushing water pressure.
4. When determining the location of Hale Foam system components keep in mind piping runs, cable routing and other interferences that will hinder or interfere with proper system performance.
5. Always position the check valve/injector fitting at a horizontal or higher angle to allow water to drain away from the fitting. This will avoid sediment deposits or the formation of an ice plug.
6. The cordsets provided with each Hale Foam system are indexed so they only go in the correct receptacle and they can only go in one way. When making cordset connections DO NOT force mismatched connections as damage can result in improper system operation.
7. The system can only perform when the electrical connections are sound, so make sure each one is correct.
8. The cables shipped with each Hale Foam system are 100% tested at the factory with that unit. Improper handling and forcing connections can damage these cables which could result in other system damage.
9. There are no user serviceable parts inside Hale Foam system electrical/ electronic components. Opening of the distribution box or control unit will void warranty.
10. Use mounting hardware that is compatible with all foam concentrates to be used in the system. Use washers, lockwashers and capscrews made of brass or 300 series stainless steel.
11. When making wire splice connections make sure they are properly insulated and sealed using an adhesive filled heat shrink tubing.
12. **ALWAYS** connect the primary positive power lead from the terminal block to the master switch terminal or the positive battery terminal using minimum 8 AWG type SGX (SAE J1127) chemical resistant battery cable and protect with wire loom.
13. Prevent corrosion of power and ground connections by sealing these connections with silicone sealant provided.
14. Prevent possible short circuit by using the rubber boot provided to insulate the primary power connection at the Hale FoamLogix distribution box.

OPERATING INSTRUCTIONS

SYSTEM OPERATION DESCRIPTION

Operation of Hale FoamLogix systems is simple with all control provided by the push buttons on the control unit face (see figure 4-1).

Upon initial power up of the apparatus the Hale FoamLogix system will go to the standby mode upon completion of a self diagnostic routine. There are four different display functions on the control unit digital display. While in standby mode with the **FLOW** LED lit the digital readout will show the current water flow rate in the monitored discharge pipe. Pressing the **DISPLAY** button will change the function indicated by the LED that is lit under a particular label. **TOTAL WATER** and **TOTAL FOAM** values can be reset any time they are displayed. When the **% FOAM** LED is lit, or in any other function mode, the foam concentrate injection rate can be set to the desired value, if different from the default value, prior to or during foam operations by pressing the ↑ and ↓ buttons.

When the red **ON** button is pressed, the leftmost LED will illuminate indicating that the system is ready. If water flow is present the foam pump will start and inject foam concentrate into the discharge stream. The bargraph will light when foam is being injected and indicate system capacity. The Hale FoamLogix system constantly monitors water and foam concentrate flow values maintaining foam injection at the specified concentrate injection rate. The system responds to variations in water flow by increasing or decreasing the speed of the foam pump.

When the **ON** button is again pressed, the LEDs will extinguish, indicating that the system is in Stand-By mode and the foam pump will stop, but other system monitoring functions will continue.

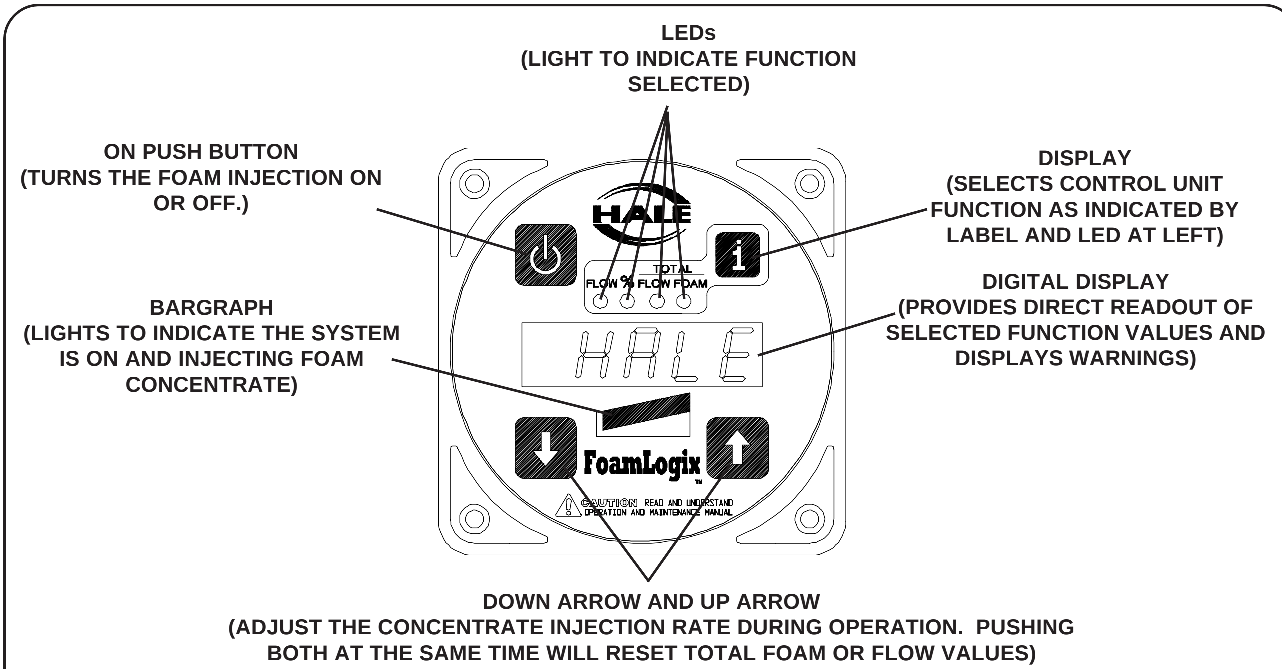


Figure 4-1. Control Unit Identification

DISPLAY INFORMATION

The five digit display on the control unit shows the value of the selected display function or provides warnings to the operator when the system is operating. A function is selected by pressing the grey **DISPLAY** button in the upper right hand corner of the control unit. Each time the button is pressed a new function mode is selected and displayed. LEDs above the digital display denote which function is being displayed. Pressing the **SELECT DISPLAY** button changes the control unit function but does not affect injection rate.

Control unit functions include:

FLOW
The display shows the current flow rate of water or foam solution per minute in Hale flowsensor monitored discharges. (See figure 4-2)

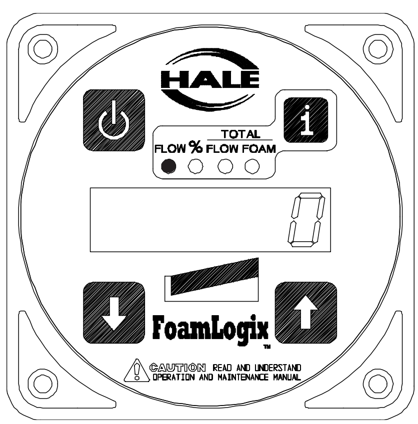


Figure 4-2. Stand-By/Flow Mode Display

% FOAM
The display shows the foam concentrate injection rate setting in the % FOAM mode ("*A 0.5*").

TOTAL FLOW
The display shows the total amount of water or foam solution pumped through flowsensor monitored discharges. This totalized value may be reset using procedures outlined in the "Reset Functions" paragraph.

TOTAL FOAM
The display shows the total amount of foam concentrate pumped. The value will be in the same unit of measure as the water flow. This totalized value may be reset using procedures outlined in the "Reset Functions" paragraph. As an example the display may show "*9.5*" indicating 9.5 gallons of foam concentrate have been used. (See figure 4-4)

BARGRAPH

The bargraph (refer to figure 4-1) consists of 10 LEDs. When the ON button is pressed the leftmost LED will light to indicate the system is on and ready to inject foam concentrate. When water is flowing LEDs to the right on the bargraph will light indicating foam concentrate is being injected. The amount of LEDs lighted provides an indication of the approximate pump capacity being used.

If water flow requirements exceed the capacity of the pump to deliver foam concentrate, the pump will run at maximum rate. All bargraph LEDs light and the rightmost LED flashes warning the operator that the system capacity is being exceeded and is running "lean" on foam concentrate percentage.

If the flow decreases such that the required

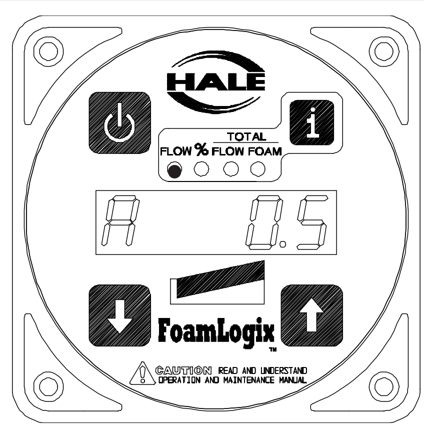


Figure 4-3. Foam Percentage Display

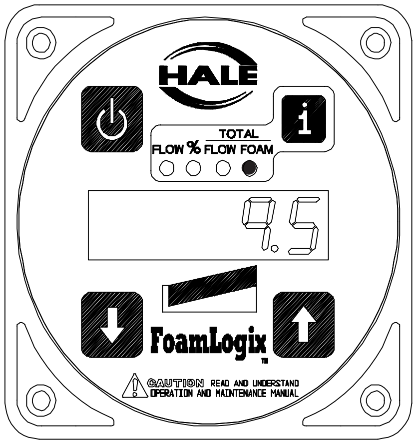


Figure 4-4. Total Foam Display

injection rate is less than the lowest rating of the pump, the pump will run at its minimum rate and the first bargraph LED to the right flashes so the operator will know the system is running "rich" on foam percentage.

RESET FUNCTIONS

The totalized values for water and foam concentrate pumped can be cleared from memory by performing a RESET function. Using the **DISPLAY** button, select either **TOTAL WATER** or **TOTAL FOAM**. By pressing and holding both the ↑ and ↓ buttons at the same time, the value shown is cleared and displayed as zero. Additionally the totalized values for water and foam concentrate reset to zero automatically when the apparatus power is turned off.

FOAM CONCENTRATE INJECTION RATE

When **% FOAM** is selected, the ↑ and ↓ buttons will respectively increase or decrease foam concentrate percentage.

While operating in any function, with the exception of **FLOW** during simulated flow operation, whenever the ↑ or ↓ buttons are momentarily pressed, the display will switch to the **% FOAM** display and show the current injection rate for 2 seconds. In any display mode, if either the ↑ or ↓ button is held down for a period of 2 seconds or more, the injection rate value will increase or decrease accordingly. Once released, the display will return to the last selected display after 2 seconds. When a reset (pressing both the ↑ and ↓ buttons at the same time) is performed in the **% FOAM** display mode the foam concentrate injection rate is returned to the default value.

WARNING MESSAGES

Several safety features are incorporated into the Hale FoamLogix system to protect the foam concentrate pump, electric motor and apparatus wiring while maintaining personnel safety. Messages appearing on the display alert the operator to adverse conditions that could cause damage to Hale FoamLogix system components, the apparatus and cause personnel injury.

Low Foam Tank Level

The Hale FoamLogix foam pump is interlocked with the foam concentrate tank level switch(es). If the tank is empty, the pump will run for 1 minute. Low foam concentrate tank level is denoted by "*Lo A*" (see figure 4-5) alternating with the normal selected function on the display. If one minute of low concentrate level is detected the display will show "*no A*", the pump will stop, and the leftmost LED will go out until the foam level is restored and the **ON** button is depressed. If the **ON** button is pressed before refilling the foam tank the system will run for 30 seconds before shutting down again.

Priming Error

In the event there is no feedback signal being received when the foam pump is started, indicating a lack of foam concentrate flow, the foam pump motor will run at full speed to attempt to establish foam concentrate flow. If the system operates for a period of 30 seconds without a feedback signal the system will go to the standby mode and the display will flash "*no Pr*" (no prime) indicating there is no foam concentrate flow. (See figure 4-6)

High Ambient Temperature

In the event the Hale FoamLogix system is operating in an environment of excessive ambient temperature the display will show "*HigH*" to indicate this situation (see figure 4-7). If the circuitry in the Hale FoamLogix system is being affected by a drop in power supply voltage the display will show "*Lo SP*" to indicate this situation.

> **NOTE:** This is not necessarily an indication of apparatus battery level or condition. This is only an indication of adverse operating conditions. For instance a bad battery cable can cause the system to see low power even though the batteries are fully charged.

In either case the system will continue to run with these adverse conditions. If conditions deteriorate to the point of potential system damage due to heat or low power the system will return to the standby and error message will remain until **ON** is pushed again.

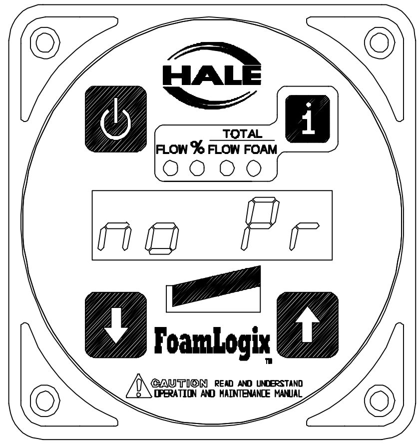


Figure 4-6. Priming Error Display

AFTER 1 MINUTE OF OPERATION

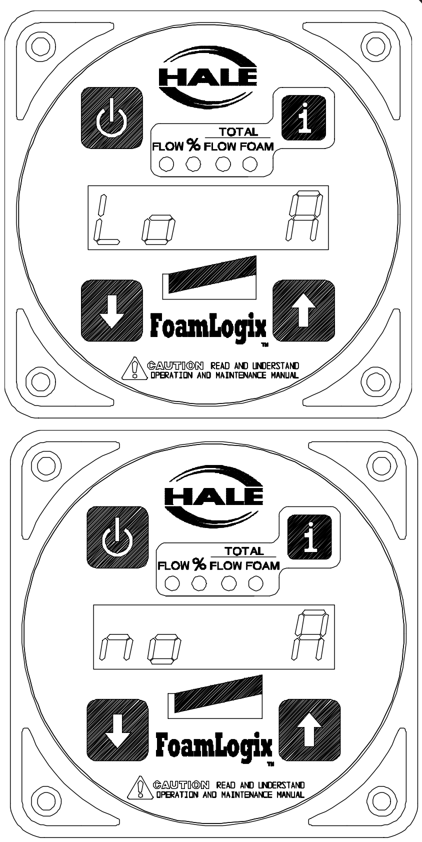


Figure 4-5. Low Foam Tank Display

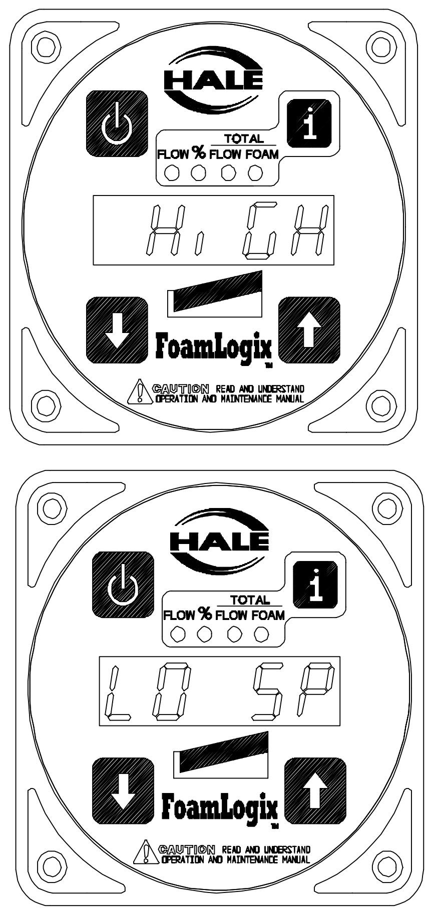


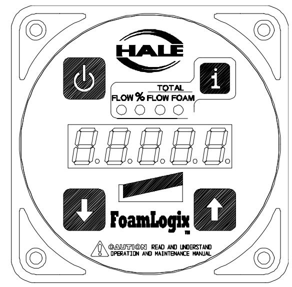
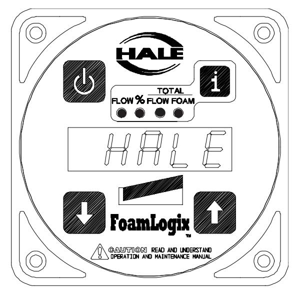
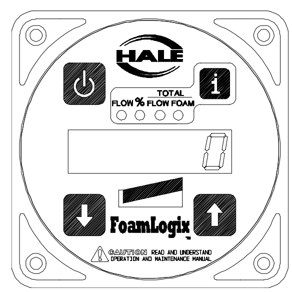
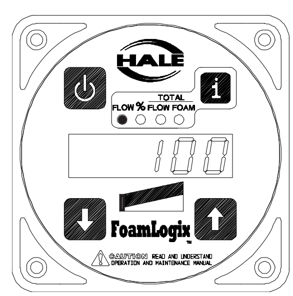
Figure 4-7. High Temperature and Low Battery Display

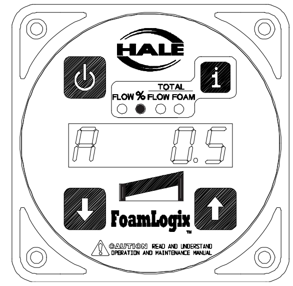
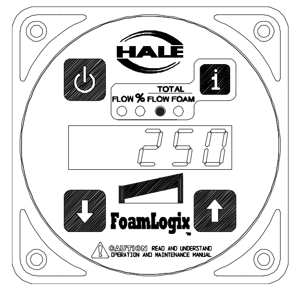
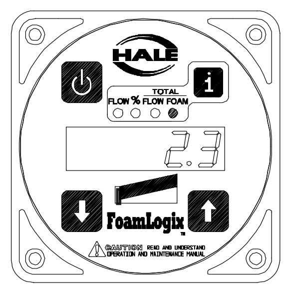
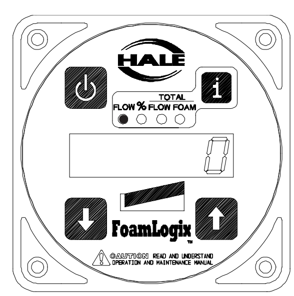
PRIMING THE FOAM PUMP WHEN FOAM TANK HAS RUN DRY

In some instances the foam tank may run dry while operating the Hale FoamLogix system. The foam pump is designed to pump liquid. When the fire pump is running the foam pump may not pump efficiently against 100 to 150 PSI (7 to 10 BAR) back pressure. To reestablish foam concentrate flow quickly the following procedure can be used.

1. Turn the bypass valve to the **BYPASS** position.
2. With the fire pump flowing water from foam discharge and the Hale FoamLogix on observe the hose from the bypass valve.
3. When foam concentrate flows from the hose turn the bypass valve back to the **INJECT** position. The pump is now primed and ready for normal operation.

