PENTAIR VALVES & CONTROLS

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JET PUMP Application Guide

A Trusted Resource for the Process Industry Worldwide!

Since 1886, Penberthy has been an innovative manufacturer of high-quality products for companies in the process industry. Whether the need is for liquid level gages, sight flow indicators, magnetic level gages, electronic level instruments or jet pump products, Penberthy has a reputation as a provider of superior products at competitive prices. Penberthy's mission is to constantly strive for excellence in product quality, customer service, engineering innovation and on-time deliveries.

In today's global market, Penberthy has recognized the need to change. Process industries are demanding more innovative ways to solve problems, to reduce cost and to develop more efficient methods of running their operations. Penberthy is keeping pace with these demands through ongoing research and development, product testing both in the lab and on the job site, while carefully tracking product performance. During this time, Penberthy has identified one very important idea...KEEP IT SIMPLE!

In fact, the directive at Penberthy is to produce durable, efficient products that operate on scientific principles and are easy to install and maintain. With this in mind, Penberthy offers a complete line of jet pumps designed to meet the needs of the process industry. These jet pumps are manufactured to stringent specifications and, as always are backed by the company's well-known service and technical support. Over the years, Penberthy has amassed a wealth of knowledge about its jet pump products, has identified new uses and products to meet the ever changing needs in the market. Penberthy jet pumps offer simple solutions to most process industry problems. Penberthy can provide the application assistance critical in selecting the right model for each process condition. Penberthy knows WHAT WORKS!

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Principle of Operation for Jet Pumps

While Penberthy jet pumps may differ in appearance, basic operation is the same. Jet pumps, also known as eductors, operate on the principles of fluid dynamics. An operating fluid media, which is referred to as the MOTIVE, placed under pressure enters the inlet and is forced through the nozzle where it is converted into a high-velocity stream. This high-velocity stream *decreases* the pressure in the suction chamber, creating a partial vacuum that draws the suction material into the chamber where it is entrained by the motive media. Once the SUCTION stream is drawn in, shear between motive media and the transported material causes both media to be intermixed and pumped out the DISCHARGE outlet, dispelled at a pressure greater than that of the SUCTION stream but lower than that of the MOTIVE. This basic principle of fluid dynamics is what makes Penberthy jet pumps work.

MOTIVE:
This function is the power phase of the pumping operation. At this stage, the velocity of the motive media increases as it passes through a nozzle. This phase of the pumping operation takes advantage of the kinetic properties of the motive media, whether it is liquid, steam or gas. Because of this, design differences may exist within the motive connection of the jet pump. For instance, jet pumps with liquid motives use a converging nozzle, since liquids usually cannot be compressed. On the other hand, jet pumps with gas or steam motives use converging/diverging nozzles to achieve trans-sonic flow velocity. The critical flow paths of all Penberthy jet pumps are smoothly machined with no abrupt turns or steps in order to produce the most efficient flow during the motive function. Without this direct flow design and smooth interior surface, the jet pump would not operate at peak efficiency.

SUCTION:
This connection of the jet pump is where the pumping action takes place. The high velocity stream of the motive causes a drop in pressure in the suction chamber. This allows pressure in the suction vessel to push a liquid, steam or gas into the suction chamber of the jet pump. This, in turn, is entrained by the high-velocity motive stream emerging from the inlet nozzle.

DISCHARGE:
As the motive flow combines with the suction medium, some kinetic energy of the MOTIVE is transferred to the SUCTION, mixing and discharging at a reduced pressure. The amount of pressure that can be recovered depends on the ratio of MOTIVE flow to SUCTION flow, plus the amount of SUCTION pressure built up in the suction vessel. Kinetic energy is converted back to pressure as the mixed media passes through the diverging taper and is discharged out the pump.

Simple Jet Pump Design Offers Economical Solutions for Many Complex Process Operations!

