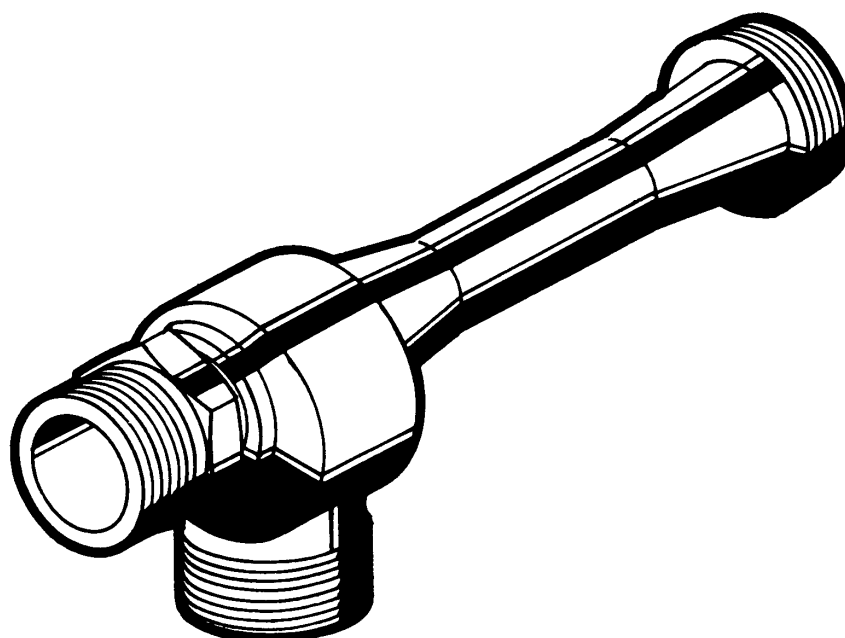




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# Ring Jet Heater

Model RJ



Installation, Operation and Maintenance Instructions

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## **PENBERTHY PRODUCT WARRANTY**

Pentair Valves & Controls Black Mountain warrants its Penberthy products as designed and manufactured by PV&C Black Mountain to be free of defects in the material and workmanship for a period of one year after the date of installation or eighteen months after the date of manufacture, whichever is earliest. PV&C Black Mountain will, at its option, replace or repair any products which fail during the warranty period due to defective material or workmanship.

Prior to submitting any claim for warranty service, the owner must submit proof of purchase to PV&C Black Mountain and obtain written authorization to return the product. Thereafter, the product shall be returned to PV&C in Black Mountain, North Carolina, with freight paid.

This warranty shall not apply if the product has been disassembled, tampered with, repaired or otherwise altered outside of PV&C Black Mountain factory, or if it has been subject to misuse, neglect or accident.

The responsibility of PV&C Black Mountain hereunder is limited to repairing or replacing the product at its expense. PV&C Black Mountain shall not be liable for loss, damage or expenses related directly or indirectly to the installation or use of its products, or from any other cause or for consequential damages. It is expressly understood that PV&C Black Mountain is not responsible for damage or injury caused to other products, buildings, personnel or property, by reason of the installation or use of its products.

**THIS IS PV&C BLACK MOUNTAIN'S SOLE WARRANTY AND IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED WHICH ARE HEREBY EXCLUDED, INCLUDING IN PARTICULAR ALL WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.**

This document and the warranty contained herein may not be modified and no other warranty, expressed or implied, shall be made by or on behalf of PV&C Black Mountain unless made in writing and signed by the General Manager or Director of Engineering of PV&C Black Mountain.

## INSTALLATION, OPERATION and MAINTENANCE MANUAL FOR PENBERTHY MODEL RJ RING JET HEATER

### 1.0 About the Manual

This manual has been prepared as an aid and guide for personnel involved installation or maintenance. All instructions must be read and understood thoroughly before attempting any installation, operation, or maintenance.