NORMAL OPERATION SUMMARY

OPERATION	ACTION	DISPLAY
Energize System Select foam tank	Energize apparatus and turn FoamLogix power switch to **ON.** If System equipped with dual foam tanks place selector to proper tank.	 INITIAL STARTUP  SELF DIAGNOSTICS  STANDBY DISPLAY SINGLE FLOWSENSOR: FLOW MULTIPLE FLOWSENSORS: % FOAM
Begin Foam Injection	Establish water flow and depress **ON** button.	 WATER FLOW ESTABLISHED, ON BUTTON PRESSED

OPERATION	ACTION	DISPLAY
Change injection rate	Press ↑ or ↓ and hold for 2 seconds. Release once desired rate is set.	 FOAM CONCENTRATE INJECTION RATE DISPLAY
Read injection rate	Press and release ↑ or ↓. Display will show injection rate and return to selected function after 2 seconds.	
Read total water or foam solution	Press **DISPLAY** until LED below **TOTAL FLOW** is lit.	 TOTAL FLOW DISPLAY
Read total foam concentrate	Press **DISPLAY** until LED below **TOTAL FOAM** is lit.	 TOTAL FOAM DISPLAY
Reset Totalized values	While in **TOTAL FLOW** or **TOTAL FOAM** press and release ↑ and ↓.	
End foam injection	Depress **ON** button.	 STANDBY DISPLAY SINGLE FLOWSENSOR: FLOW MULTIPLE FLOWSENSORS: % FOAM

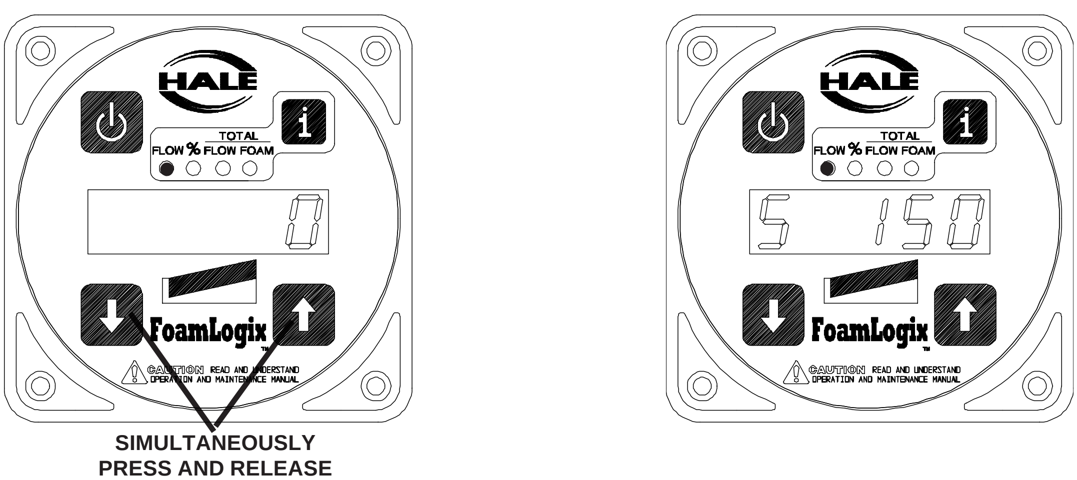
SIMULATED FLOW OPERATION

The Simulated Flow mode of the Hale FoamLogix system allows the operator to operate the foam pump without discharging water through a foam capable discharge or when the flowsensor is not functioning. The simulated flow mode is used for draining the foam tank for cleaning, checking calibration of the feedback sensor, verifying foam pump operation or manually controlling foam injection if the flowsensor malfunctions. The factory default simulated flow rate is 150 GPM (568 LPM). The simulated flow rate and the concentrate injection percentage rate can be set by using the display readout and the rate adjustment buttons on the control unit while in simulated flow mode. The simulated flow function provides manual operation of the foam injection system required by NFPA standards.

> **CAUTION:** When operating the Hale FoamLogix in Simulated Flow mode an outlet for the foam concentrate must be provided to prevent excessive pressure buildup in discharge piping or hoses.

Use the following procedure to operate the Hale FoamLogix system using simulated flow:

1. Locate the bypass hose and uncoil to place the end into a suitable container to collect the foam concentrate.
2. Place the Hale FoamLogix system BYPASS valve in the BYPASS position.
3. Energize apparatus electrical system and turn Hale FoamLogix power switch to ON.
4. When the Hale FoamLogix is in the standby mode, **FLOW** LED lit, depress and release the ↑ and ↓ buttons at the same time. The display will show "*S 150*" (or other preset default value) and the **FLOW** LED will be lit. (see figure 4-8)
5. Depress the **ON** button. The leftmost LED will light and the foam pump will begin running. Foam concentrate will flow out of the end of the bypass hose.
6. To end simulated flow operation, first depress the **ON** button to stop the foam pump.
7. Press **DISPLAY** button until the **FLOW** LED is lit.
8. Depress and release the ↑ and ↓ buttons at the same time. The display will show the current water flow value and the **FLOW** LED will be lit.
9. Deenergize apparatus electrical system.



ENTERING SIMULATED FLOW MODE **SIMULATED FLOW MODE DISPLAY**

Figure 4-8. Simulated Flow Operation Display

10. Place the bypass valve to the INJECT position. Secure bypass hose in the appropriate compartment.
11. Return apparatus to normal ready condition.

MAINTENANCE

MAINTENANCE PROCEDURES

1. **After each use:** Inspect wiring, hoses, flowsensors, and connections for tightness, corrosion, leaks and/or damage. Refer to installation drawings.
2. **After each use:** Remove and clean the foam strainer screen. Flush as required.
3. **After each use:** Flush foam pump if a non approved foam concentrate is used.
4. **Monthly:** Verify water flow calibration.
5. **Monthly:** Verify foam feedback calibration.
6. **Every 3 Months:** If an approved foam concentrate has been left in the system operate foam system to move the foam concentrate to prevent jelling.

TROUBLESHOOTING

USER DIAGNOSTICS

Power indicator lamps are provided on the distribution box and on the feedback sensor. The lamp on the distribution box located next to the **ON/OFF** switch is illuminated whenever power is supplied to the control cable. The LED on the feedback sensor will flash when the sensor is receiving pulses from the flowsensor. These LEDs help to ease tracing of power supply faults and eliminates some of the guesswork in troubleshooting. This feature is referenced in the troubleshooting guide.

If the system malfunctions make sure ALL the following conditions are met:

- ❑ All hose connections correct and tight (Refer to appropriate system plumbing diagram in Section II).
- ❑ All electrical connections correct and tight (Refer to appropriate system electrical diagram in Section II).
- ❑ Apparatus electrical system energized with power supplied to pump panel and Hale FoamLogix.
- ❑ Hale FoamLogix power switch located on the distribution box is in the ON position.
- ❑ Power indicator LED on the distribution box is illuminated.

Once all the above conditions are met proceed to the system troubleshooting section to determine cause of malfunction.

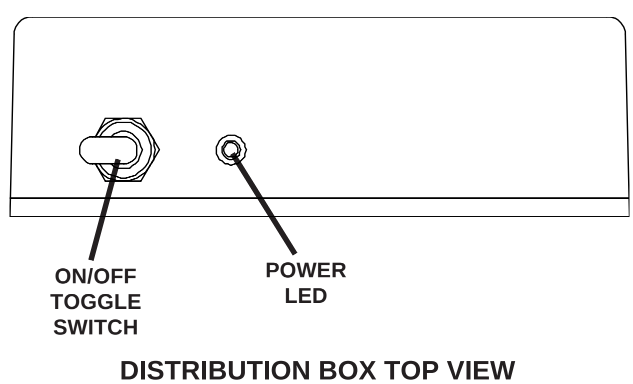


Figure 4-9. Power Indicator LED Location

Hale FoamLogix systems consist of individual subsystems working together to provide finished foam solution at the proper percentage.

The entire system is designed using modular components making troubleshooting and repair easier. Each subsystem has its own set of troubleshooting procedures. The procedures that follow will provide a logical flow path to isolate and correct any system failure.

NOTE: Hale FoamLogix system electronic components have no user serviceable components and are replaced as a unit. Opening of Hale FoamLogix electronic components will void the manufacturer warranty.

PROBLEM ISOLATION

The first step in troubleshooting the Hale FoamLogix system is to determine which subsystem caused the overall system failure. To make this determination operate the apparatus and Hale FoamLogix system in accordance with standard operating procedures noting where problems occur.

Refer to the following to isolate the cause of Hale FoamLogix system failure.

Following are the basic steps to follow to isolate system problems. They are presented in block format in chart 4-1.

1. Setup apparatus for normal operation.
2. Power-up apparatus and energize the pump operator panel. Take notice of the Hale FoamLogix Control unit. If the display is NOT illuminated proceed to the power supply troubleshooting chart 4-2.
3. If the Hale FoamLogix control unit is illuminated engage apparatus water pump and establish discharge. If water flow CANNOT be established, troubleshoot the water pump system in accordance with pump troubleshooting procedures.
4. If there is no indication of water flow on control unit display troubleshoot flowsensor using procedures outlined in chart 4-3.
5. If water flow can be established turn Hale FoamLogix system ON to flow foam. Observe foam pump discharge, if foam is NOT flowing refer to foam pump troubleshooting chart 4-4.
6. Check accuracy of system using calibration procedures in Section III of this manual making adjustments as required.

