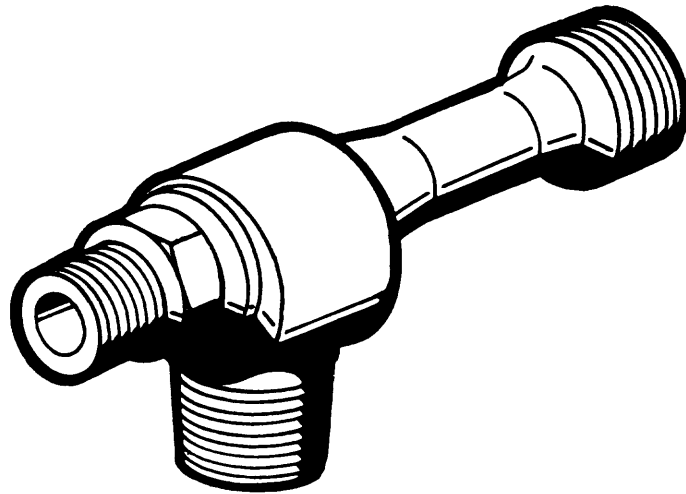


PENBERTHY®

Section 1000
Instal. Instr. 1950
Issued 6/94
Replaces 7/90

Jet Pumps

Models LL, LM, LH, ELL & HLM
CAST METAL CONSTRUCTION



Installation / Operation / Maintenance Instructions

PENBERTHY

INSTALLATION / OPERATION / MAINTENANCE FOR MODELS LL, LM, LH, ELL, & HLM JET PUMPS CAST METAL CONSTRUCTION

This manual has been prepared as an aid and guide for personnel involved in installation or maintenance. All instructions must be read and understood thoroughly before attempting any installation, operation, or maintenance. Failure to follow any instruction could possibly result in a malfunction of the jet pump resulting in leakage of the contained fluid, property damage or physical injury to personnel.

CAUTION

Penberthy does not have any control over the manner in which its jet pump is handled, installed, or used, and Penberthy cannot and does not warrant or guarantee that a jet pump is suitable or compatible with the user's specific application.

WARNING

Safety glasses should be worn when in the area of a jet pump installation.

I. INTRODUCTION:

A. Features and Specifications

Penberthy liquid operated jet pump models LL, LM, LH, and ELL are designed to pump a secondary fluid using a liquid as the operating medium.

Penberthy liquid operated jet pump models EL, LM, and HLM are designed to heat the operating liquid by direct contact with steam, whereby they are also called steam jet heaters.

B. Design Ratings PSIG at Maximum and Minimum Operating Temperatures

MATERIAL	BODIES	NOZZLES
Iron	80 PSIG at - 20° F to + 150° F 50 PSIG at + 350° F	200 PSIG at - 20° F to + 400° F
Bronze	200 PSIG at - 20° F to + 150° F 125 PSIG at + 400° F	200 PSIG at - 20° F to + 400° F
316 STS	200 PSIG at - 150° F to + 150° F 125 PSIG at + 400° F	200 PSIG at - 150° F to + 400° F

To determine the maximum allowable working pressure for a specific temperature within the design limits stated above, the user should refer to Penberthy dimension sheets, or when provided, the specifically stated design limits on a Penberthy product proposal.

C. Application Data

Penberthy models LL, LM, and LH are liquid operated jet pumps for pumping liquids against low, medium and high discharge pressures respectively.

Penberthy models LM and ELL are liquid operated jet pumps for exhausting gases. Model ELL is self priming and has greater suction capacity at vacuum.

Penberthy models ELL, LM, and HLM are liquid operated jet pumps for heating the operating liquid at low, medium, and high steam pressures respectively.

For specific application data within the above ranges, the user should consult the Penberthy product proposal for the specific model and size jet pump, or should request Penberthy to supply the applicable technical data bulletin.

WARNING

Under no circumstances should these design ratings or application data be exceeded. Exceeding design ratings or application data may cause property damage or physical injury to personnel.

II. INSPECTION AND PERFORMANCE CONFIRMATION:

A. Receiving Inspection

Upon receipt of jet pump, check all components carefully for damage incurred in shipping. If damage is evident or suspected, do not attempt installation. Notify carrier immediately and request damage inspection.