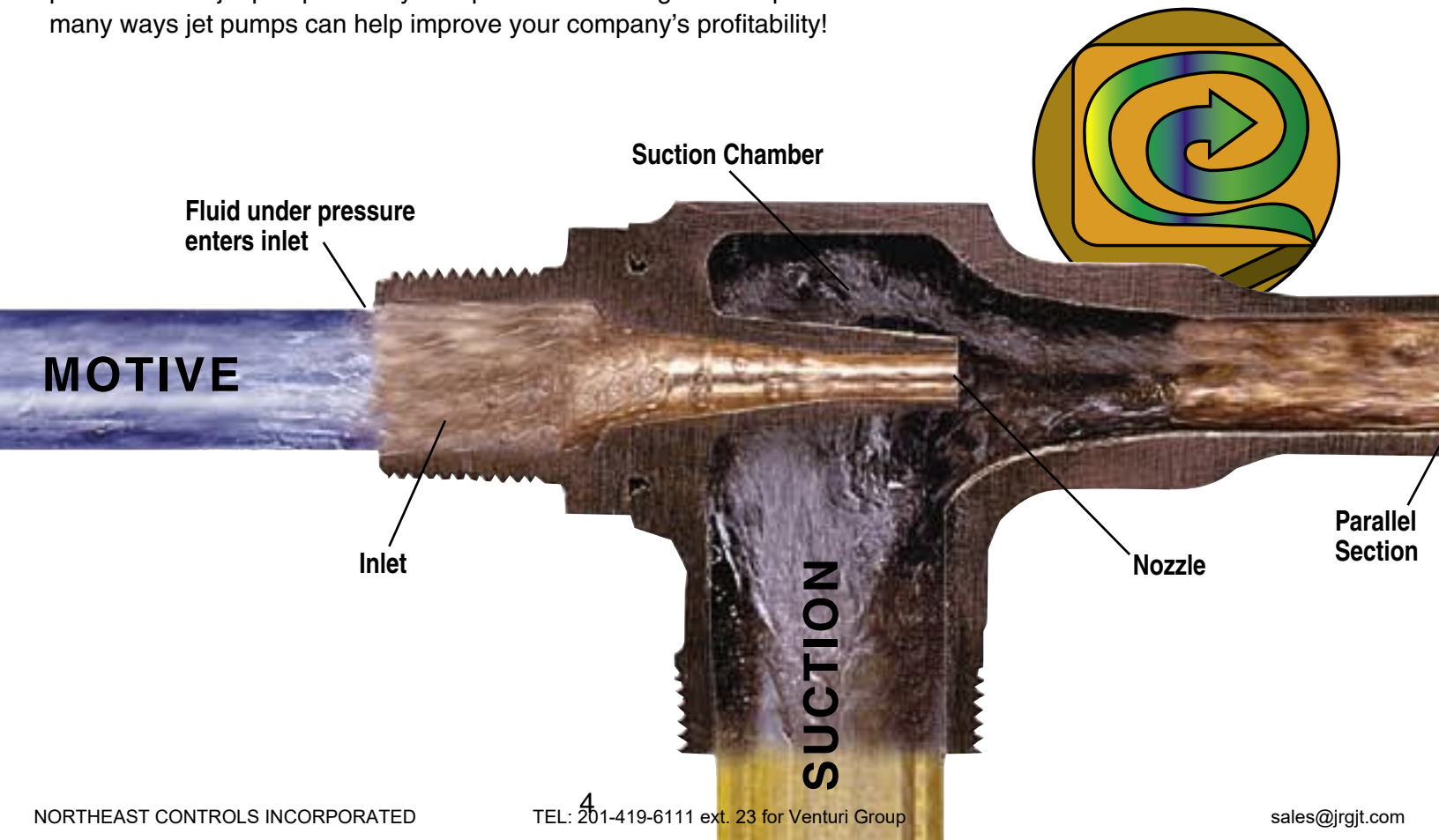
Providing a practical alternative to more complicated and expensive methods, Penberthy jet pumps offer simple, more cost-effective ways to pump, mix or heat a wide range of liquids and gases used in the process industry. Jet pumps can operate with a wide variety of motive liquids and gases. If you recognize any of the following, you can probably use a Penberthy jet pump.