Chart 4-1. Hale FoamLogix System Troubleshooting

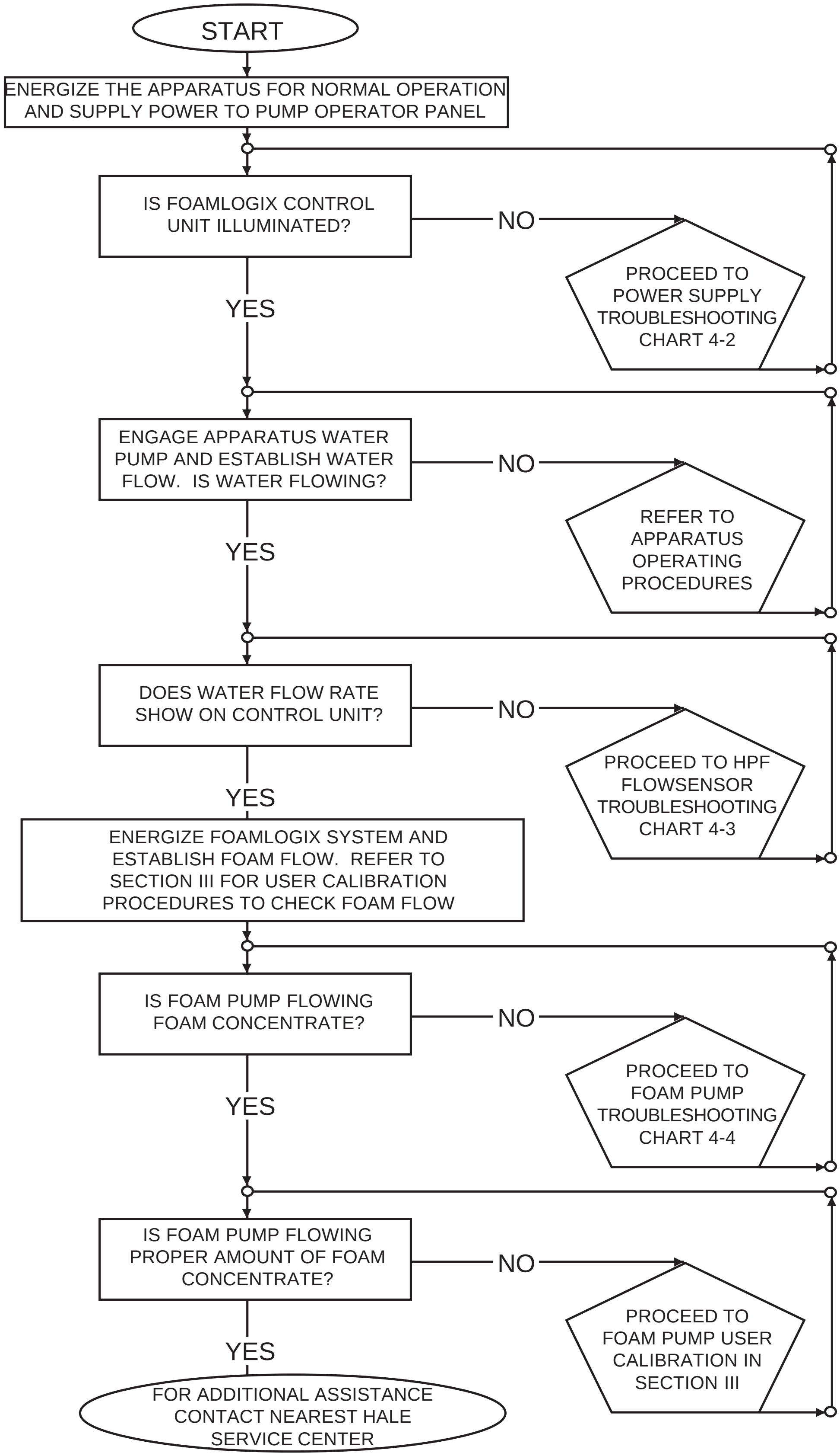


Chart 4-2. Power System Troubleshooting

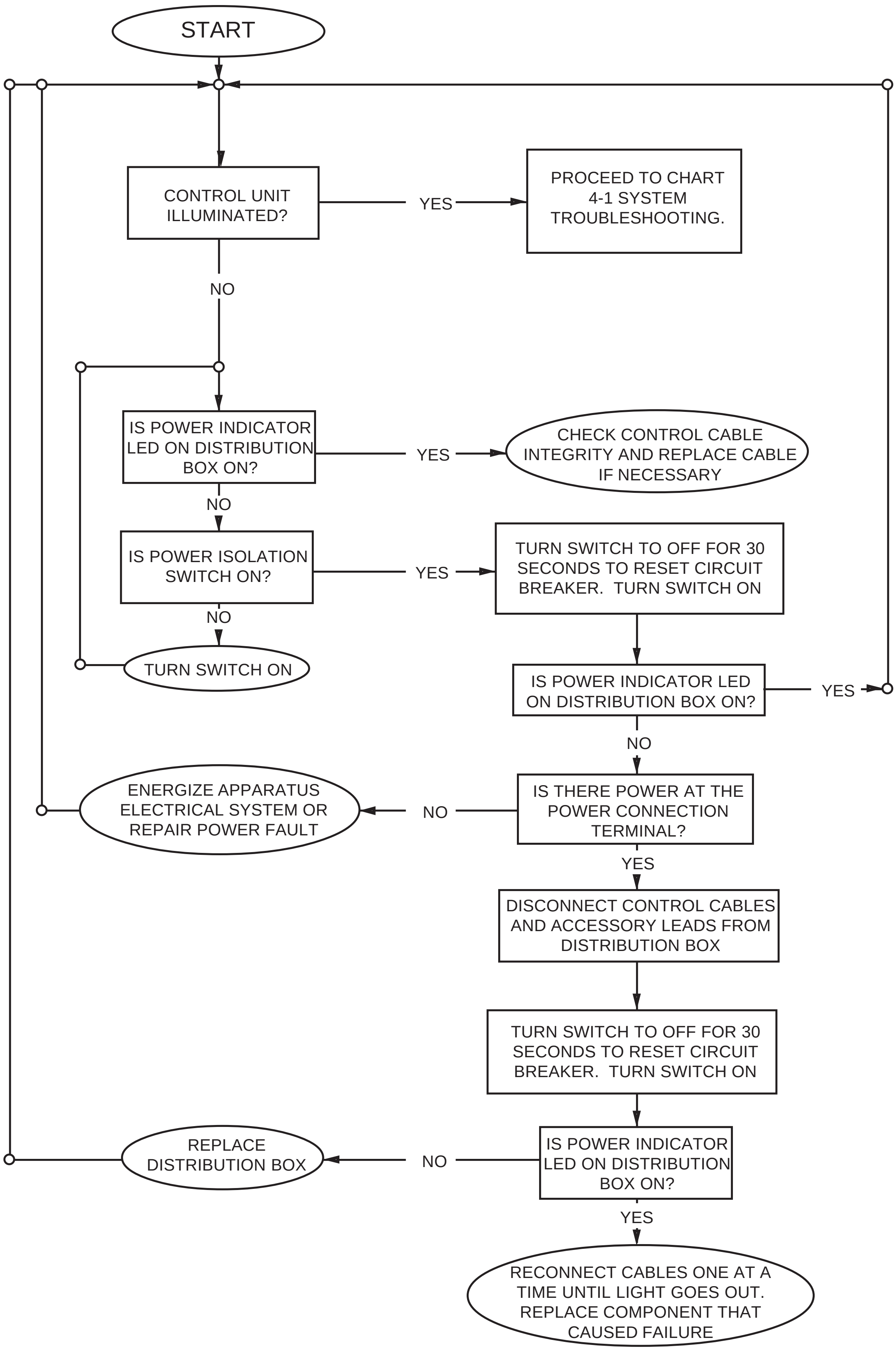


Chart 4-3. HPF Flowsensor Troubleshooting

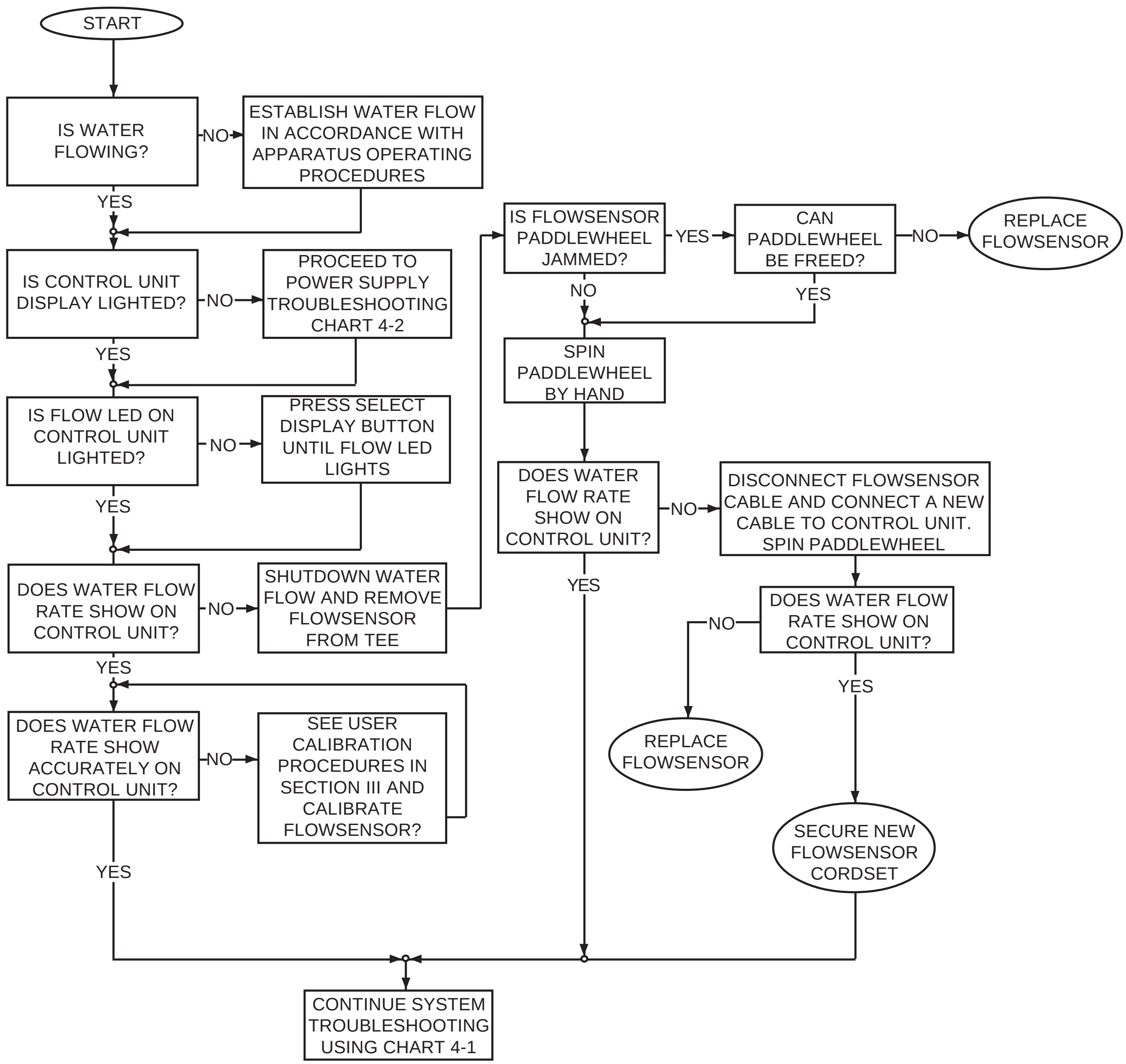
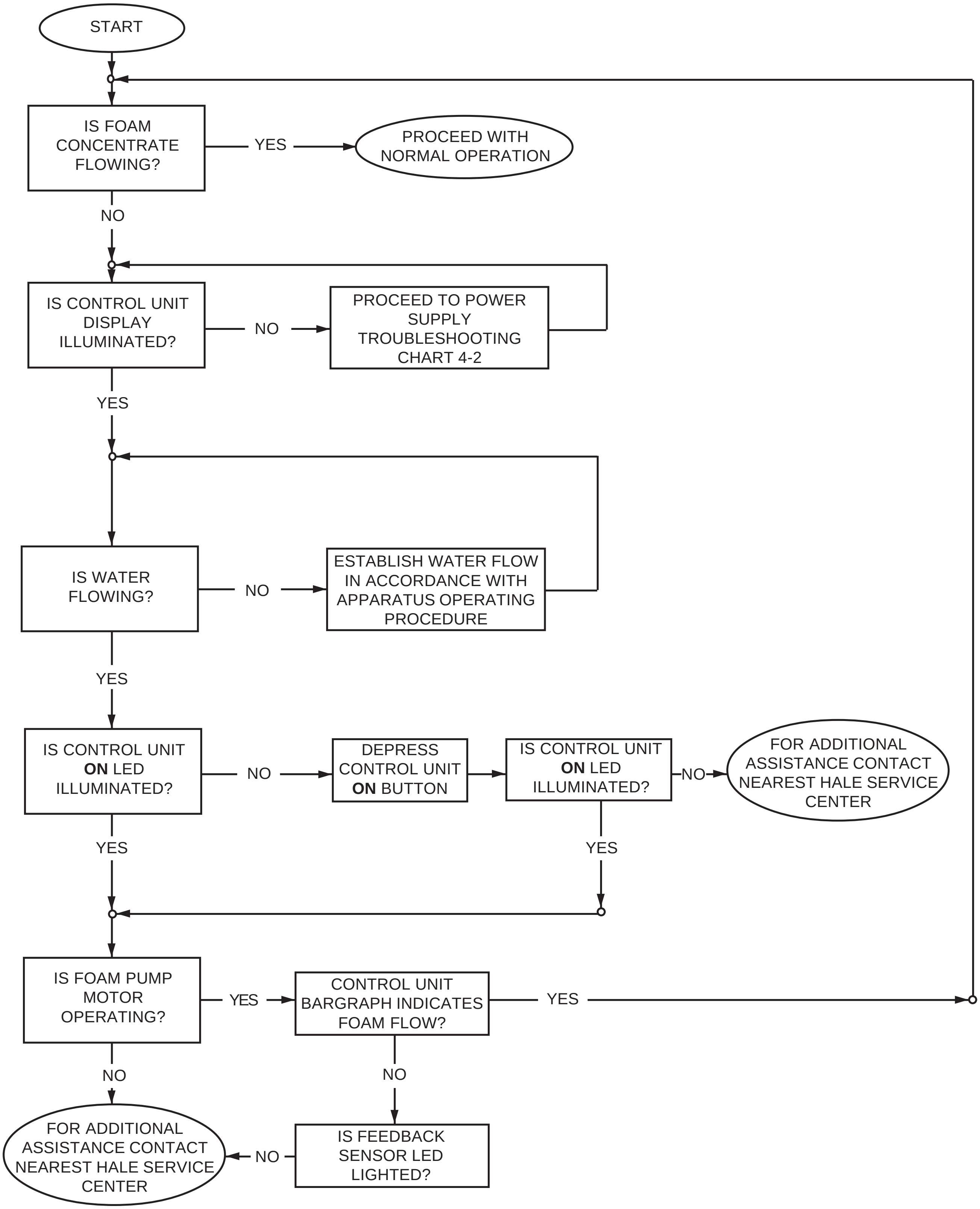


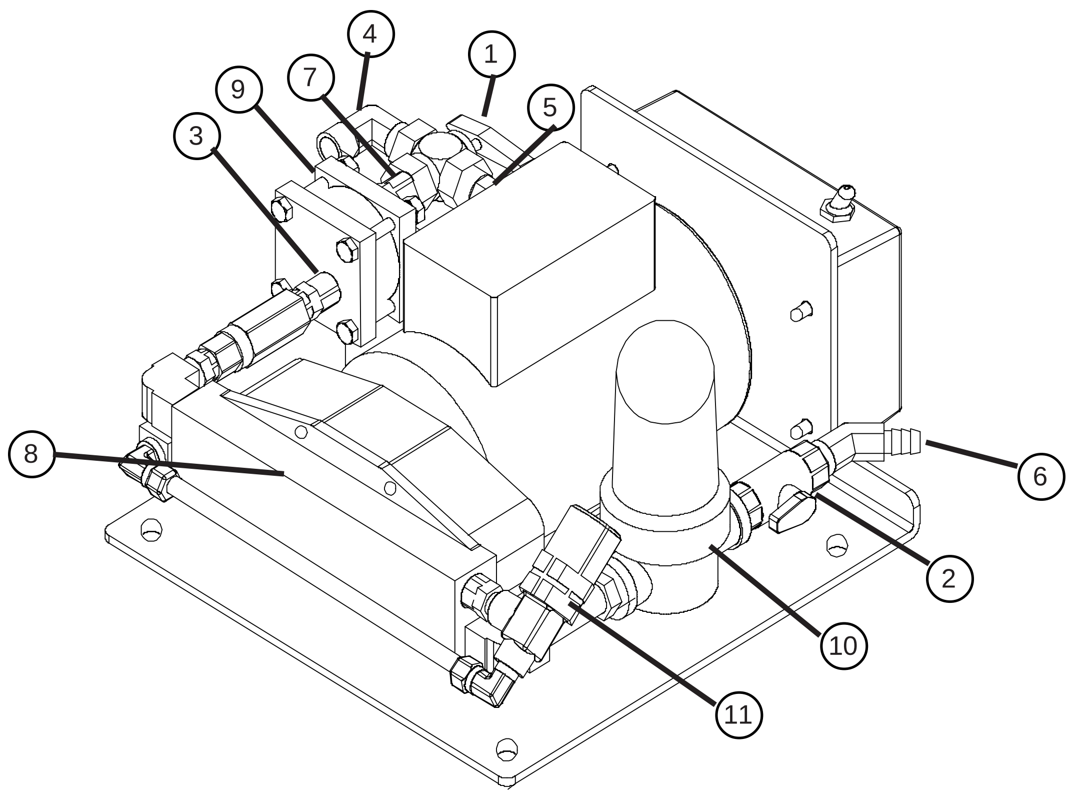
Chart 4-4. Foam Pump Troubleshooting



PARTS IDENTIFICATION

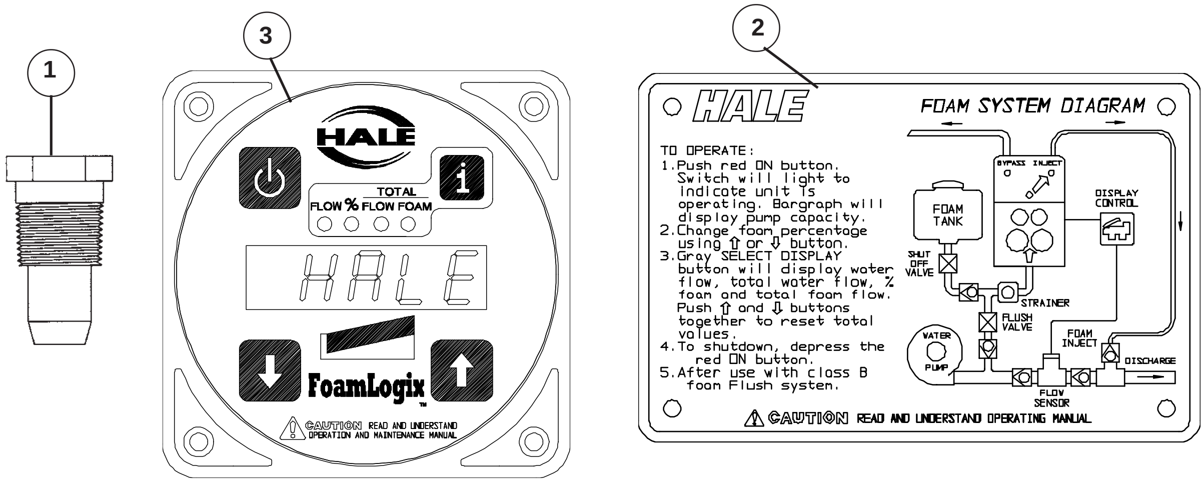
FOAM PUMP ASSEMBLY

REF	PART NUMBER	DESCRIPTION	QTY	UNIT
1	038-2220-00-0	VALVE - 3/8 NPT 3-WAY BY-PASS A	1	EA
2	038-2230-00-0	3/8NPT MALE/FEMALE SHUTOFF VLV	1	EA
3	082-0301-02-0	NIPPLE-3/8 NPT BRASS CLOSE	1	EA
4	082-0317-02-0	ELBOW-3/8NPT X 1/2 COMPRESSION	1	EA
5	082-0327-02-0	ELBOW-3/8NPT X 1/2 HOSE BRASS	1	EA
6	082-0328-02-0	ELBOW-3/8 NPT X1/2 HOSE(45 DEGREE)	1	EA
7	082-0364-02-0	NIPPLE - 3/8 NPT BRASS HEX	1	EA
8	501-3420-08-0	2.1A-12 TRANSFER PUMP ASSEMBLY	1	EA
9	168-0420-00-0	2.1A FOAM FLOW METER	1	EA
	040-0340-00-0	SEAL RING 2-034	2	EA
	097-1971-00-0	5 MM SEALING WASHER	1	EA
	200-2481-00-0	FOAM FEEDBACK SENSOR ASSY	1	EA
	516-0670-00-0	FLOWMETER ROTOR ASSEMBLY	2	EA
10	510-0200-02-0	FILTER ASSEMBLY	1	EA
11	538-1750-01-0	RELIEF VALVE	1	EA
	538-1750-02-0	RELIEF VALVE REPAIR KIT	1	EA



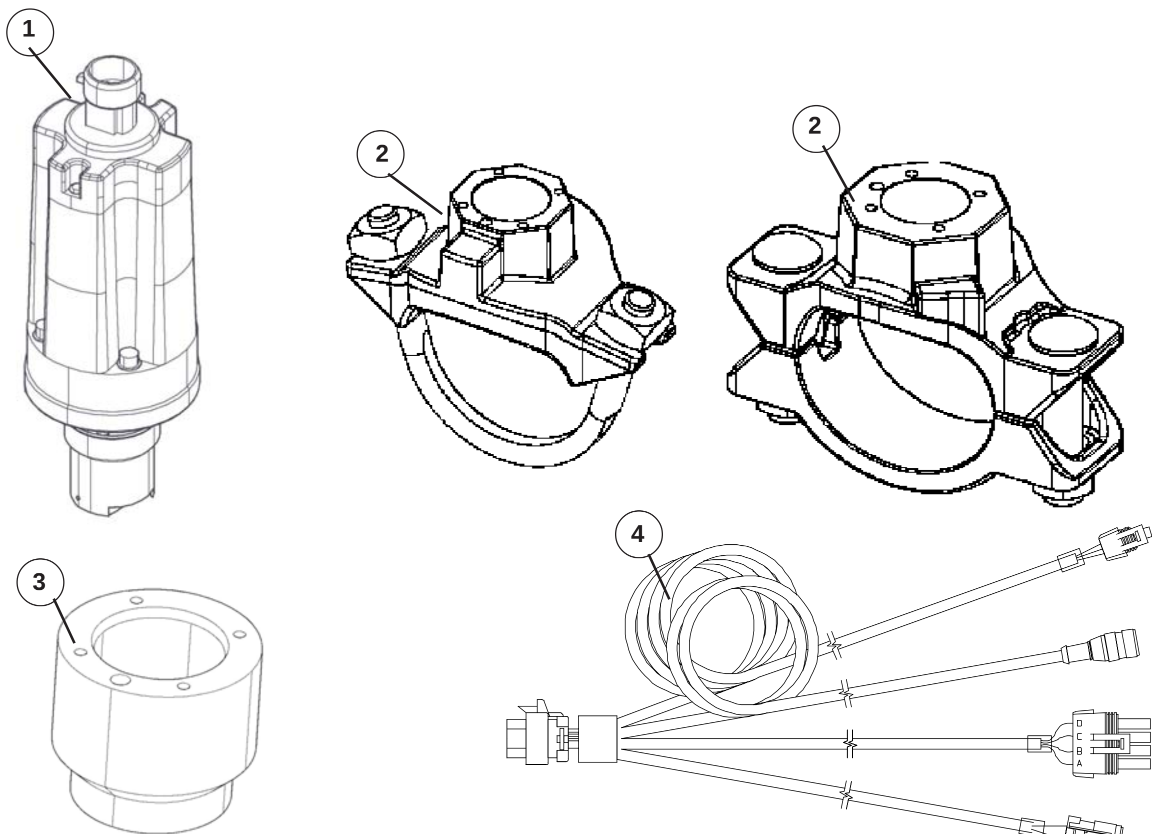
ADDITIONAL FOAMLOGIX SYSTEM COMPONENTS

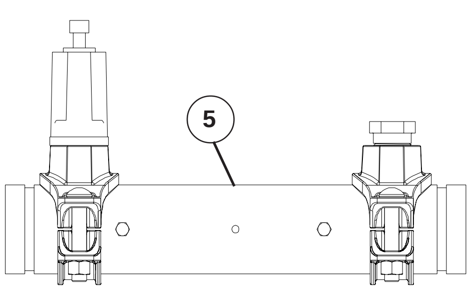
REF	PART NUMBER	DESCRIPTION	QTY	UNIT
1	038-1790-00-0	CHECK VALVE INJECTOR	1	EA
2	101-1630-12-0	FOAM SYSTEM DIAGRAM NAMEPLATE (SINGLE TANK)	1	EA
3	107064	CONTROL UNIT	1	EA



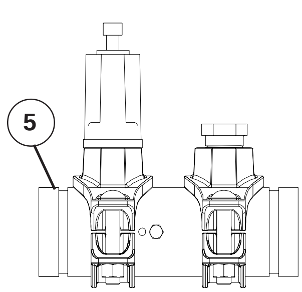
FOAMLOGIX FLOWSENSOR

REF	PART NUMBER	DESCRIPTION	QTY	UNIT
1	102714	PADDLE WHEEL		
2	4842010	SADDLE CLAMP (2 INCH)		
	4843010	SADDLE CLAMP (2-1/2 INCH)		
	4844010	SADDLE CLAMP (3 INCH)		
	4846010	SADDLE CLAMP (4 INCH)		
	4845010	SADDLE CLAMP (5 INCH)		
3	082-3060-00-0	WELD FITTING (STAINLESS STEEL)		
	309020	WELD FITTING (STEEL)		
	309010	WELD FITTING (ALUMINIUM)		
4	107400	FOAMLOGIX FLOWSENSOR CABLE 10 FT (3 M) LG	1	EA
	107362	FOAMLOGIX FLOWSENSOR CABLE 20 FT (6 M) LG	1	EA
	107401	FOAMLOGIX FLOWSENSOR CABLE 30 FT (9 M) LG	1	EA
5	108751	DUAL CHECK VALVE MANIFOLD ASSEMBLY	1	EA
	108893	SINGLE CHECK VALVE MANIFOLD ASSEMBLY	1	EA
6	513-0270-04-0	WIRE HARNESS	1	EA

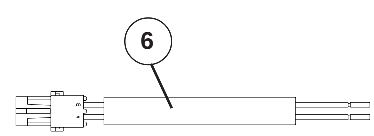




DUAL CHECK VALVE MANIFOLD



SINGLE CHECK VALVE MANIFOLD



WARRANTY

LIMITED WARRANTY

EXPRESS WARRANTY. Hale Products Inc. (“Hale”) hereby warrants to the original buyer that products manufactured by it are free of defects in material and workmanship for one (1) year. The “Warranty Period” commences on the date the original buyer takes delivery of the product from the manufacturer.

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

THE ABOVE EXPRESS LIMITED WARRANTY IS EXCLUSIVE. NO OTHER EXPRESS WARRANTIES ARE MADE. SPECIFICALLY EXCLUDED ARE ANY IMPLIED WARRANTIES, INCLUDING WITHOUT LIMITATIONS, THE IMPLIED WARRANTIES OF MERCHANTABILITY OR 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 DAMAGES 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.