B. User's Rating Inspection

The user should confirm

1. That the jet pump size (cast on side of body) and model designation (stamped on nozzle hex flats) conforms to the description on the user's purchase order.
2. That the operating conditions described in the purchase order agree with the actual conditions at the installation site.
3. That the actual operating conditions at the installation site are within the application data shown on the Penberthy Technical Data Bulletin or product proposal referred to above.
4. That the materials of construction of the jet pump are compatible with both the contained fluid and surrounding atmosphere in the specific application.

CAUTION

If the size model or performance data of the jet pump as received does not conform with any of the criteria above, do not proceed with installation. Contact an authorized Penberthy distributor for direction on what to do.

III. INSTALLATION:

Installation should only be undertaken by qualified experienced personnel who are familiar with this equipment and have read and understood all the instructions in this manual.

The user should refer to Penberthy dimension sheets or Penberthy product proposal to obtain dimensional information for the specific size and model jet pump.

Check the exploded view Figure 3 for the location of operating, suction, and discharge connections to insure correct hook up.

A. Effect of Related Piping and Precautions

1. For Pumping Fluids

- a. Penberthy liquid operated jet pump models LL, LM, LH, and ELL are installed and operated in any position. For applications handling gases, it is more desirable to install the models of LM and ELL with the discharge pointing down at 45° or more. This prevents back splash of motive liquid into the suction line.
- b. Jet pumps should be installed with pipe and fittings which provide minimum resistance to fluid flow. Pipe line friction losses must always be a consideration when estimating jet pump performance.
- c. It is recommended that provisions be made for pressure gauge connections near the operating inlet, suction and discharge connections of the jet pump. If operating difficulties are encountered at any time, it may become necessary to install pressure gauges to identify the problem.
- d. When pumping liquids, suction piping should be sized so that the velocity of the liquid does not exceed 4 feet per second. This is almost always automatically obtained when the suction line is the same pipe size as the suction connection.
- e. Some back pressure is necessary to prime models LL, LM, and LH when pumping liquids, and when using the model LM as an exhaustor. A simple arrangement which would provide the minimum necessary back pressure is the installation of two consecutive 90° elbows in the discharge line.
- f. When flow reversal into the suction must be prevented, a check valve should be installed in the suction line close to the jet pump. Pressure drop created by the check valve must be considered when applying the jet pump.
- g. Install a valve in the suction line if it is desirable to:

- a. Prevent contamination of suction fluid by motive fluid at start up.
- b. Prime a centrifugal pump.
- c. Throttle suction flow.

- h. Discharge piping should be sized as short as possible and with the least number of turns and restrictions. Discharge piping friction losses must always be considered when estimating jet pump performance. Increase discharge line pipe size if necessary to minimize loss.
- i. Do not impose system piping loads on jet pump. The unit is NOT designed to be a load bearing fitting.
- j. All piping should be free of foreign materials which could clog the jet pump.

2. For Heating Liquids

- a. Penberthy steam jet heaters can be installed and operated in any position. It is more desirable, however, to install the heater unit with the suction connection pointing up, to aid in the removal of condensate in the steam line at start up.
- b. The steam jet heater should be installed with pipe and fittings which provide minimum resistance to fluid flow. Pipe line friction losses must always be a consideration when estimating steam jet heater performance.
- c. It is recommended that provisions be made for pressure gauge connections near the operating inlet, suction and discharge connections of the steam jet heater. If operating difficulties are encountered at any time, it may become necessary to install pressure gauges to identify the problem.

d. Steam must not have over 20° F of superheat, or performance will differ from that published on Penberthy Technical Data Bulletin or product proposal referred to above.

e. Steam line must be clean, and provided with a strainer to prevent foreign materials from clogging the steam jet heater.

f. Steam line should be insulated and as short as possible to prevent condensation and line friction losses.

g. A check valve in the steam line located as close to the steam jet heater as possible will help prevent water from being driven into the steam line at shut down.

h. Some installations require the addition of a pressure relief line to reduce discharge pressure at start up, see Figure 2. If appropriate for the application, the line can be connected to a tank, drain, or the suction side of the pump supplying liquid pressure to the inlet of the heater. Back pressure limitations at start up are as follows:

- 1) Model HLM, 1 ft. of water head for every psi of operating liquid pressure.
- 2) Model LM ½ ft of water head for every psi of operating liquid pressure.
- 3) Model ELL, atmospheric pressure.

i. Do not impose system piping loads on steam jet heater. Unit is NOT designed to be a load bearing component.

j. All piping should be free of foreign materials which could clog the jet pump.