- **Injectors**
- **Exhausters**
- **Ejectors**
- **Siphons**
- **Eductors**
- **Boosters**
- **Kinematic Pumps**

Penberthy jet pumps have a myriad of uses. Jet pumps not only pump liquids, they can also heat, mix, and blend either in-line or in a tank. Jet pumps can evacuate gases, create a vacuum, boost suction pressures, mix granular solids with liquids and move granular solids with compressed air. In fact, you will be surprised at what a jet pump can do to solve your problem.

The purpose of this Penberthy Jet Pump Application Guide is to identify the many uses for jet pumps, to identify pumps for specific processing operations, and perhaps recognize new ways to use jet pumps to reduce costs and optimize your plant's efficiency. Penberthy invites you to explore the possibilities of jet pump use in your operation. You might be surprised at the many ways jet pumps can help improve your company's profitability!

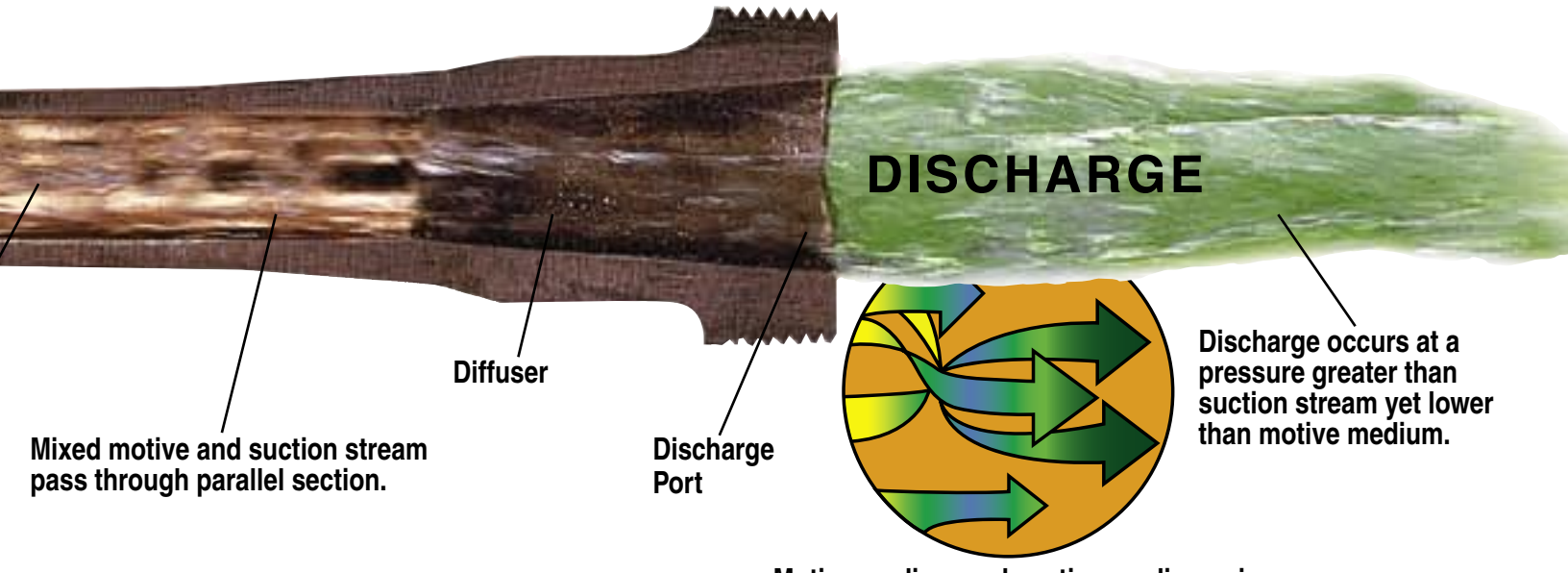
High-velocity motive stream creates vacuum and entrains suction media in suction chamber.