# SAFETY INSTRUCTIONS

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



## WARNING

Always wear safety glasses when in the area of a ring jet installation. Failure to follow *any* instruction may cause a malfunction of the Ring Jet resulting in severe personal injury or property damage.

### 2.0 Introduction

#### 2.1 Features and Specifications

Penberthy model RJ Ring Jet is designed to heat liquids in line and tank by direct contact with steam. The steam passes through a ring shaped opening between the jet body and the end of the nozzle, and condenses into the liquid within the discharge portion of the jet. The model RJ Ring Jet is also designed to pump granular solids or gases by using a fluid as the operating medium, and to pump liquids or slurries by using steam or a liquid as the operating medium.

Unless otherwise specified on a Penberthy Product Sheet, the iron Ring Jet is NOT designed for heating liquids in line by direct contact with steam.

#### 2.2 Design Ratings at Maximum and Minimum Operating Temperatures

Material	Body and Nozzle
Iron	80 psig [550 kPaG] at -20°F [-29°C] to +150°F [66°C] 50 psig [340 kPaG] at +350°F [177°C]
Bronze	200 psig [1380 kPaG] at -20°F [-29°C] to +150°F [66°C] 125 psig [860 kPaG] at +400°F [204°C]
316 SS	200 psig [1380 kPaG] at -150°F [-101°C] to +150°F [66°C] 125 psig [860 kPaG] at +400°F [204°C]

**Table 1**

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

## 2.3 Application Data

### For Heating In Line: (Except the iron Ring Jet)

The Ring Jet is designed to operate at liquid line pressures from 10 to 100 psig (70 to 690 kPaG) and steam pressures from 20 to 150 psig (140 to 1030 kPaG).

### For Heating In Tank:

The Ring Jet is designed to operate at steam pressures from 5 psig above submergence (tank) pressure to 50 psig (30 to 340 kPaG). Maximum liquid temperature for shallow tanks is 150°F (66°C) when using 30 psig (210 kPaG) steam.

### For Pumping:

The Ring Jet is designed to pump granular solids or gases by using a fluid as the operating medium at up to 50 psig (30 kPaG); and to pump liquids or slurries by using steam or a liquid as the operating medium at up to 50 psig (30 kPaG).

For specific application data within the above ranges, the user should consult the Penberthy product proposal for the specific model and size Ring Jet, 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 severe physical injury or property damage.**

## 3.0 Inspection and Performance Confirmation

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

### 3.1 Users' Rating Inspection

The user should confirm that:

1. The Ring Jet 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. The operating conditions described in the purchase order agree with the actual conditions at the installation site.
3. 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. The materials of construction of the Ring Jet are compatible with both the contained fluid and surrounding atmosphere in the specific application.

## SAFETY INSTRUCTIONS

**If the size, model or performance data of the Ring Jet 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.**

## 4.0 Installation

Installation should only be undertaken by qualified experienced personnel who are familiar with this equipment and have read and understand 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 RJ (Ring Jet).

Check the exploded view in Figure 5 for the location of the operating, suction, and discharge connections to insure correct hook up.

### 4.1 Effect of Related Piping and Precautions

#### 1. All Installations

- a. The Model RJ Ring Jet can be mounted and will operate in any position. When heating, it is more desirable to install the unit with the side connection pointing up, to aid in the removal of condensate in steam line at start up.
- b. The Ring Jet should be installed with piping and fittings which provide the minimum resistance to flow. Pipe line friction losses must always be a consideration when estimating Ring Jet performance.
- c. It is recommended that provisions be made for pressure gage connections near the operating, suction, and discharge connections of the Ring Jet. If operating difficulties are encountered at any time, it may be necessary to install pressure gages to identify the problem.
- d. Steam must not have over 20°F (-7°C) of superheat, or performance will differ from that published in the Penberthy Technical Data Bulletin or product proposal referred to above.
- e. Motive fluid line must be clean and provided with a strainer to prevent foreign materials from clogging the Ring Jet.
- f. Steam line should be insulated and as short as possible to prevent condensation and line friction losses.
- g. Do not impose system piping loads on Ring Jet. Unit is NOT designed to be a load bearing component.
- h. A check valve in the steam line located as close to the Ring Jet as possible will help prevent water from being driven into the steam line at shutdown.