WARNING



Failure to provide a pressure relief line on applications exceeding the start up back pressure limitations stated above may cause property damage or physical injury to personnel.

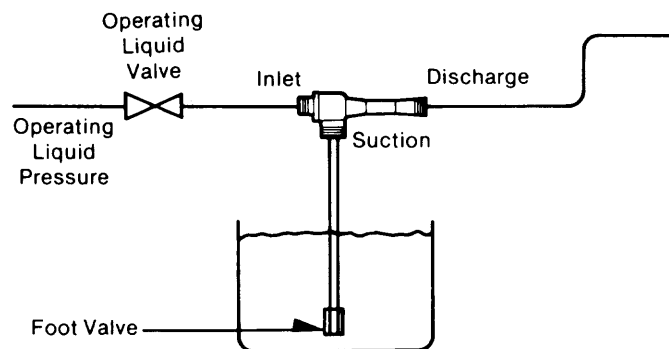


Figure 1. — Typical Installation Schematic
Liquid Operated Pumping Liquids

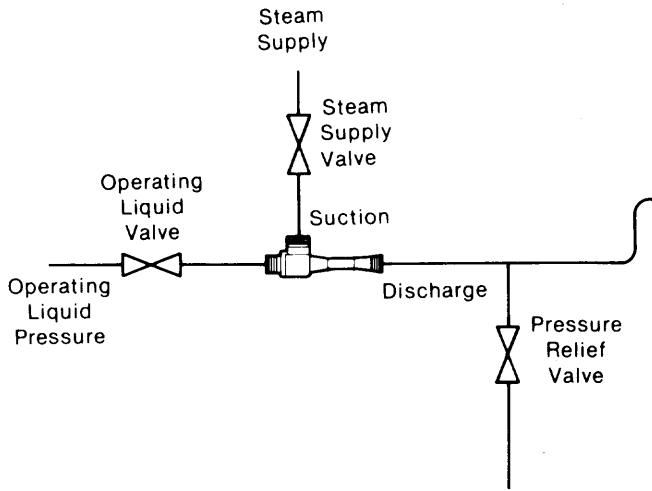


Figure 2. —Typical Installation Schematic Heating Operating Liquid

IV. OPERATION:

A. Pre-Operational Check

1. For Pumping Liquids
 - a. Assure that all installation procedures have been completed.
 - b. Assure that any restrictions in the discharge line have been removed.
 - c. Assure that any discharge line valves are fully open.
 - d. Assure that suction line valve, if installed, is fully closed.
2. For Heating Liquids
 - a. Assure that all installation instructions have been completed.
 - b. Assure that any restrictions in the discharge line have been removed.
 - c. Assure that discharge line valves are fully open. (Including the pressure relief line valve when applicable.)

B. Operating

1. For Pumping Liquids
 - a. Open the Operating liquid valve quickly.
 - b. Open the suction line valve, if any.
 - c. Regulate the discharge pressure as desired, to a value within the capability published on Penberthy Technical Data Bulletin or product proposal referred to above.
 - d. For pump priming applications, when evacuation is completed, close the suction valve and immediately start the centrifugal pump. Then shut off the operating fluid valve to the jet pump.
2. For Heating Liquids
 - a. Turn operating liquid valve fully open.
 - b. Turn steam supply valve slowly on until the desired discharge liquid temperature is reached.
 - c. Regulate line discharge pressure or close the pressure relief line valve when applicable.

V. MAINTENANCE:

Maintenance should only be undertaken by qualified experienced personnel who are familiar with this equipment and have read and understood all the instructions in this manual.

CAUTION

Do not proceed with any maintenance unless the jet pump has been relieved of all pressure or vacuum, has been allowed to reach ambient temperature, and has been drained or purged of all fluids.