V-Series

Venturi Based Balanced Pressure Foam Proportioning System

Installation and Operation Manual

Model	Foam Concentrate Flow	Maximum Operating Pressure
3.0V-12	3.0 GPM (11.4 LPM)	250 PSI (17 BAR)
3.0V-24	3.0 GPM (11.4 LPM)	330 PSI (22 BAR)
2.5V-Series	2.5 GPM (9.5 LPM)	150 PSI (10 BAR)
1.0V-Series	1.0 GPM (3.8 LPM)	250 PSI (17 BAR)

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

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Certificate A4026

V-Series

Venturi Based Balanced Pressure Foam Proportioning System

V-Series

Venturi Based Balanced Pressure Foam Proportioning System

Table of Contents

Please record the model and serial number of your unit. This will ensure that you provide accurate information when placing an order with a Hale customer service representative. The ID tag is located on the side of the Venturi/metering assembly as shown in the accompanying picture.

MODEL:__________________________SERIAL #________________________________

Safety Information

Hale V-Series Foam systems are designed to provide safe and reliable foam concentrate injection. Before installing or operating a V-Series Foam system, read all the safety precautions and follow the instructions carefully to ensure proper installation and personal safety.

⚠ WARNING

- Do not permanently remove or alter any guards or insulating devices. It is unsafe to operate the system with these guards removed.
- To prevent electrical shock, always disconnect the primary power source before servicing any part of the V-Series Foam system.
- All electrical systems have the potential to create sparks while being serviced. Remove any explosive or hazardous material from the environment before performing any maintenance.
- Before servicing any components, it is important to depressurize the system and drain it of all concentrate and water.
- Always lock out the equipment prior to working on the V-Series Foam system, as directed by department procedure.

⚠ CAUTION

Foam tank low-level sensors should be utilized as extra protection to prevent the system from running dry. Damage could occur to the pump if this sensor is bypassed or not installed. A low tank option kit is available from Hale Products, Inc.

- READ THE MANNUAL COMPLETELY BEFORE ATTEMPTING THE INSTALLATION. Contact Hale Products, Inc. with questions.

- To prevent system damage or electrical shock, the main power supply (+) must be the last connection made to the V-Series Foam wiring harness.

- Do not operate the system at pressures higher than those listed below:

	Foam Proportioning System Model			
	1.0V	**2.5V**	**3.0V-12**	**3.0V-24**
Max Operation Pressure	250 PSI (17 BAR)	150 PSI (10 BAR)	250 PSI (17 BAR)	330 PSI (22 BAR)
Max Hydrostatic Test Pressure	400 PSI (28 BAR)	400 PSI (28 BAR)	400 PSI (28 BAR)	400 PSI (28 BAR)
Max Pressure During Priming	100 PSI (7 BAR)	100 PSI (7 BAR)	100 PSI (7 BAR)	100 PSI (7 BAR)

- Throughout the entire system, only use pipe, hose, and fittings rated at or above the maximum operating pressure of the water pump.
- V-Series Foam systems are designed for use on negative ground, 12 or 24-volt direct current (DC) electrical systems. The operating voltage is indicated in the model name. For example, model 2.5V-12 is a 12-volt system.
- **Do not remove the lock pin from the Venturi/ metering assembly** until the control cable installation is complete. The unit will loose calibration and may fail to operate.
- Verify the foam tank and concentrate suction hoses are clean and dry before making the final connections to the foam pump.
- Before connecting the wiring harness, inspect the seal washer in the connector. If it is missing or damaged, water can enter the connector causing a short circuit.
- Always disconnect the power cable, ground straps, and electrical wires from the control unit and other foam equipment before performing any electric arc welding. Failure to do so may result in a power surge capable of irreparable damage.
- Ensure the system is drained when temperatures below freezing are expected. This will prevent freeze plugs from developing that could render the unit temporarily inoperable.

Do not connect the main power lead to any other device, such as a light bar or siren. Refer to the chart on page 15 for wire gauge and fuse sizing requirements for the V-Series Foam system. Always use appropriate wire, terminals, and in-line fuse holders to attach a new power lead directly to the apparatus battery or power distribution block. Follow safe wiring practices and never tap into another circuit that has not been designed to carry additional current loads safely.

NOTES:

- After each use, check for weak or worn hoses. Ensure that all connections and fittings are tight and secure.
- The source of power for the unit must be a negative ground DC system with the correct input voltage and minimum reserve current required to drive the V-Series Foam system.

- When determining the location of the V-Series Foam components, keep in mind piping runs, cable routing, and any interferences that will hinder proper system performance.
- The wiring harness provided with each Hale Foam system is indexed so the proper component will mate only with the correct receptacle. **Do not** force any mismatched connections. Damage can result from improper system installation.
- Verify the connections to the power source are properly insulated and sealed by using the boots and sealer provided.
- Each V-Series Foam system is tested at the factory using the wiring harness provided. Improper handling or forcing connections can damage the cables, compromise performance or cause malfunctions.
- Use mounting hardware that is compatible with every foam concentrate that will be used in the system. Use washers, lock-washers, and cap screws made of brass or 300 series stainless steel.
- Always secure the foam percentage cable at least every 12" along its full length. An unsecured cable will move during operation, altering the control settings. Connections should be tight enough to hold the cable in place, but not deform the cable. Route the cable as straight as possible to gain the most precise control of the system.
- The foam pump safety relief valve is preset at the factory at 290/350 PSI on 1.0V models and 3.0V models, and 160/200 PSI on 2.5V models. **DO NOT** alter or adjust the safety relief valve or damage to the pump and system could result.
- Model numbers 1.0V-12M, 1.0V-24M, 2.5V-12M, 2.5V-24M, 3.0V-12M, and 3.0V-24M use 2-1/2" female BSP (ISO228/1-G2-1/2) threaded connections on the Venturi section. All others have 2-1/2" female NPT. Every model has 3" Victaulic® connections as well.

Model	**2.5" Female NPT**	**2.5" Female BSP (ISO228/1-G2-1/2)**	**3" Victaulic®**
1.0V-12	✓		✓
1.0V-12M		✓	✓
1.0V-24M		✓	✓
2.5V-12	✓		✓
2.5V-12M		✓	✓
2.5V-24M		✓	✓
3.0V-12	✓		✓
3.0V-12M		✓	✓
3.0V-24M		✓	✓

V-Series

Venturi Based Balanced Pressure Foam Proportioning System

System Description

The V-Series Foam system consists of three main components: a foam pump/motor assembly, control panel assembly, and a venturi/metering assembly. These three parts work together to provide a reliable foam proportioning system. The control panel turns the system on, adjusts the foam injection percentage, and primes the foam lines.

The foaming agent is pumped from a tank into a metering valve and drawn into the venturi at a rate proportional to the water flow. The foam pump cycles on and off as necessary to provide the metering unit with an adequate supply of foam concentrate. A metering valve controls the flow of concentrate drawn into the venturi. The position of the metering valve is adjusted by a cable connected to the control panel. Once the percentage is set on the panel, the flow rate of the foam concentrate automatically changes to maintain proportionality with the water flow rate.

The V-Series Foam system turns on when the control lever is moved away from the “OFF” position, illuminating a green LED. The operator may prime the system with foam concentrate by moving the lever to the “PRIME” position.

The venturi assembly is equipped with pipe thread connections as well as 3” Victaulic® grooves to improve versatility. The venturi also has a built-in check valve feature to prevent the water tank from becoming contaminated with foam. A separate user-supplied check valve must be installed between the venturi and the fire pump to further prevent contamination.

This foam proportioning system is engineered to provide reliable, consistent foam concentrate injection for Class A foam operations. The V-Series system directly injects between 0.1% and 1.0% foam concentrate into the water discharge stream, over a range of 10 to 250 GPM. The foam solution is then fed through the apparatus discharge piping into a standard fog nozzle, air aspirated nozzle, or CAFS equipment. A properly configured and installed V-Series Foam system with components recommended by Hale virtually eliminates the possibility of foam contamination in the booster tank, fire pump, or relief valve.

V-Series Models include:

- Foam Pump / Motor Assembly
- Control Panel with Wiring Harness
- Venturi/metering Assembly
- Control Cable
- All Necessary Fittings and Tubing

User Supplied Components

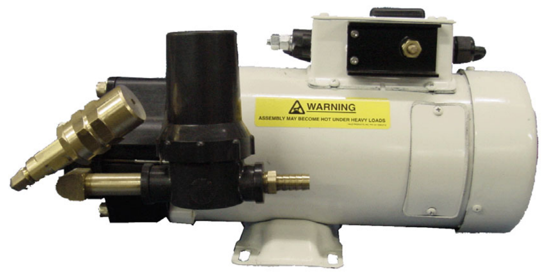
- Class A foam concentrate
- Water pump to Venturi, 2 ½” check valve.
- Foam concentrate tank. Also available from Hale Products, Inc.
- Foam tank to foam pump shutoff valve. ¾” recommended, ½” minimum size.

V-Series

Venturi Based Balanced Pressure Foam Proportioning System

Foam Pump/Motor Assembly

The foam pump/motor assembly is supplied with pre-assembled safety relief valve, filter, and all the fittings necessary for installation. *(3.0v Pump shown)*
Refer to the Drawings section for mounting templates.



Minimum space required for mounting: 16"x14"x8"

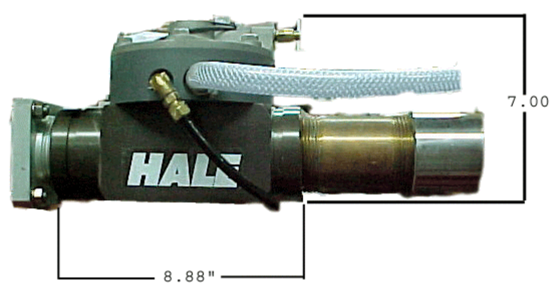
Control Panel

The sliding control arm on the V-Series Foam system provides easy, reliable operation. Sliding the control arm to the full left position will prime the system. Once the system is primed, the operator sets the concentrate percentage by sliding the control arm to the full right position and back to the desired percentage.
Refer to the Drawings section for mounting templates.

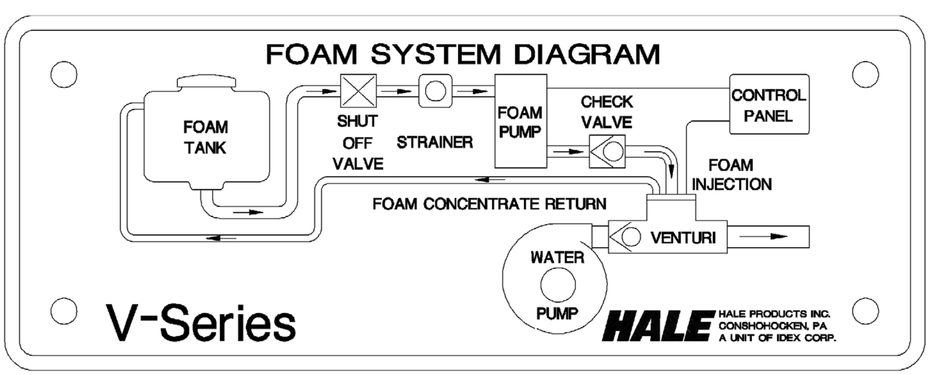
Minimum space required for mounting: 7.75"x3"

Venturi/Metering Assembly

The heart of the Hale V-Series Foam system, foam concentrate is metered into the venturi and precisely mixed with water.



Minimum space required for mounting: 7"x 8"x 10"



V-Series

Venturi Based Balanced Pressure Foam Proportioning System

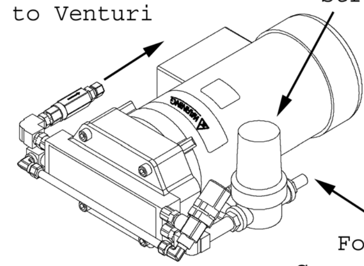
Installation

The V-Series Foam proportioning system has been carefully designed for ease of installation as well as maintenance. Please read and understand all the instructions in this manual before undertaking the installation.

There are 14 easy steps to follow when installing a V-Series Foam system. After completing the installation, double-check all the wires, tubing, lines, fittings, and connections before operating the system.

Step 1

Mount the Foam Pump



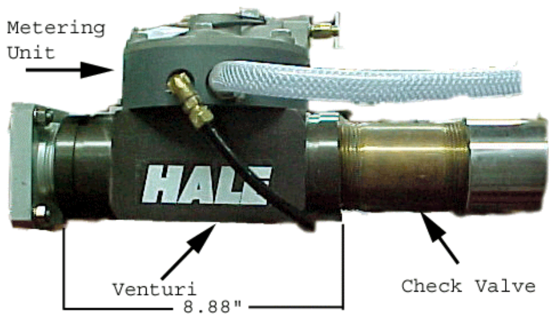
Mount the foam pump motor using the mounting flange. The pump must be mounted in the position shown and cannot hang from the mounting bracket.

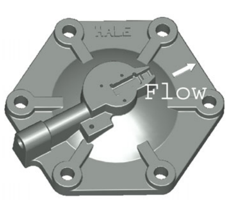
The pump must be mounted in horizontal position **below** the level of the foam tank to allow gravity feed of foam concentrate to the inlet connection of the system.

A ½” ID service valve should be installed between the pump and the foam tank, near the foam strainer, to allow servicing of the strainer. This valve is not provided in the V- Series Foam kit and should be supplied by the system installer.

Step 2

Mount the Venturi

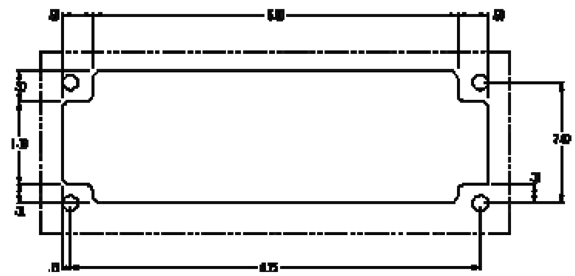




Mount the Venturi/metering assembly into the pump discharge piping using either 2-1/2” female pipe thread or 3” Victaulic® connections. Bushings to reduce the pipe size to 1-1/2” or 2” may be used without loss of accuracy. An arrow on the cover plate indicates the direction of the water flow. Standard versions use 2-1/2” NPT, while 2-1/2” BSP thread is used on metric systems. A separate, 2-1/2” check valve should be mounted upstream of the venturi assembly to insure back flow from the metering system doesn’t contaminate the water pump or booster tank with foam solution. Do not mount the Venturi vertically as the system will not drain properly.

Step 3

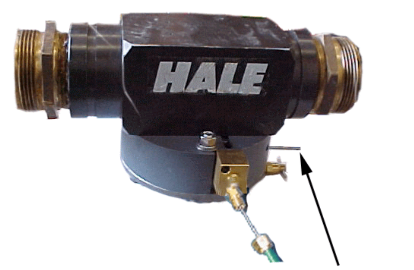
Mount the Control Panel



Mount the panel section in an appropriate and convenient location. Choose a location that will minimize bends and prevent kinks in the control cable along its length to the metering valve on the Venturi. Refer to the drawing on page 38 of this manual for a panel cutout template.

Step 4

Route and Cut the Control Cable



Choose a route for the control cable that eliminates sharp bends and does not cause any kinks. The minimum bend radius of the cable is 3”. The control cable is pre-installed on the Venturi assembly.

The control cable should be shortened to remove any excess length before attaching it to the control panel. Perform the following procedures to shorten cable.

- Mark outer conduit at the desired length at the end to be attached to the control panel.
- Use an 11/16” wrench to loosen the nut on the cable fitting at the venturi/metering assembly.
- Pull the outer conduit cover until the inner wire is 4-6” inside conduit beyond the point of the cut.

⚠CAUTION

Do not pull on the inner wire. Excessive tension may cause the metering unit to lose calibration.

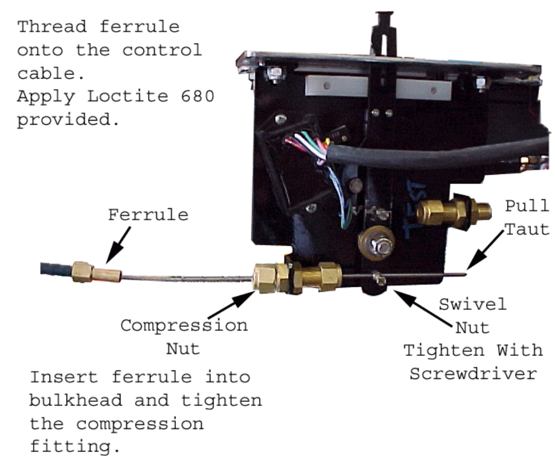
- Cut the outer conduit using an abrasive cutoff wheel or a hacksaw.
- Deburr the conduit to prevent damage to the inner wire.
- Push outer conduit cover back over inner wire and into cable fitting of the venturi/metering assembly. Tighten fitting nut securely.

Step 5

Attach the Control Cable to the Control Panel

If the control cable was shortened, thread the ferrule (provided) onto the outer conduit and secure with the provided Loctite ™ 680. Verify the control lever is in the off position. Guide the inner wire through the swivel nut on the lever. Insert the ferrule completely into the fitting. Insert the end of the control cable into the bushing on the control panel. Tighten the fitting nut securely with an 11/16" wrench. Do not tighten the swivel nut screw at this time.

***NOTE:** Use only Swagelok ™ ferrules and nuts.*



Step 6

Mount the Control Cable

Secure the control cable in a fixed position on the vehicle frame for its entire length using wire ties, or cable clamps. Secure the cable every 12" along the length to minimize any movement during operation as discussed in steps 3 and 4. Choose as straight a line as possible to mount the control cable. A straight cable assures a more accurate metering of foam. Keep all bends and turns greater than a three-inch radius. This insures proper operation of the cable and more accurate metering of the foam.

Step 7

Final Setting of the Control Cable

Move the control lever to its locked "OFF" position.

Verify the Lock Pin is in the metering valve housing and spool. (The Lock Pin is used to set the spool valve in the "OFF" position.) Using pliers, pull the inner wire taut and tighten the swivel nut screw with a nutdriver or screwdriver. This procedure automatically calibrates the system.

Use a wire cutter to trim off any excess inner wire.

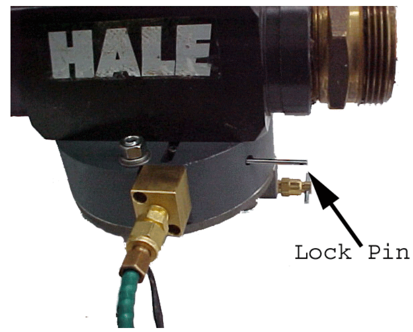
⚠CAUTION

Do not move the control handle until the lock pin is removed from the Venturi/metering assembly.

Step 8

Remove the Lock Pin

Remove the lock pin from the metering portion of the venturi/metering assembly. Move the control lever back and forth slowly several times to check for proper operation.



Save the lock pin for any future service or repair. A 1/64" hole is provided through the pin so it can be wired to a bracket for future service. Check the operation of the cable. Move the control lever from the prime to the foam positions. Observe the cable, if possible, as the control lever is manipulated. Check for excessive movement and add additional clamps to secure the cable as necessary.