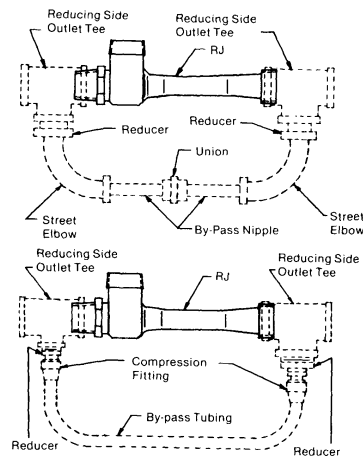
#### 2. For Heating In Line

- a. Some installations require the addition of a bypass line. See Figure 1. Check with Penberthy Technical Data Bulletin or the Penberthy product proposal for the specific model and size Ring Jet. When heating, the ring jet is capable of discharging at up to 30 psig (210 kPaG) above line pressure. The by-pass line is recommended for installations where the pumping action is undesirable. Recommended by-pass line sizes are as indicated in Table 2.
- b. To prevent flow reversal into the inlet, install a check valve in the liquid inlet line close to the Ring Jet. Pressure drop created by the check valve must be considered when sizing the Ring Jet.

**Recommended By-Pass Line Sizes**

RJ Size	1	1 ¼	1 ½	2	2 ½	3
Tube ID	.25	.375	.500	.625	.875	1.25
or pipe size	1/8	¼	3/8	½	¾	1 ¼

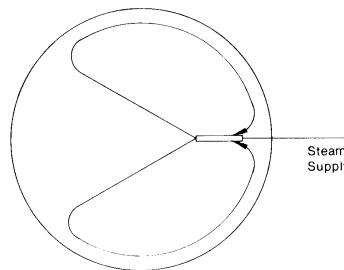
**Table 2**



**Figure 1**  
**Typical By-pass Line Installations**

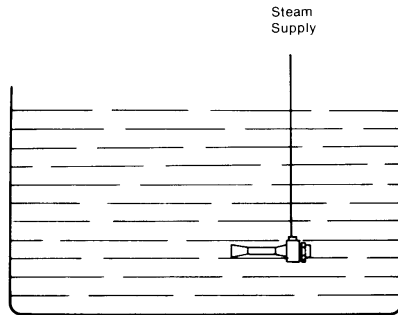
### 3. For Heating In Tank

- a. The Ring Jet should be positioned within the tank so as to insure the free flow of liquid to be heated into and out of the unit. The greatest agitation occurs within the discharge plume; therefore, the discharge end should be aimed towards the most remote part of the tank. On the other hand, the intake end of the unit must be far enough from the tank corner or wall to allow the free flow of liquid into the suction opening. Tank shape and size influence the placement and number of Ring Jet heaters required to assure even temperature distribution. A spherical tank with a single Ring Jet heater mounted as shown in the illustration, Figure 2, makes the best use of the heating and circulating characteristics of the Ring Jet heater. With no corners to impede liquid flow, the liquid circulates undisturbed while being heated.



**Figure 2**  
**Spherical Tank**

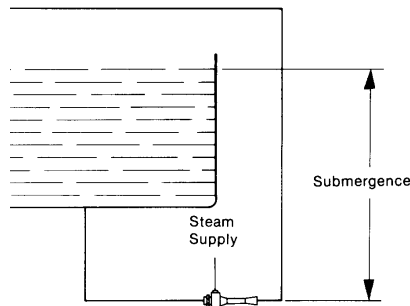
The angular intersection of surfaces in cylindrical, square, or rectangular tanks can interrupt liquid flow patterns and cause liquid stagnation in these areas. A single Ring Jet heater mounted as shown in Figure 3 will tend to minimize this effect. However, multiple Ring Jet heaters can often produce more efficient circulation when using these tank shapes. To avoid significant steam pressure drop, never use smaller steam pipe than the heater connection size.