A. Preventative Maintenance

The user must create maintenance schedules, safety manuals and inspection details for each specific installation of a jet pump or heater.

On all installations, the following items should be regularly evaluated by the user for purposes of maintenance.

1. Jet pump units for corrosion or debris build up.
2. Piping and fittings for corrosion or debris build up.
3. All connections for tightness.
4. Units for wear.
5. Strainers for debris build up.

The user must determine upon evaluation of his or her own operating experience an appropriate maintenance schedule necessary for his or her specific application. Realistic maintenance schedules can only be determined with full knowledge of the services and application situation involved.

B. Troubleshooting

1. For Pumping

Problem	
The suction flow is less than expected.	
Cause	Cure
Suction piping is too restrictive.	Remove restriction.
Discharge pressure is too high	Remove restriction.
Operating liquid pressure is lower than required.	Increase pressure.
Suction or motive liquid is at much higher than ambient temperature.	Lower temperature or size larger jet pump.
Suction piping leaks.	Tighten fittings.

2. For Heating

Problem	
Discharge of live steam, objectionable noise and vibration, and inlet flow reversal.	
Cause	Cure
Operating liquid pressure too low.	Increase pressure.
Attempted operation beyond discharge pressure capability	Reduce discharge pressure.

Attempted start up without
pressure relief line

Install pressure
relief line.

Problem

Surges in liquid outlet temperature.

Cause

Operating liquid pressure too low.

Cure

Increase pressure.

C. Disassembly—Reassembly

CAUTION

Do not proceed with the removal of jet pump from connecting piping unless the jet pump has been relieved of all pressure or vacuum, has been allowed to reach ambient temperature, and has been drained or purged of all fluids.

To disassemble the unit, first attach a short piece of pipe to the suction connection as a handle. then grip the nozzle flats and rotate in a counterclockwise direction.

When ready to reassemble unit, be sure the seal face of the nozzle and body are free of foreign material and raised metal due to nicks. A non-hardening pipe seal compound may be applied to the threads to further promote sealing. Thread the body back on to the nozzle turning in a clockwise direction.

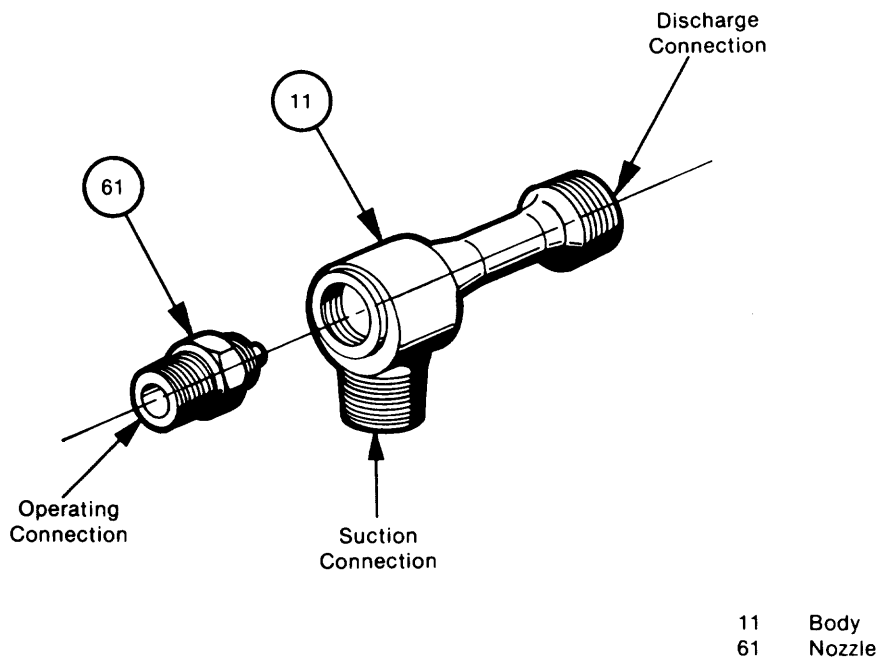


Figure 3.

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Printed in U.S.A. Form No. 14868-009