Jet Pump Process Application Guide

MOTIVE (Operating Medium)

SUCTION (Transport Medium)	LIQUID	STEAM	GAS (e.g., air)
LIQUID	• Liquid Transfer • Pump from Tank or Sump • Dilute In-Line • Mix or Blend In-Line • Lift or Elevate Liquids • Boost Suction Pressure to Centrifugal Pump **Models LL, LM, LH** *(Pages 6 & 7)*	• Liquid Transfer • Pump from Tank or Sump • Lift or Elevate Liquids **Models GL, GH** *(Pages 8 & 9)*	• Liquid Transfer • Pump from Tank or Sump • Lift or Elevate **Models GL, GH** *(Consult Factory)*
	• In-Tank Mixing • Destratify **Models CTE, TME** *(Pages 18 & 19)*	• In-Tank Heating **Models NWH, CTE, XL-32, RJ** *(Pages 14 & 15)*	
STEAM	• Heat Liquids In-Line **Models ELL, HLM, SRH, FHS** *(Pages 16 & 17)*	• Exhaust from Vessel • Evacuate from Vessel • Produce Vacuum **Models GL, GH, U, L, 2NC** *(Pages 10 & 11)*	• Exhaust from Vessel • Evacuate from Vessel • Produce Vacuum **Models GL, GH, U, L 2NC** *(Pages 10 & 11)*
	• Exhaust from Vessel • Produce Vacuum **Models LM, ELL, FL** *(Pages 12 & 13)*		
	• Evacuate from Vessel **Models LM, ELL** *(Pages 12 & 13)*		
GAS	• Aeration of Vessel • Evacuate from Vessel • Prime Pump **Models LM, ELL,** *(Pages 12 & 13)*	• Exhaust from Vessel • Evacuate from Vessel • Produce Vacuum **Models GL, GH, U, L, 2NC** *(Pages 10 & 11)*	• Exhaust from Vessel • Evacuate from Vessel • Produce Vacuum **Models GL, GH, U, L 2NC** *(Pages 10 & 11)*
	• Exhaust from Vessel **Models LM, ELL, FL** *(Pages 12 & 13)*	• Prime Pump **Models GL, GH** *(Pages 10 & 11)*	• Prime Pump **Models GL, GH** *(Pages 10 & 11)*
SOLIDS	• Transport Liquid Slurries • Dilute or Mix In-Line **Models LL, LM, LH** *(Pages 6 & 7)*	• Transport Liquid Slurries • Humidify **Models GL,GH** *(Pages 8 & 9)*	• Pneumatic Transport **Models GST, GL, GH** *(Pages 20 & 21)*
	• Transport Powders **Model LM, ELL** *(Pages 12 & 13)*	• In-Tank Heating **Models NWH, CTE, XL-32, RJ** *(Pages 14 & 15)*	
	• In-Tank Mixing • Suspension in Liquid Tanks • Sweep Bottom in Liquid Tanks **Model CTE, TME** *(Pages 18 & 19)*		
	• Wetting Solids **Model 62DP** *(Not Shown)*		



Pumping Liquid/Liquid Motive
Models LL, LM, LH

One of the most common applications for a Penberthy jet pump is to pump liquids using a liquid motive. In the process industry, this is perhaps one of the most recognized uses for a jet pump. Like all Penberthy jet pumps, liquid motive jet pumps are simple in design with no moving parts to wear out, they require no lubrication, are virtually maintenance-free and are easy to install without special structures or foundations. All Penberthy jet pumps are self-priming and are available in a variety of materials to suit the specific characteristics of the liquids involved in the process.