Step 9

Attach the Inlet Hose

Connect the supplied ½ inch reinforced PVC hose to the 3/8 x ½" barb fitting on the pump intake. Install the other end on the discharge of the foam tank. Secure both ends with hose clamps. It is recommended the installer supply a two-way valve on this line, near the strainer, to stop the flow of foam concentrate when the strainer is serviced. The pump must be installed below the supply tank. Foam concentrate must be gravity fed from the tank to the foam pump or the system may not operate. Refer to Appendix II for the system diagram and connections.

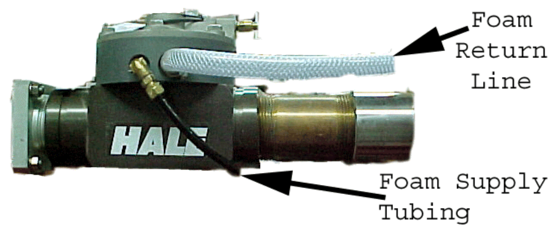
Step 10

Connect the Foam Supply to the Pump

Connect the provided 3/8" OD nylon foam supply tubing to the outlet of the foam pump. Use a 5/8" wrench to tighten the fitting nut. Run the other end of the line to the Venturi/Metering assembly.

❒ Step 11

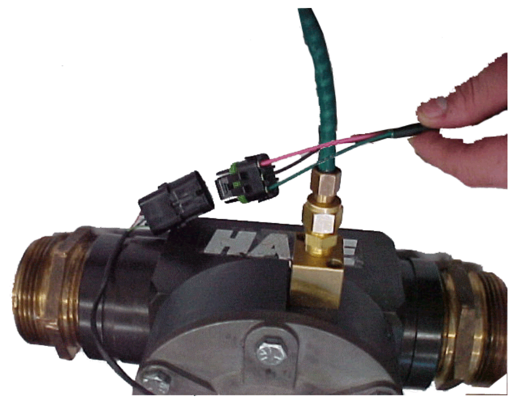
Connect the Foam Supply and Return Lines to the Venturi
Trim any excess length from the foam supply tubing installed in step 10. Insert the end into the venturi section foam supply fitting and tighten the fitting nut with an 11/16” wrench. Secure the tubing in place using wire ties or other suitable clamping means.



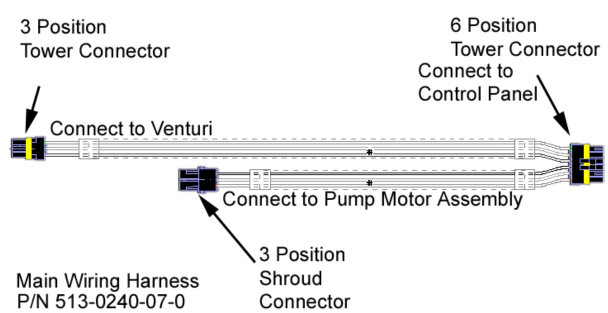
Connect the provided ½” reinforced PVC foam return line to the top of the foam tank or a collection container. Next, connect the other end to the prime fitting on the venturi/metering assembly and secure it with a hose clamp.

❒ Step 12

Connect the Wiring Harness to the Pump and Venturi
Route the wiring harness (P/N 513-0240-07-0) from the panel to the foam pump and venturi/metering assembly. Mount the harness on the equipment and push the connectors together. **NOTE:** The ends are keyed and will only plug into the correct mating connector. If the connectors won’t fit together with minimal force, **do not** force the connection.



Connect the 6-position connector to the control panel. Connect the three-position tower connector to the Hall effect switch in the Venturi/metering assembly and the three-position shroud connector to the motor assembly.



❒Step 13

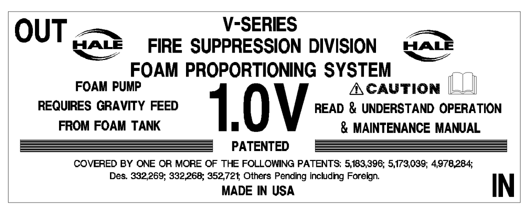
At this time, install the Optional Low Foam indicator and sensor as described in Appendix 1. The Low Foam option can be ordered anytime from Hale Products, Inc. Refer to Appendix 1 for additional Low Foam option information.

❒Step 14

Connect to a Power Source

Route the user supplied power leads from the motor to a 12 or 24-volt DC power source as required by the system. Isolate the power and ground for best electrical noise immunity. Secure the leads to the power source. The final step is to connect power to the unit. First, connect the red wire to the positive (+) terminal. The black ground (-) wire should always be connected last and disconnected first. The tables on the next page list the proper wire and fuse sizes that must be used to avoid injury and equipment damage. Always replace a blown fuse with the correct size as listed; **never** install a larger capacity fuse to cure a recurring blown fuse fault. Perform the relevant diagnostics to isolate, identify, and repair the fault, then replace the fuse and return the apparatus to normal service.

Motor heat warning label



Typical pump model label

⚠CAUTION

When selecting wire for the power supply, always consult the table below for minimum wire sizes to be used to connect the pump unit to the apparatus electrical system. Terminal ends should be crimped and soldered to the power wires, then, if possible, insulated with shrink tubing. If soldering is not possible, inspect crimps closely after assembly for any signs of looseness or cable pullout. Crimps must be clean and tight to safely carry the full electrical load demanded by these units. Failure to heed these warnings may cause severe equipment damage and/or personal injury.

Foam Proportioning System								
	12V				24V			
Model	Operating Current	Fuse Size (Amp)	Min. Wire Gauge		Operating Current	Fuse Size (Amp)	Min. Wire Gauge	
			AWG	mm^2			AWG	mm^2
1.0V	15	40	8	6	8	40	8	6
2.5V	31	40	8	6	17	40	8	6
3.0V	43	70	4	16	24	50	8	6

⚠ WARNING

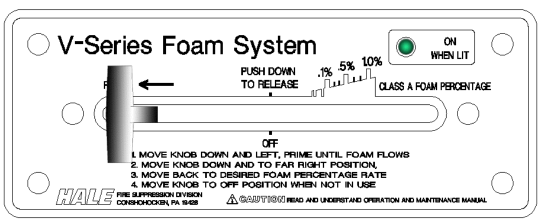
Replacing a blown fuse with a new fuse with a rated capacity larger than the existing fuse may cause fire, severe equipment damage, and/or personal injury. Always consult the above chart for proper replacement fuse capacities.

The installation is complete. Before operating the system, double-check that all the wires, tubing, lines, fittings, and connections are secure.

Hale Part Numbers for Fuses	
Fuse	**P/N**
40 amp blade type	200-0440-10-0
50 amp blade type	200-0440-12-0
70 amp blade type	200-0440-13-0

Prepare the System:

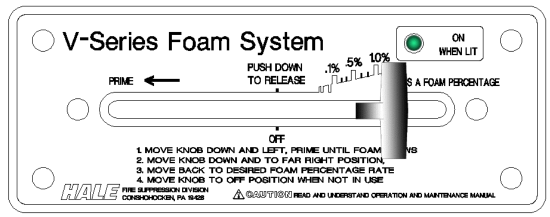
1. Fill the foam tank with foam concentrate. The system will operate effectively with any approved Class A foam. Contact Hale Products, Inc. for a list of approved Class A foam concentrates.
2. Move the lever on the control panel, down and to the left, to the “PRIME” position. The green LED will illuminate, indicating that the system is on. Keep the lever in the Prime position for 30 seconds or until the system is primed. Return the lever to the locked "OFF" position.



3. The system is primed when the foam concentrate is in the return line to the tank. The sound of the foam pump will also change when the system is primed. The system only has to be re-primed when the foam pump draws air. If the system is maintained wet, no priming is necessary. When drawing the foam concentrate from a container, the system should be primed with each new container of foam. Always position the foam concentrate tank above the foam pump to allow gravity feed to the pump.

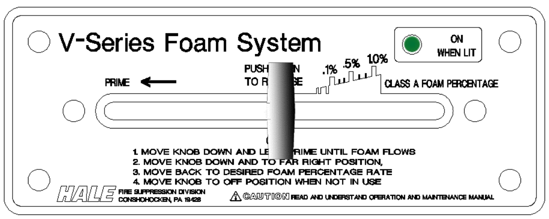
Operation:

1. Once the foam pump is primed, and water is fed to the system:
   - Move the lever on the control panel, down and to the far right position.
   - Move the lever back to the desired foam percentage rate.
   - The green LED light will illuminate, indicating that the system is on.



   - To re-adjust the mixture to another percentage rate, move the lever to the far right position and then to the new desired foam percentage rate.
2. The system will maintain the foam injection percentage setting.
3. During operation, the foam pump will cycle on and off to maintain the supply of foam concentrate to the metering assembly. The Venturi assembly introduces the concentrate into the water stream at a steady, constant rate. This provides a uniform mixture of foam and water.
4. If equipped with the optional low foam components, the “Low Foam” indicator will light and the pump will stop running when the foam concentrate tank is depleted. The Low Foam option is designed to ensure long life and trouble free operation of the foam pump.

5. Move the control lever back to the locked "OFF" position. The green LED light will go out, indicating that the system is off. Verify the control handle has fully engaged the locked position. This will prevent inadvertent operation of the pump due to vibration.



6. You may keep the system filled with an approved Class A foam at all times. However, to flush the system, remove the return line from the Venturi/metering assembly and, "PRIME" water, through the system.

7. Drain the system to prevent damage from freezing and foam contamination.

8. Switch the valve between the foam concentrate tank and the pump, off. If the valve was not supplied in the system installation, the foam tank must be drained prior to servicing the strainer. Remove and clean the foam concentrate strainer. Flush the strainer with water. Use a soft brush to remove any buildup. Inspect the strainer for damage. Replace as necessary.

Flushing the System

As long as the system is maintained wet, it is unnecessary to flush the foam concentrate lines. Using non-approved Class A foam concentrate in the V-Series Foam system can cause build up resulting in extra maintenance and damage to the system components.

Close the installer-supplied valve between the foam tank and the V-Series foam pump or drain the foam tank completely.

Remove the foam return line from the top of the foam concentrate tank.

If possible, place both lines into a bucket of water. Raise the bucket to provide a gravity feed to the foam pump and move the control handle to the "Prime" position.

Allow the system to operate in the prime position for 45 seconds to a minute.

Drain the system completely. Flush the concentrate tank if necessary. Reconnect the feed and return lines to the concentrate tank.

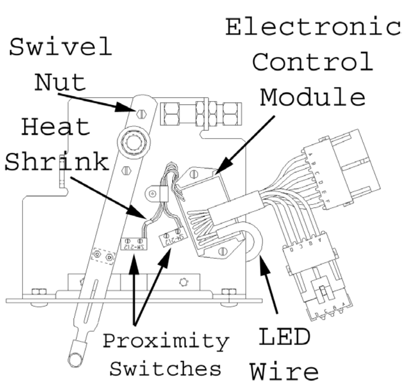
⚠CAUTION

DO NOT ALLOW THE PUMP TO RUN DRY. SERIOUS DAMAGE TO THE INTERNAL COMPONENTS WILL RESULT.

Assembly & Disassembly

The Hale V-Series foam systems are designed for easy maintenance. Each component can be disassembled and reassembled quickly with only a few hand tools. In this section, each major component system will be disassembled and discussed.

Control Panel



There are two systems on the control panel: an electrical system and a mechanical system. The mechanical system consists of a sliding lever and a control cable to the Venturi/metering assembly. The electrical system consists of two proximity switches, which control the pump motor and an LED to indicate when the system is on.

To disassemble the mechanical system,

- Place the control arm in the off position.
- Insert the lock pin in the Venturi/metering assembly as shown in Step 8.
- Loosen the cable swivel nut that secures the control cable.
- Use a 9/16” wrench to remove the 3/8” – 16 stainless lock nut.
- A switch magnet is attached to the control arm to interact with the proximity switches. The magnet and switches must be mounted close enough to interact but not touch.

To disassemble the electrical system,

- Remove the ¼” nuts and screws that secure the wiring harness to the panel
- Mark and remove the proximity switches

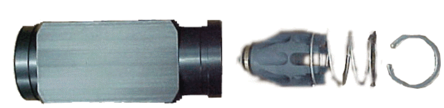
***Note**: The proximity switches must be installed in the proper location for the pump to function properly. The power switch has a heat shrink band as an indicator. The switches must be installed with the printed side facing the actuator or magnet.*

- Disconnect the LED wire.
- Remove the 8-32x ½ plated screws, washers, and nuts that secure the electronic control module to the control panel.
- The control panel section of the wiring harness can now be removed and replaced if necessary.

Venturi Metering Unit

The two sections of this assembly, the venturi and the metering section are held together by four 3/8 – 16 hex head screws. Use a 9/16” wrench to remove these screws and separate the sections. There are two seal rings where the channels meet.

Disassemble the Venturi



Use a snap ring pliers to remove the snap ring from the front of the venturi. The spring and the piston check valve should slide out of the housing. Use a 9/16” wrench to remove the 3/8 – 24 x 1” hex head screw. This will give access to the piston washers and seals. Assemble the parts in the reverse order.

⚠WARNING

The snap ring is under tension and proper eye protection should be used while removing the snap ring. Always use the appropriate tool for the task.

Disassemble the Metering unit

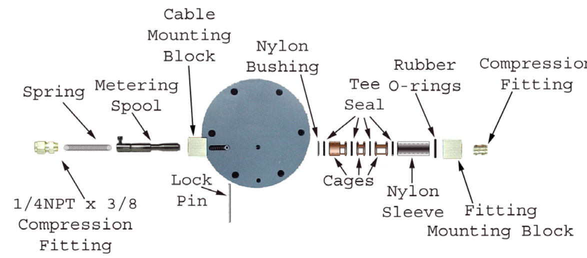
1. A small flat tip screwdriver is required to remove the three #4-40 x ¼ screws securing the cover plate to the outboard housing. The exposed position sensor is held in place with a silicon sealer. If it is necessary to remove the switch from the housing, it can be pried loose.
2. A 9/16” wrench will remove the remaining two 3/8 – 16 hex head screws that hold the housing assembly together.

The housings can now be separated exposing the diaphragm. Check the diaphragm for tears or perforations.

3. Loosen the cable from the spool with a 5/32” hex wrench. Use a 5/32” hex wrench to remove the cable block from the housing and gain access to the metering valve.
4. Remove the compression fitting with a 7/8” socket. Remove the fitting block to gain access to the internal parts.
5. Remove the nylon sleeve, tee seals, and cages. A thin pick may be necessary to remove the nylon bushing.
6. Check the tee seals and nylon sleeve. Replace any that show signs of damage. Refer to the section on maintenance and repair for the proper repair kit part number.

Reassemble the Metering Unit

1. Inspect the housing and verify the bores are free from debris.
2. Lubricate all o-rings with Parker O-ring lubricant or equivalent.
3. Install the nylon o-ring and other

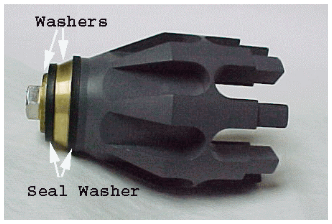


hardware in the order depicted in the picture above. Verify the nylon seal and sleeve are oriented to allow the cages and tee seals to center properly on the spool.

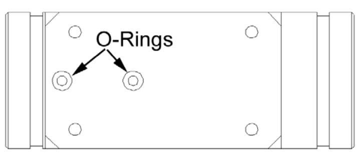
4. Install the fitting mounting block and the compression fitting.
5. Slide the metering spool into the housing. Install the lock pin until it fully engages the spool. The spool is now locked in the closed position.
6. Insert the spring and thread the brass 3/8 x ¼ cable block into the metering block.
7. Install the cable into the spool and bushing. Tighten the socket head screw to secure the cable to the metering spool and tighten the cable ferrule.
8. Place the diaphragm in the cover with the magnet near the sensor and carefully install the cover on the housing.
9. Verify the diaphragm is properly seated in the housing and is not twisted or kinked. Tighten the two 3/8 – 16 hex head screws that hold the housing together. Torque to 15 ft lbs (20Nm).
10. Install the position sensor in the top of the cover with the printed side down.
11. Seal the switch housing with a silicon sealer and install the plate over the switch.

Note*: The locking pin remains in place until the connection is made to the control panel.*

Reassemble the Venturi



Verify the piston seals and washers are properly installed on the piston as shown. Place the spring on the piston opposite the seal washers and install the piston/spring in the Venturi. Use a snap ring pliers to reinstall the snap ring on the venturi and check the operation of the check valve by pushing it back and forth to verify it centers properly in the Venturi.



Lightly lubricate with a general-purpose o-ring lubricant. Place the seal rings on the venturi and carefully mate the metering unit and the venturi. Use four 3/8 – 16 x 2 3/4 " hex head screws to secure the venturi and metering unit together. Torque to 15 ft-lbs (20 Nm) in a criss-cross pattern

***Note**: Remember to inspect this area for leaks when the system is pressurized.*

Pump and Motor Assembly

The Hale V-Series foam pump assembly is designed for hundreds of hours of use without significant maintenance. Inline check valves assist the pump in providing consistent pressure to the metering unit. A pressure relief valve protects the system from damage.

Inspection:

Monthly:
Inspect wiring, hoses, fittings, piping, connections, and tubing for tightness, corrosion, leaks, or damage. Replace as necessary.

Annually:
- Inspect the inline check valve for wear or damage. Replace as necessary.

As Required:
Clean out the area below the foam pump. It is normal to have some seepage that may collect in the area below the foam pump.

Clean the foam concentrate tank.

- Empty the tank of all foam concentrate.
- Disconnect the PVC line between the tank and the pump assembly.
- Use clean water to flush any buildup or debris out of the tank.
- If installed, visually inspect the "Low Foam" sensor. Verify this sensor is free of debris and moves freely.

Pump Disassembly

All V-Series pumps are similarly constructed. Disassembly will be discussed in this section; however, tool sizes will not be called out as they vary for each model of pump.

⚠CAUTION

Disassembling, adjusting, or altering the pressure relief valve may damage the pump and cause the system to fail.

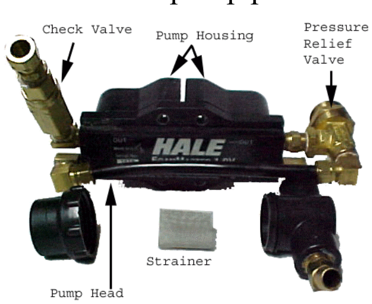
1. Begin by shutting off the user installed two-way bypass valve on the PVC line that feeds the pump from the tank.
2. Remove the four socket head cap screws that secure the pump to the motor.
3. Carefully remove the pump head. Inspect the cam and eccentric on the motor shaft. If damaged, use the pump rebuild kit to repair the pump head
4. Remove the socket head cap screws that

secure the valve assemblies to the pump head. It is now possible to remove the valve assemblies to a suitable work area.