**Figure 3**  
**Rectangular Tank**

Long, narrow tanks whose ratio of length to diameter is greater than 2:1 normally require multiple Ring Jet heaters to maintain even temperature distribution.

- b. Ring Jet heaters must be fully submerged to prevent liquid from splashing and to promote condensation of steam.
- c. Clearance should be provided for removal of Ring Jet heater.
- d. Steam piping must be secured to the tank wall near the Ring Jet heater to keep strain off piping when in operation.
- e. Steam supply valve should be a quick opening type installed as close to the Ring Jet heater as practical.
- f. Some installations require a specific depth of submergence in order to achieve maximum liquid temperature. Install Ring Jet within an outside circulating loop if necessary to obtain submergence, see Figure 4.



**Figure 4**

## 5.0 Operation

### 5.1 Pre-Operational Check

1. For In Line Installations
  - 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.
2. For In Tank Installations
  - a. Assure that all installation instructions have been completed.
  - b. Assure that tank has sufficient liquid for full submergence of the Ring Jet.



## 5.2 Operating

1. For In Line Installations
  - a. Turn operating liquid valve fully open.
  - b. Slowly turn operating steam valve on until the desired discharge liquid temperature is reached.
  - c. Regulate line discharge pressure if desired.
2. For Tank Installations
  - a. Turn steam flow fully on and maintain throughout the heating process.
  - b. After desired temperature is reached, steam pressure should be turned off.
  - c. Do not throttle steam supply valve. Throttling of steam flow to conditions outside the recommended operating levels will cause the Ring Jet to hammer with resulting noise and vibration.

# SAFETY INSTRUCTIONS

**Excessive vibration can become hazardous due to loosening of pipe joints and release of steam.**

Temperature of liquid can be thermostatically controlled only if the steam supply is controlled with a snap acting on-off valve.



## WARNING

**Do not attempt to heat liquid beyond the maximum temperature for the specific application. Heating beyond the maximum may cause noise, vibration, and release of live steam resulting in splashing of liquid in tank and loosening of pipe connections causing property damage or physical injury.**

For specific application data on temperature limitation, the user should consult the Penberthy product proposal for the specific model and size Ring Jet, or should request Penberthy to supply the applicable technical data bulletin.

## 6.0 Maintenance

Maintenance should only be undertaken by qualified, experienced personnel who are familiar with this equipment and thoroughly understand all the instructions in this manual.



## CAUTION

**Do not proceed with any maintenance unless the Ring Jet has been relieved of all pressure or vacuum, has been allowed to reach ambient temperature and has been drained or purged of all fluids. Failure to follow these instructions may cause a sudden release of pressure resulting in personal injury or property damage.**

## 6.1 Preventative Maintenance

The user must create maintenance schedules, safety manuals, and inspection details for each specific installation of a Ring Jet.

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

1. Ring Jet for corrosion or debris build up.
2. Piping and fittings for corrosion or debris build up.
3. All connections for tightness and leaks.
4. Units for wear.
5. In tank units for full submergence.
6. Strainers for debris build up.

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

## 6.2 Troubleshooting

Problem	Cause	Cure
Surges in liquid flow of in line heating installations	Liquid flow below minimum	Install by-pass line
	Pumping action	Install by-pass line
	Continued surges	Increase pressure discharge
Surges in outlet temperature of in line heating installations	Liquid flow below minimum	Install by-pass line
	Temperature controller overshoot	Desensitize controller
Partial heating on in line installations	Inadequately sized heater	Obtain proper size heater
	Debris blockage	Remove debris
	Operating steam pressure too low	Increase pressure
	Increased liquid flow	Balance liquid flow to heating capability of unit
Noise, water hammer, vibration of in tank installations	Operating steam pressure too low or liquid temperature too high	Increase pressure or decrease temperature. Increase submergence
	Throttling of steam pressure	Thermostatically controlled heating cycles with snap acting on-off valve
Noise and vibration after tank has reached temperature set point	Set point is too high (such as 200°F [93°C])	Decrease to recommended operating level. Increase submergence
	Debris blockage of inlet, suction, discharge, or strainer	Remove debris
Insufficient heating taking place	Loss of steam pressure due to loose connections	Recheck and tighten all connections
	Steam pressure too low	Increase pressure