5. Remove the plunger, o-rings, and nylon seals. Refer to page 33 for information on the pump rebuild kit.
6. Carefully remove each individual valve, noting its position and orientation in the housing. Mark the housing if necessary to insure the pump is reassembled properly.
7. Insert the new hardware into the pump housing. Verify each piece is properly seated in the housing.
8. Reassemble the housings with the pump head and install the socket head cap screws to secure them in place.
9. Lubricate the cam and eccentric with Lubraplate 3000 or equivalent and place the pump head on the motor so the cam engages the plunger. Secure the unit to the motor with the four socket head cap screws.

⚠CAUTION

The pressure relief valve is set at the factory and field adjustment should not be attempted. Occasionally it may be necessary to replace the check valve on the pump if there is a noticeable decrease in pump performance.



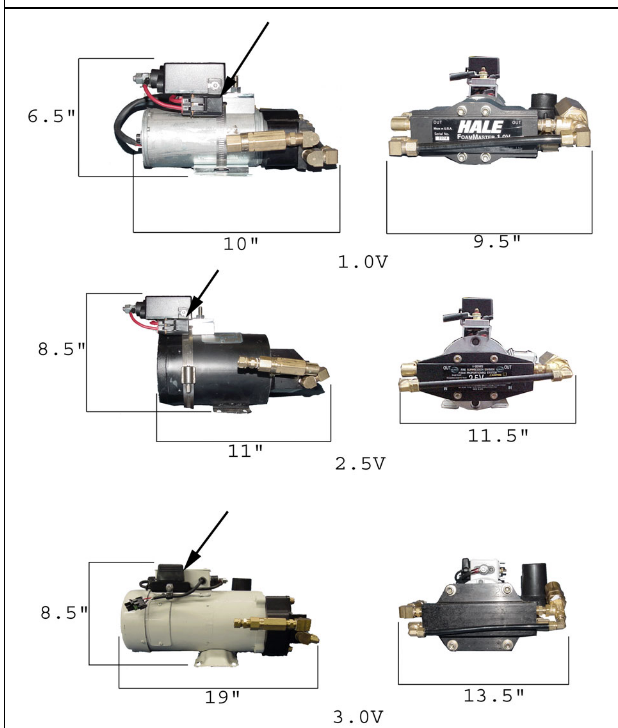
Use two 11/16” wrenches to loosen the compression fitting that secures the line from the pump to the Venturi/Metering assembly. A 7/8” wrench is required to remove the check valve from the pump assembly. Do not attempt to operate the system without the inline check valve installed, as the system performance will suffer.

Fuse Location

The fuse is conveniently located on the foam pump/motor assembly. To change the fuse, un-plug the environmentally sealed fuse block and pull out the fuse. Replace it with a new like rated blade style fuse and push the block back together. Consult the chart on page 15 to select the correct replacement fuse.

The following pictures illustrate the location of the fuses on the motor assembly. The motors pictured may not exactly match the equipment found on any particular V-Series Foam unit. However, the location of the fuses on all models is approximately the same.

Overall Dimensions and Fuse Locations

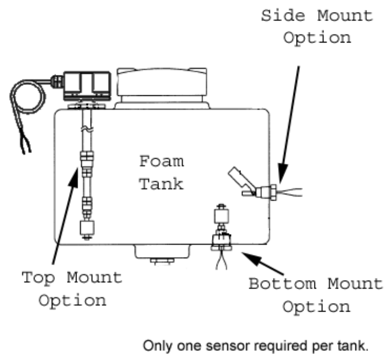


Appendix 1

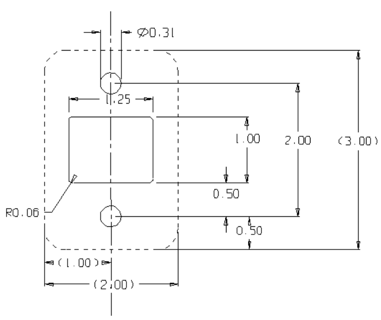
Installing the Optional Low Level Kit

Low Foam Kits		
	12 V	24 V
Side Mount	546-2610-12-0	546-2610-24-0
Bottom Mount	546-2610-13-0	546-2610-25-0
Top Mount	546-2610-14-0	546-2610-26-0

The foam tank "Low Foam" option should be installed to monitor the foam concentrate level and protect the pump from running dry. This illustration shows the low foam level sensor mounting options.



Install the Low Foam Panel



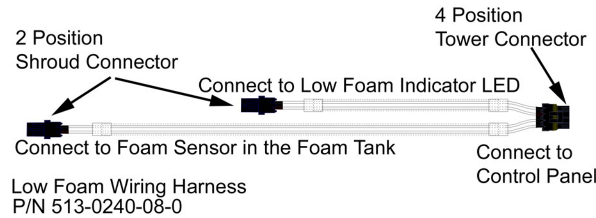
Mount the indicator plate near the V-Series Foam control panel. Use this graphic as a guide for installation.

Install the Wiring Harness

P/N 513-0240-08-0

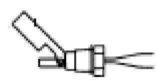
Remove the plug from the four-position lead on the control panel harness (illustrated on page 37). Connect the four-position tower connector to the control panel harness. Connect the short 10" lead to the "Low Foam" LED panel. Connect the long 6' lead to the low foam sensor in the foam tank.

For best operation, when installing low foam sensor, the sensors should be wired in the "normally open" position. The sensor should close in the low foam condition.



Side Mount Sensor Installation

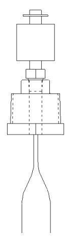
Low Tank Kits: P/N 546-2610-12-0 (12VDC) P/N 546-2610-24-0 (24 VDC)



1. The side mount low foam level sensor is a simple float and magnet sensor. When the foam concentrate level falls below the sensor, a magnet in the float activates the sensor and shuts the pump off. The sensor is manufactured with ½ inch NPT threads. If tank design and construction allows, the side mount sensor can be threaded directly into the side of the tank. The sensor can also be mounted on the foam tank using a ½ x 1 inch NPT bushing and a bulkhead fitting with 1-inch FNPT threads. The center of the sensor must be located at least 1-½ to 2 inches (38 to 51 mm) from the bottom of the foam tank with the float positioned on top of the sensor to move up and down as pictured. The sensor is embossed with an arrow to indicate the proper orientation after installation.
2. Coat the threads of the low foam sensor with a sealant suitable for the tank material and insert the sensor into the tank fitting. Use a 1" wrench to tighten the sensor and verify the embossed arrow is pointed up.
3. After installation, check operation of the side mount low tank level sensor with a powered test light. With no foam in the tank, the light should be on. If light does not illuminate, rotate the side mount low foam level sensor until the test light is on.

Bottom Mount Sensor Installation

Low Tank Kits: P/N 546-2610-13-0 (12VDC) P/N 546-2610-25-0 (24 VDC)



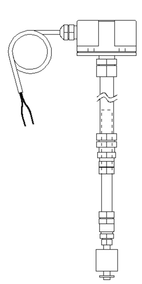
1. The sensor is installed from the outside of the foam tank through a bulkhead fitting or boss with 1-inch FNPT threads. The sensor is mounted in the bottom of the foam tank in an upright position. Use a sealant suitable for the tank material to prevent leakage.

NOTE: There must be sufficient space under the foam tank for the low foam level sensor wires to be routed to the control panel assembly. Be sure not to remove the float from the shaft on the assembly. If the float is installed in the reverse position, the "Low Foam" LED will light and the system will automatically shut down even if there is foam concentrate in the tank.

2. Check the low foam level sensor operation with a powered test light. With no foam in the tank, the light should be on. If this is not the case, remove the clip from the end of the sensor. Remove float, invert, and reinstall. Reinstall the clip and retest.

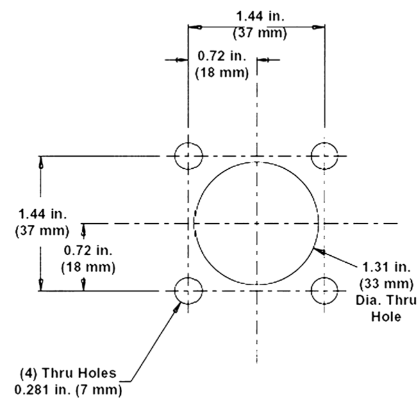
Top Mount Sensor Installation

Low Tank Kits: P/N 546-2610-14-0 (12VDC) P/N 546-2610-26-0 (24 VDC)



1. A top mount low foam level sensor assembly is available for installations where the side or bottom of the foam tank is not accessible or sensor service is required without draining the foam tank. The sensor assembly is flange mounted in an access hole on top of the foam tank. The two section telescoping assembly permits adjustment of the low foam level sensor position for various foam tank depths from 31-½ to 60 inches (800 to 1524 mm. The flange gasket can be used as a template to mark hole location.
2. Layout and drill holes in the top of the foam tank. The center of the sensor must be located at least 1-½ to 2 inches (38 to 51 mm) from the side of the tank.

NOTE: The minimum depth of a foam tank for the top mount sensor is 31-½ inches (800 mm. For tanks less than 31-½ inches (800 mm) deep, cut the tubing as described in the next section.



Top Mount Flange Cutout

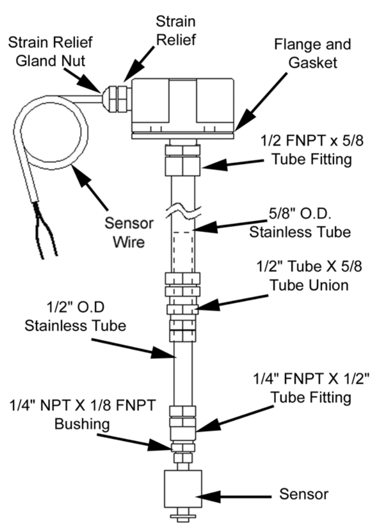
3. Determine the approximate length of the top mount low foam sensor extension by measuring from the top of the foam tank at the flange opening to the bottom of the tank. When properly installed the center of the sensor float should be 1-½ to 2 inches (38 to 51 mm) above the bottom of the foam tank.
4. Adjust the telescoping section until the desired length is achieved as measured from the center of the flange to the bottom of the sensor. Tighten the compression fittings on the union to lock the length.

CAUTION: Use mounting hardware that is compatible with all foam concentrates to be used in the system. Use washers, lock washers, and cap screws made of brass or 300 series stainless steel.

5. Insert the sensor assembly through the 1.31-inch (33 mm) hole and align the screw holes on the flange and gasket with the holes on the tank. Secure the assembly in place using four ¼-20 UNC x 2 inch long cap screws, ¼ inch washers and ¼ inch lock washers.
6. Tighten the strain relief nut to seal out water and contamination.

Resizing the Low Foam Sensor

Some applications may require the top mounted sensor to be shorter than factory length.



1. Loosen the strain relief gland nut on the sensor flange.
2. Loosen the compression nut on the ½ NPT X 5/8" tube fitting and remove the tube from the flange. Feed the sensor wire through the strain relief.
3. Loosen the compression nut on the ¼ NPT X ½" tube fitting and remove the fitting and sensor from the tube assembly.
4. Measure and use a tube cutter to remove half the required length from each end of the tube assembly. Deburr the inside of the tubes to prevent damage to the sensor wire.
5. Install a new ferrule on the ½" tubing and thread the sensor wire through the tube assembly. Tighten the compression fitting on the ½" tubing.
6. Install a new ferrule on the 5/8" tubing. Thread the sensor wire through the flange and strain relief. Insert the tube assembly into the flange and tighten the compression nut.
7. Adjust the telescoping section until the desired length is achieved as measured from the bottom of the flange to the center of the sensor. Tighten the compression fittings on the union to lock length. Tighten the strain relief nut.
8. Install the sensor assembly in the foam tank.

Foam Tank System Wiring

It may be necessary to lengthen the wires of the low foam sensor. Use 18 AWG (0.75mm^2) Type SXL or GXL (SAE J1128) wire to extend the low foam sensor wires. Low foam level sensors must be mounted in the normally open position. When a low foam condition is detected, the sensor must close to complete the circuit.

CAUTION: When extending the low foam sensor wires properly seal the splices with an adhesive filled heat shrink tubing.

V-Series Troubleshooting

Condition	Solution
Foam mixture lever difficult to operate or will not move.	• Verify the control lever swivel and/or control cable swivel nut is not corroded or damaged. Lubricate as necessary. • Verify no foreign material is lodged in the control lever swivel points or the control cable opening. • Inspect the control cable along its entire length for corrosion, kinks, sharp bends, or abrasions that have fully penetrated the outer plastic sheathing. • If the placard was previously removed from the control panel, verify the placard is properly aligned and not interfering with the control arm operation.
Liquid leakage from venturi/metering block assembly.	• Shut down the pump and verify the system pressure has been relieved. • Inspect all inlet and outlet piping and clamps for looseness, damage, or leakage. Tighten, repair, or replace as required. • If leakage appears to be from a fitting threaded into the venturi/metering assembly unit, remove the fitting, inspect and clean the threads, then coat the threads with liquid Teflon and reinstall. Replace damaged components as required. • If leakage is between the Venturi and the metering block or the metering block and cover, retorque the six metering block assembly bolts to 15 Ft-Lbs in a criss-cross pattern. If the leak is not repaired, remove the cover and check the diaphragm for perforations. Otherwise, replace the venturi/metering block seals and retest.

V-SERIES TROUBLESHOOTING (Continued)

Condition	Solution
Foam and water not mixing properly (Low or no foam output).	• Verify the control lever is moved to the desired water/foam mix percentage. • Verify the foam pump is operating and is not leaking or losing prime. • Verify the control cable is not kinked, disconnected, or damaged. • Verify there is a positive head pressure (gravity feed) to the inlet of the foam pump. • Inspect the transfer tube from the foam concentrate tank to the foam pump. Verify the tube is not kinked, clogged by foreign debris, or damaged. Any cuts in this tube will result in air leaks that will hinder proper operation. • Verify the transfer tube from the foam pump to the venturi/metering block assembly is not kinked, clogged by foreign debris, or pinched. • Open the drain cock on the venturi/metering block. If foam is present, the internal pressure-balancing diaphragm is damaged. Replace the diaphragm and retest. • Loosen the feed line from the pump to the metering unit. If there is little or no pressure, the pump unit will need to be rebuilt. See page 33 for the appropriate part number for the rebuild kit.

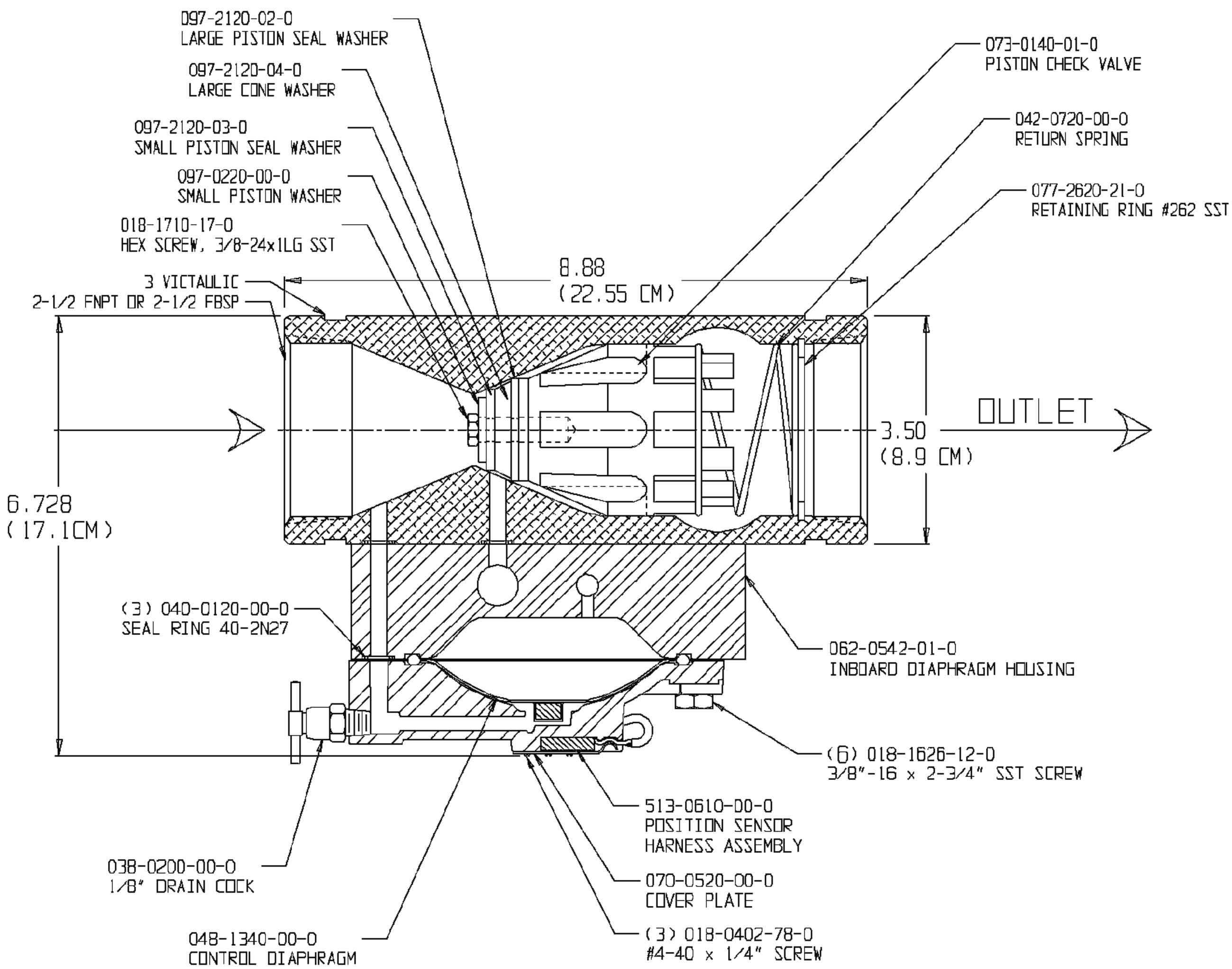
V-SERIES TROUBLESHOOTING (Continued)

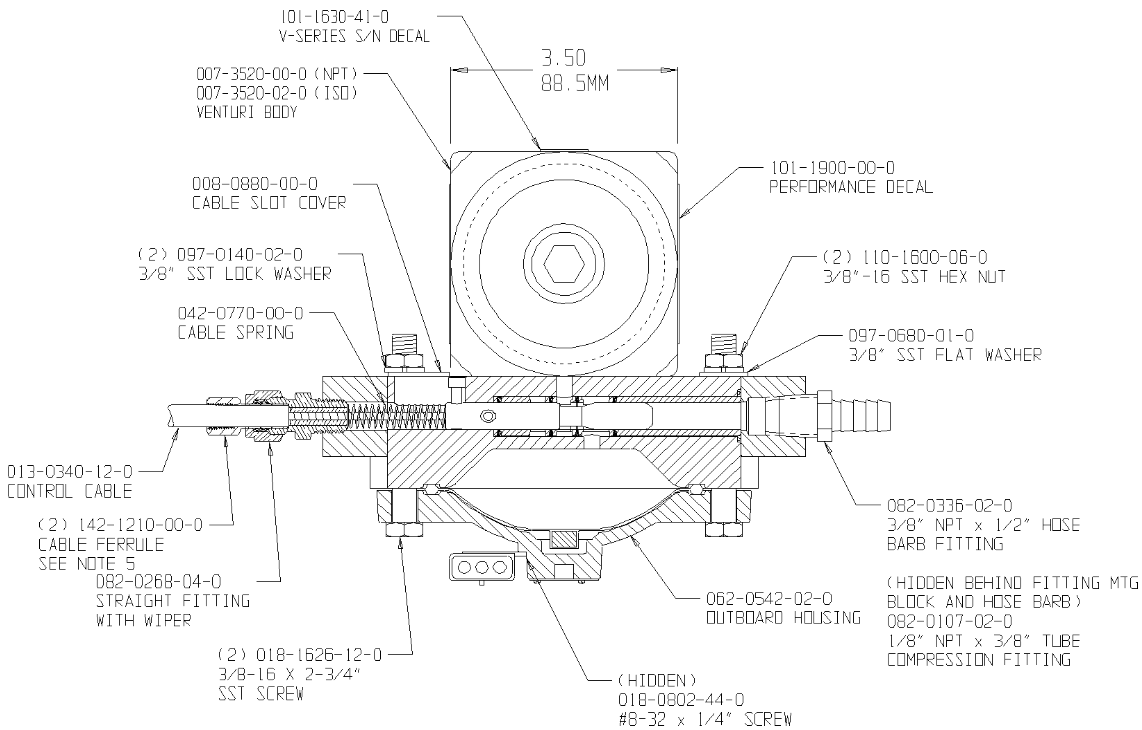
No LED, pump will not operate	• Check all electrical connections. • Check the fuse. • Check power connections to the motor. • Replace the Electronic Control Module.
LED functions, pump will not operate	• Verify the foam tank is full and the "Low Foam" indicator is not lit. • Check the electrical connection from the control panel to the pump motor. • Replace the pump.
LED functions, pump works in "Prime" but not in "Proportion" mode.	• Place the control lever in the off position. Verify the metering spool is in the off position. • Check the control cable for damage. • Verify the control cable is properly installed on the metering spool.
LED functions, pump works in "Proportion" but not "Prime" mode	Replace the Electronic Control Module.
No LED, the pump functions normally.	Replace the LED.
LED always lit.	Replace the Electronic Control Module.