**Table 3**

## 7.0 Disassembly-Reassembly



**Do not proceed with removal of Ring Jet from connecting piping unless the Ring Jet has been relieved of all pressure or vacuum, has been allowed to reach ambient temperature and has been drained or purged of all fluids. Failure to follow these instructions may result in a sudden release of pressure, personal injury and property damage.**

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 counterclockwise direction.

## 8.0 Disposal at End of Useful Life

Penberthy Ring Jet Heaters are used in a variety of fluid applications. By following the appropriate federal and industry regulations, the user must determine the extent of preparation and treatment the Ring Jet must incur before its disposal. A Material Safety Data Sheet (MSDS) may be required before disposal services accept certain components.

Metal, glass and polymers should be recycled whenever possible. Refer to order and PV&C - Black Mountain Material Specification sheets for materials of construction.

## 9.0 Telephone Assistance

If you are having difficulty with your Ring Jet, contact your local Penberthy distributor. So that we may assist you more effectively, please have as much of the following information available as possible when you call:

- Model #
- Name of the company from whom you purchased the Ring Jet
- Invoice # and date
- Process conditions (pressure, flow rates, tank shape, etc)
- A brief description of the problem
- Trouble shooting procedures that failed

If attempts to solve your problem fail, you may request to return your Ring Jet to the factory for intensive testing. You must obtain a Return Authorization (R.A.) number from PV&C Black Mountain before returning anything. Failure to do so will result in the unit being returned to you without being tested, freight collect. To obtain an R.A. number, the following information (in addition to that above) is needed:

- Reason for return
- Person to contact at your company
- Ship To" address

There is a minimum charge of \$75.00 for evaluation of non-warranty units. You will be contacted before any repairs are initiated should the cost exceed the minimum charge. If you return a unit under warranty, but is not defective, the minimum charge will apply.

### 10.0 Exploded Parts Drawing

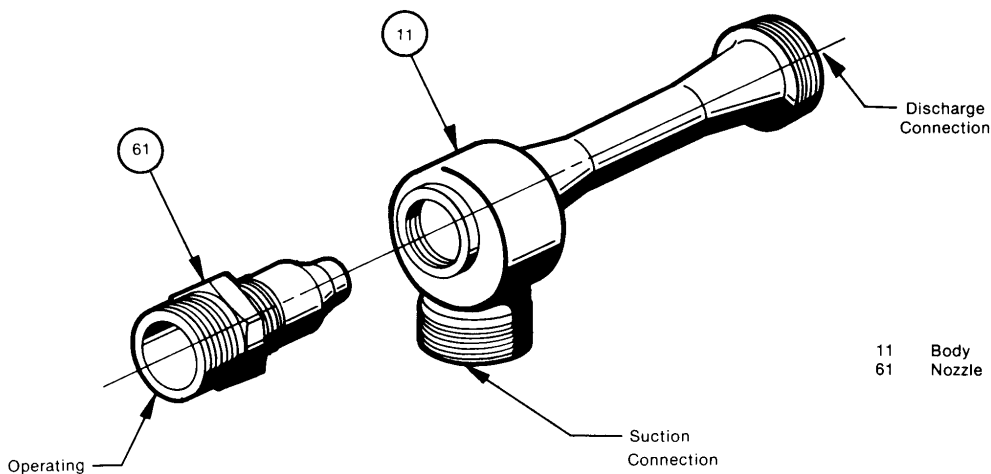


Figure 5



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