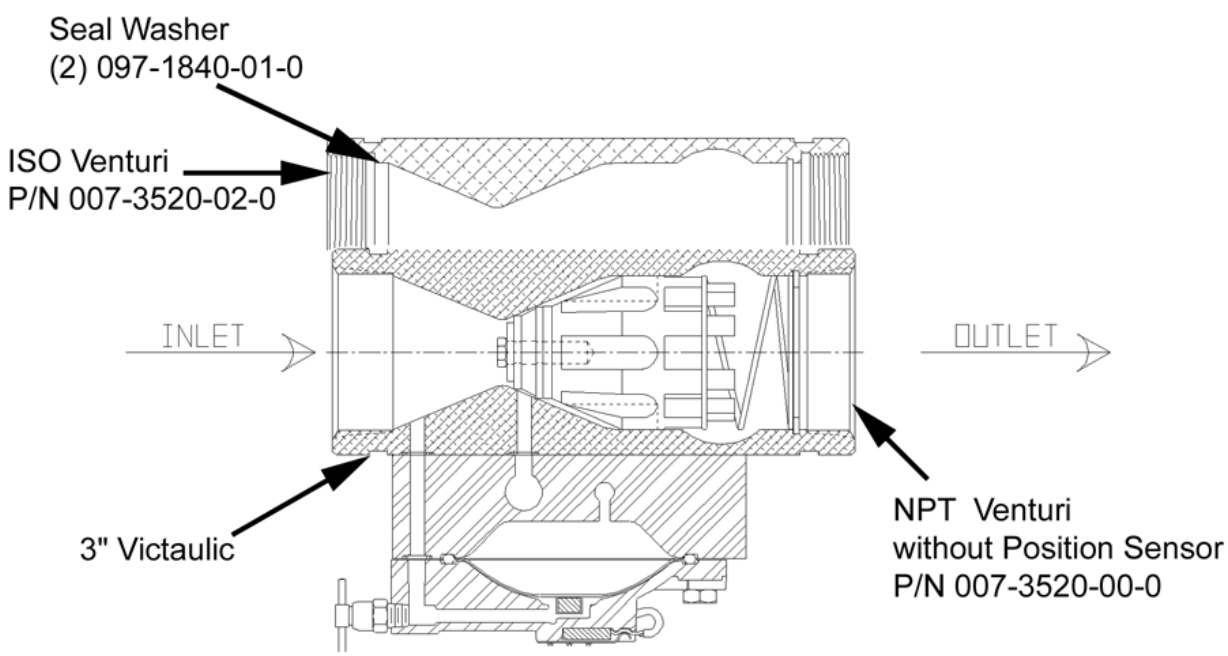
Pump runs continuously	• Disconnect the Electronic Control Module.
	  o If the pump motor continues to run, replace the pump motor.
	  o If the pump motor stops, replace the Electronic Control Module.

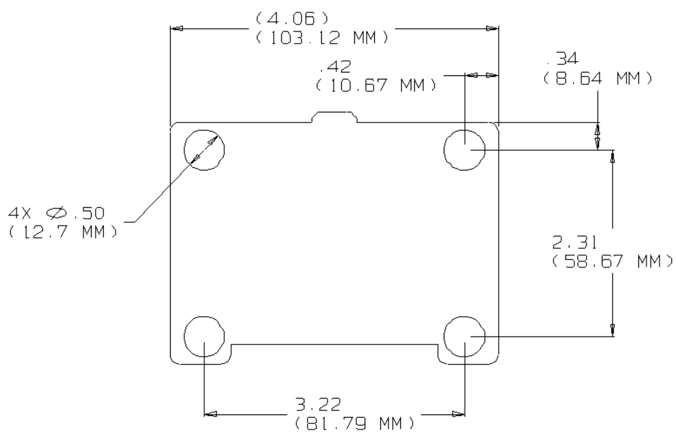
Foam Tank Full, Low Foam indicator on	• Unplug Low Foam indicator, if the pump starts the tank will need to be emptied and cleaned. • Verify the sensor is wired properly. • Replace the Low Foam sensor.
Foam Tank Empty, Low Foam indicator off	• Clean out the foam tank • Replace the Low Foam sensor.

Drawings

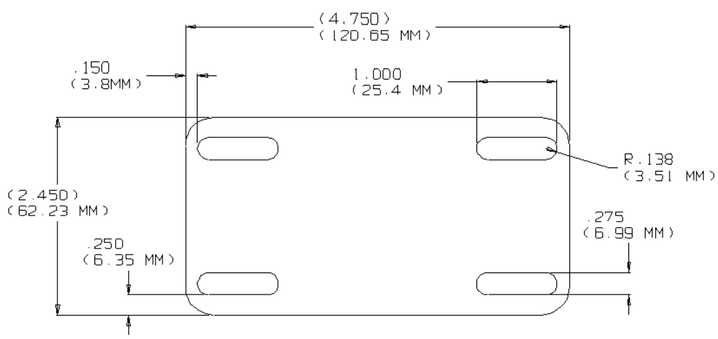

097-2120-02-0
LARGE PISTON SEAL WASHER
097-2120-04-0
LARGE CONE WASHER
097-2120-03-0
SMALL PISTON SEAL WASHER
097-0220-00-0
SMALL PISTON WASHER
018-1710-17-0
HEX SCREW, 3/8-24x1LG SST
3 VICTAULIC
2-1/2 FNPT OR 2-1/2 FBSP
073-0140-01-0
PISTON CHECK VALVE
042-0720-00-0
RETURN SPRING
077-2620-21-0
RETAINING RING #262 SST
8.88
(22.55 CM)
OUTLET
3.50
(8.9 CM)
6.728
(17.1CM)
(3) 040-0120-00-0
SEAL RING 40-2N27
062-0542-01-0
INBOARD DIAPHRAGM HOUSING
(6) 018-1626-12-0
3/8"-16 x 2-3/4" SST SCREW
513-0610-00-0
POSITION SENSOR
HARNESS ASSEMBLY
038-0200-00-0
1/8" DRAIN COCK
070-0520-00-0
COVER PLATE
048-1340-00-0
CONTROL DIAPHRAGM
(3) 018-0402-78-0
#4-40 x 1/4" SCREW


101-1630-41-0
V-SERIES S/N DECAL
3.50
88.5MM
007-3520-00-0 (NPT)
007-3520-02-0 (ISO)
VENTURI BODY
101-1900-00-0
PERFORMANCE DECAL
008-0880-00-0
CABLE SLOT COVER
(2) 097-0140-02-0
3/8" SST LOCK WASHER
(2) 110-1600-06-0
3/8"-16 SST HEX NUT
042-0770-00-0
CABLE SPRING
097-0680-01-0
3/8" SST FLAT WASHER
013-0340-12-0
CONTROL CABLE
082-0336-02-0
3/8" NPT x 1/2" HOSE
BARB FITTING
(2) 142-1210-00-0
CABLE FERRULE
SEE NOTE 5
082-0268-04-0
STRAIGHT FITTING
WITH WIPER
(HIDDEN BEHIND FITTING MTG
BLOCK AND HOSE BARB)
082-0107-02-0
1/8" NPT x 3/8" TUBE
COMPRESSION FITTING
062-0542-02-0
OUTBOARD HOUSING
(2) 018-1626-12-0
3/8-16 X 2-3/4"
SST SCREW
(HIDDEN)
018-0802-44-0
#8-32 x 1/4" SCREW

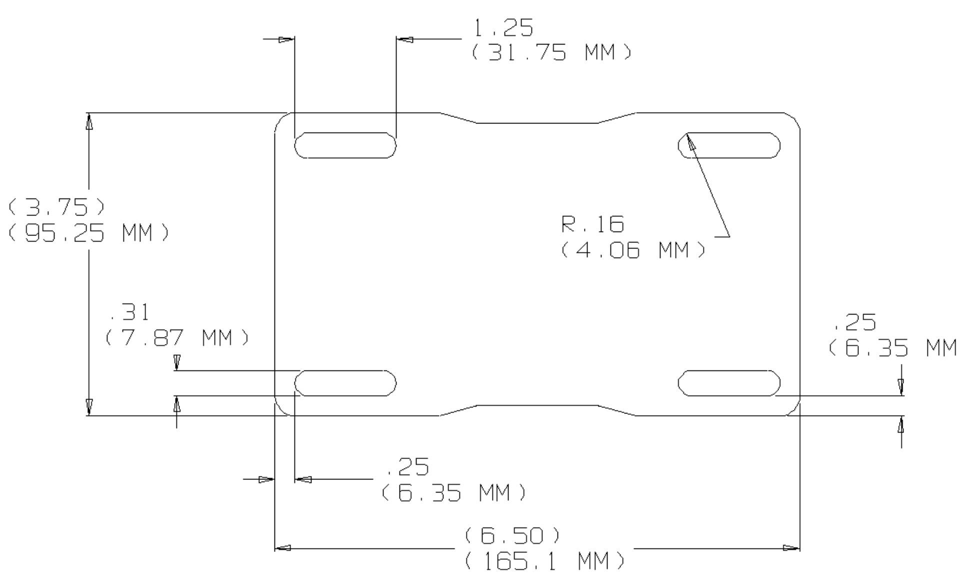

Seal Washer
(2) 097-1840-01-0
ISO Venturi
P/N 007-3520-02-0
INLET
OUTLET
3" Victaulic
NPT Venturi
without Position Sensor
P/N 007-3520-00-0



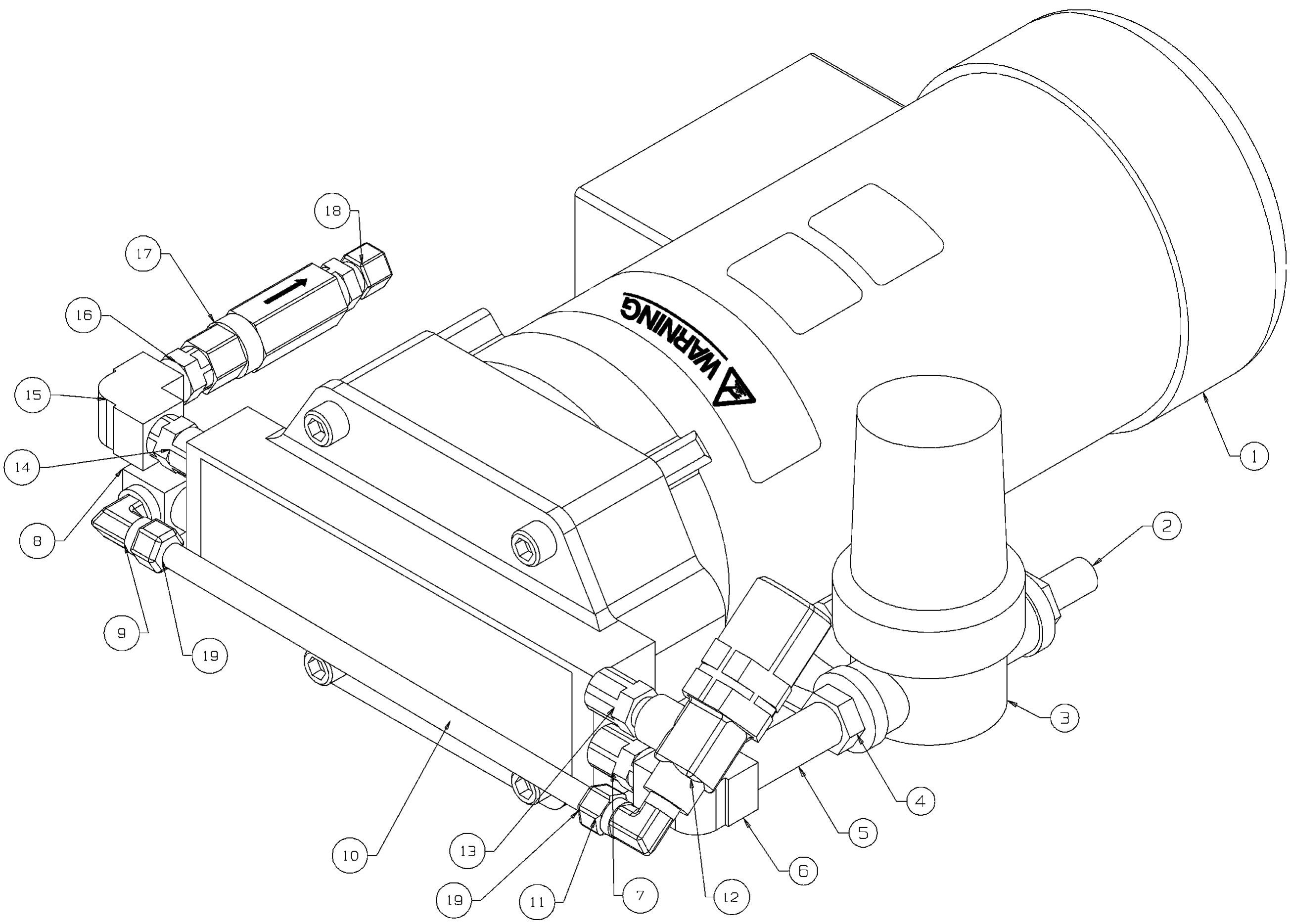
Mounting flange for 1.0V



Mounting flange for 2.5V



Mounting flange for 3.0V



Refer to the table on the following page for the list of pump parts.

V-Series

Venturi Based Balanced Pressure Foam Proportioning System

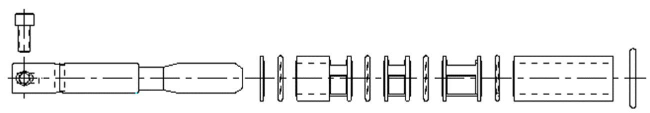
V-SERIES PUMP/MOTOR ASSEMBLY FITTINGS TABLE			
REF	1.0 VERSION DESCRIPTION	2.5 VERSION DESCRIPTION	3.0 VERSION DESCRIPTION
1	1.0V TRANSFER PUMP / MOTOR	2.5V TRANSFER PUMP / MOTOR	3.0V TRANSFER PUMP / MOTOR
	HALE P/N 501-3421-02-0 24 volt HALE P/N 501-3421-00-0 12 volt	HALE P/N 501-3421-03-0 24 volt HALE P/N 501-3421-01-0 12 volt	HALE P/N 501-3420-05-0 24 volt HALE P/N 501-3420-04-0 12 volt
2	3/8 NPT x 1/2 HOSE BARB FITTING	3/8 NPT x 1/2 HOSE BARB FITTING	3/8 NPT x 1/2 HOSE BARB FITTING
3	3/8 NPT FILTER ASSEMBLY HALE P/N 510-0200-00-0	3/8 NPT FILTER ASSEMBLY HALE P/N 510-0200-00-0	3/8 NPT FILTER ASSEMBLY HALE P/N 510-0200-00-0
4	3/8 x 1/4 NPT BRASS BUSHING	3/8 x 1/4 NPT BRASS BUSHING	N/A
5	1/4 NPT x 2-1/2 NIPPLE	1/4 NPT x 2-1/2 NIPPLE	3/8 NPT x 2-1/2 NIPPLE
6	1/4 x 90° STREET ELBOW	1/4 NPT x 90° ELBOW	3/8 NPT x 90° STREET ELBOW
7	N/A	1/4 NPT x 2-1/2 NIPPLE	N/A
8	1/4 x 90° STREET ELBOW	1/4 NPT x 90° STREET ELBOW	3/8 NPT x 90° STREET ELBOW
9	1/4 NPT x 3/8 TUBE COMP 90° ELBOW	1/4 NPT x 3/8 TUBE COMP 90° ELBOW	3/8 NPT x 3/8 TUBE COMP 90° ELBOW
10	3/8 O.D. x .062 WALL TUBING	3/8 O.D. x .062 WALL TUBING	3/8 O.D. x 062 WALL TUBING
11	1/4 NPT x 3/8 TUBE COMP 90° ELBOW	1/4 NPT x 3/8 TUBE COMP 90° ELBOW	1/4 NPT x 3/8 TUBE COMP 90° ELBOW
12	RELIEF VALVE	RELIEF VALVE	RELIEF VALVE
13	1/4 NPT HEX NIPPLE	1/4 NPT HEX NIPPLE	3/8 NPT x 1/4 NPT HEX NIPPLE
14	N/A	1/4 NPT HEX NIPPLE	3/8 NPT HEX NIPPLE
15	1/4 NPT x 90° STREET ELBOW	1/4 NPT x 90° STREET ELBOW	3/8 NPT x 90° ELBOW
16	1/4 NPT HEX NIPPLE	N/A	3/8 NPT HEX NIPPLE
17	1/4 NPT CHECK VALVE P/N 038-1710-01-0	1/4 NPT CHECK VALVE P/N 038-1710-01-0	3/8 NPT CHECK VALVE P/N 038-1550-02-0
18	1/4 NPT x 3/8 TUBE COMP STRAIGHT	1/4 NPT x 3/8 TUBE COMP STRAIGHT	3/8 NPT x 3/8 TUBE COMP STRAIGHT
19	3/8 O.D. TUBING INSERT	3/8 O.D. TUBING INSERT	3/8 O.D. TUBING INSERT

Repair Kits

Maintenance kits can be ordered from Hale Products, Inc. Refer to the disassembly and reassembly instructions for the installation procedures.

Spool Repair kit

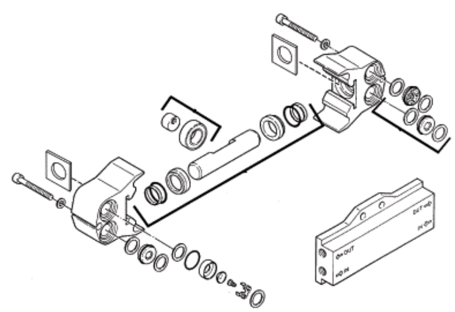
Provides the internal service parts for the metering valve.



Hale P/N 538-1740-00-0

Pump Rebuild kit

The pump kit provides the internal valves o-rings, bearings, and seals (shown in the brackets) to rebuild the pump head.



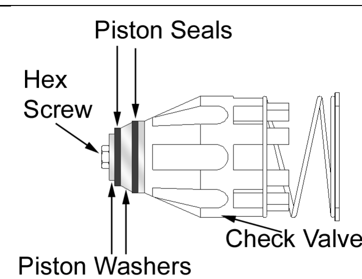
Hale P/N

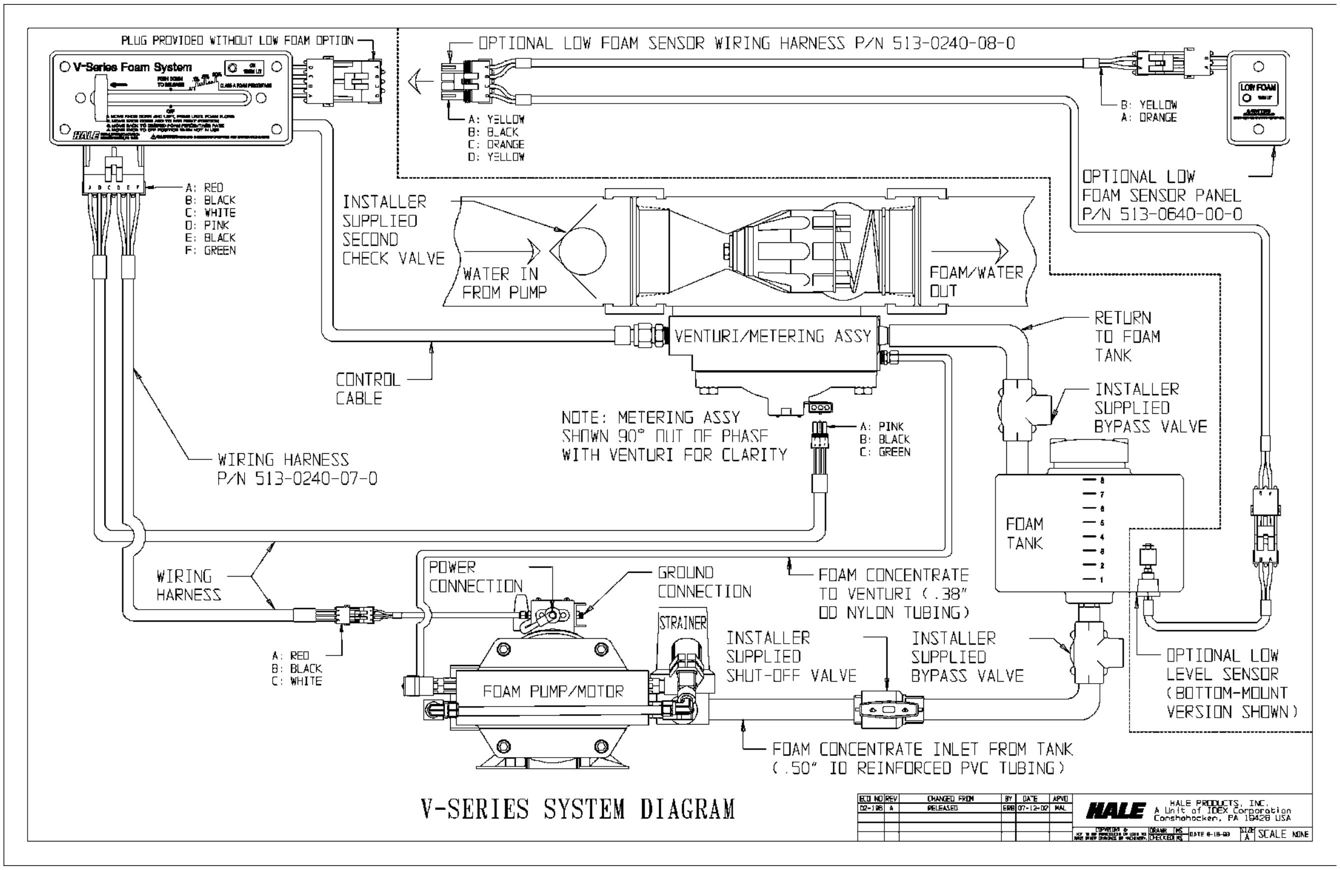
1.0V 546-1910-05-0

2.5V 546-1910-06-0

3.0V 546-1910-07-0

Venturi kits Part Number	Part Numbers included in the kit.	Part Description	
546-2620-00-0	097-2120-02-0	Piston Seal Washer, Large	
	097-2120-03-0	Piston Seal Washer, Small	
	097-2120-04-0	Piston Washer-Large	
	097-0220-00-0	Piston Washer, Small	
	048-1340-00-0	Control Diaphragm	
	097-1840-01-0	ISO seal washer (x2)	
	040-0120-00-0	Seal Ring 40-2N27 (x3)	



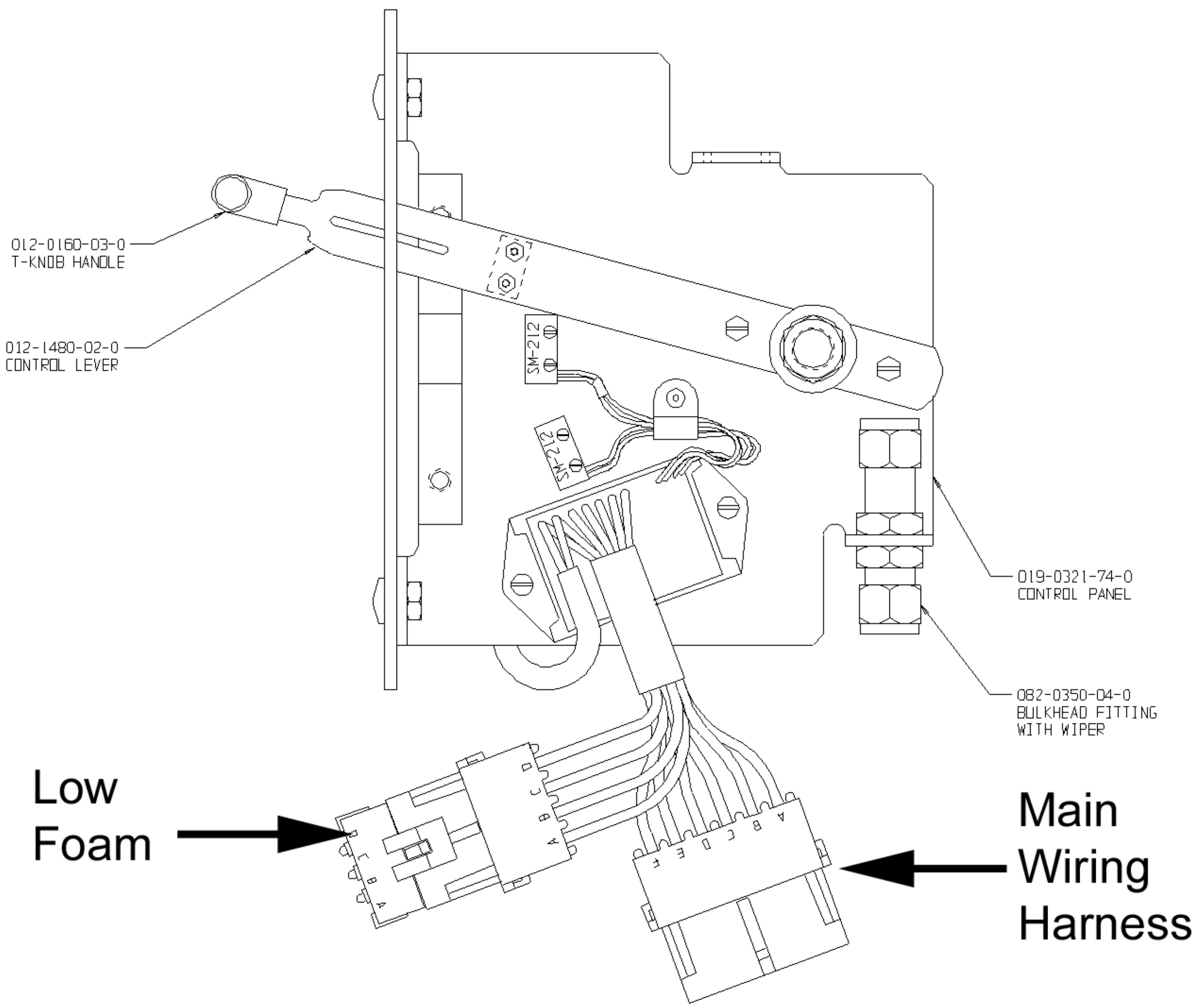


Appendix II: V- Series System Diagram

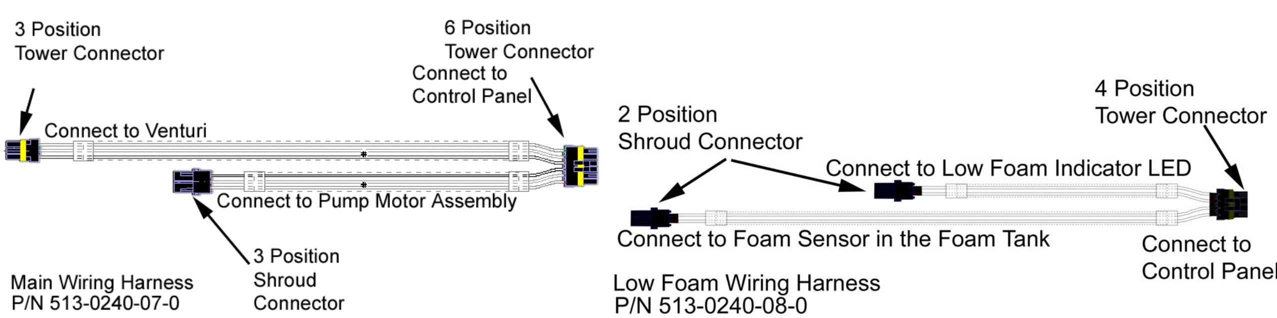
NOTE: As Hale endeavors to continuously improve the product line, some parts may not appear exactly as depicted. Functionality will be equal or superior to the parts substituted. All specifications are subject to change without prior notice.

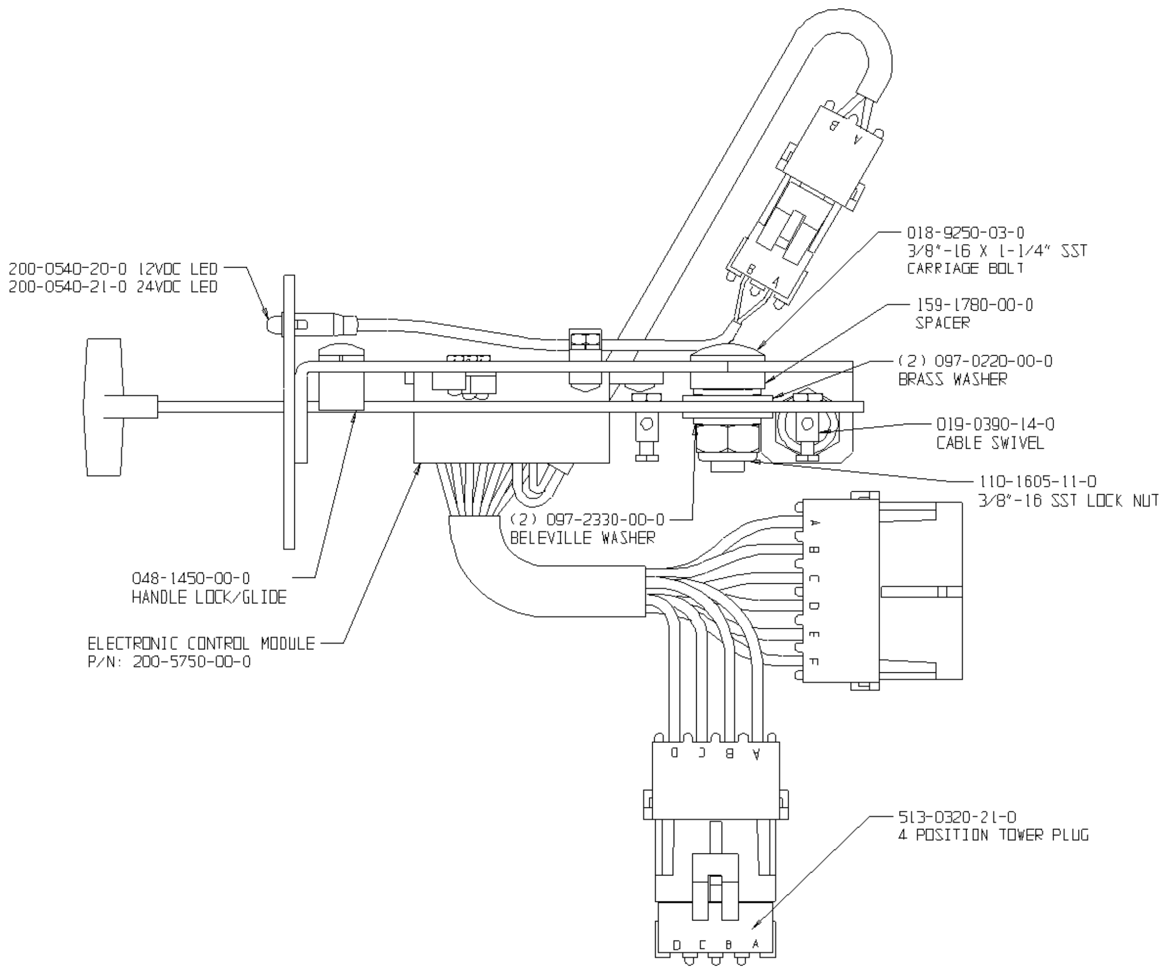
V-Series

Venturi Based Balanced Pressure Foam Proportioning System

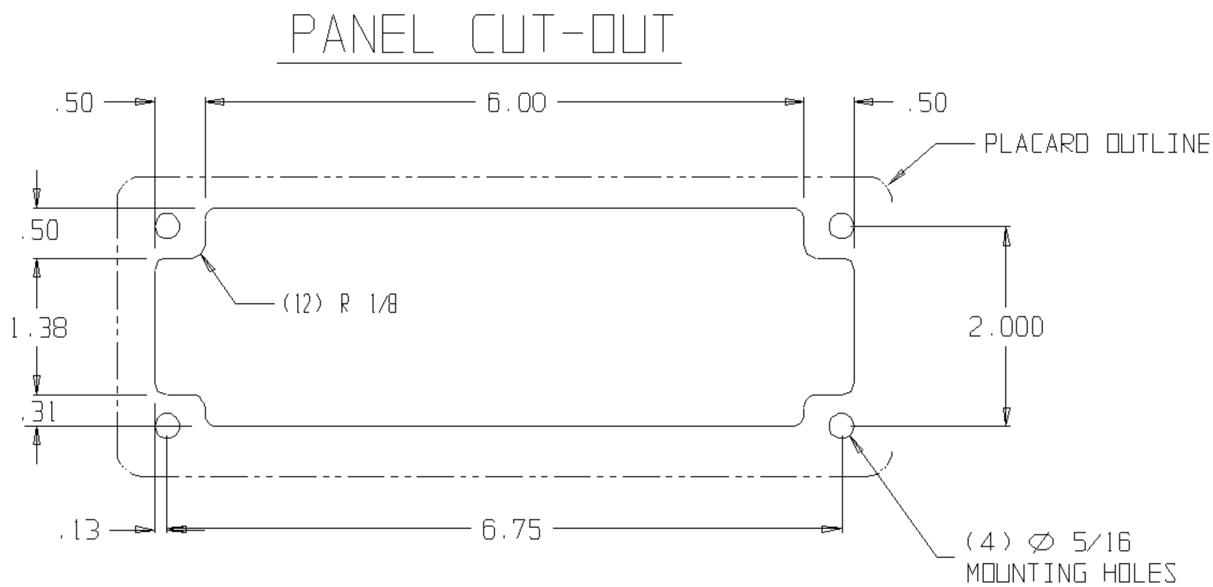


V-Series Panel Assembly Bottom View





V-Series Panel Assembly Side View



This graphic is for reference only and is not to scale.

The following are provided as a quick operation reference:

V-Series Operation Quick Reference

- To prime the system, move the control lever down and to "Prime" until the concentrate is visible through the transparent return hose.
- Once system is primed, move control lever down and to far right and then back to the desired foam injection percentage. This may be adjusted at any time.
- Move the control to the "OFF" position to stop the flow of foam.
- A Hale Products, Inc. approved Class A foam may be left in the system. To flush the system, prime and operate with water.

V-Series Operational Parameters Reference

- Read and Understand the Operation Manual
- Prime system at less than
  100 PSI (7 Bar) Pump Pressure
- Max Operation Pressure
  3.0V-12 250 PSI (17 Bar)
  3.0V-24 330 PSI (22 Bar)
  2.5V-Series 150 PSI (10 Bar)
  1.0V-Series 250 PSI (17 Bar)
- Move the control to far right position before selecting or re-selecting the desired foam injection percentage

LIMITED WARRANTY

EXPRESS WARRANTY. Hale Products Inc. ("Hale") hereby warrants to the original buyer that V-Series foam systems manufactured by Hale 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 Product is first placed in service.

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

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

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

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

HALE

V-Series

Venturi Based Balanced Pressure Foam Proportioning System