*The **L Series** jet pumps, **Models LL, LM and LH**, are specifically designed to operate well in a range of liquid pumping applications. Some industries in which these models are particularly well-suited include chemical processing, textile manufacturing, petroleum production & refining, power generation, mining, nuclear power generation, waste water treatment & processing, construction, distilling and potable water processing. Specific applications within these industries might include: handling condensate, flow volume multiplication, for pumping, making dilutions, pumping wells, circulating solutions, emptying cesspools, pumping brine solutions, extracting solvents, draining cellars & tanks, pumping out barges, acidifying, causticizing oils, producing emulsions and elevating/lifting liquids.*

Models Available

LL, LM, LH

Selection Guide

To determine the correct jet pump for a specific application, certain operating information is necessary. Simply make note of the individual specification data that is required under each of the functions listed below: MOTIVE, SUCTION and DISCHARGE. By completing our appication form with the required information, identifying the correct jet pump will be easy. Then simply contact your Penberthy representative who will be able to select the optimum jet pump based on the data.

MOTIVE:
- Liquid
- Pressure (Available)
- Flow Rate (Available volume)
- Specific Gravity/Viscosity
- Temperature/Vapor Pressure

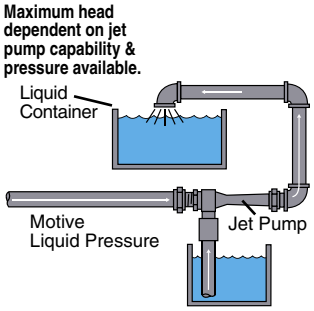
SUCTION:
- Liquid
- Suction Lift or Static Head
- Specific Gravity/Viscosity
- Temperature/Vapor Pressure
- Required Pumping Capacity

DISCHARGE:
- Pressure or Discharge Head (That unit must overcome)

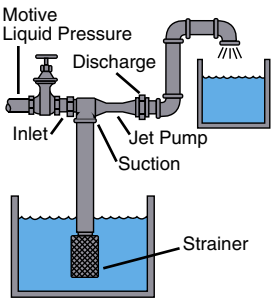
All conditions are measured at the Motive, Suction and Discharge ports.

Typical Applications

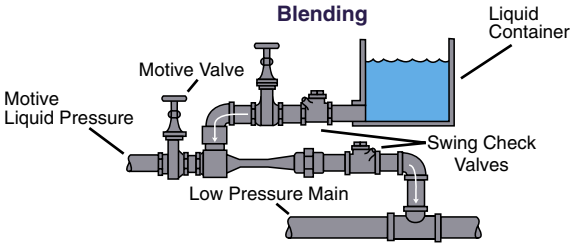
Lifting Or Elevating Liquids



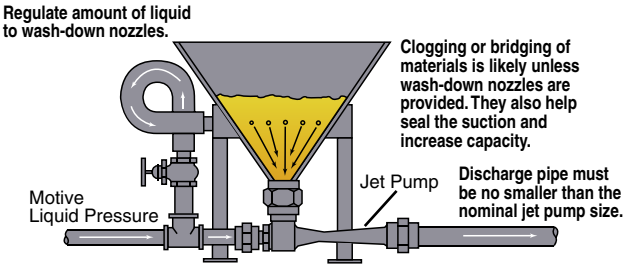
Draining Sump or Well



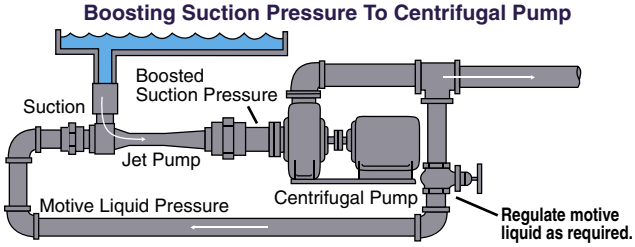
Blending



Handling Granular Solids With Liquids



Boosting Suction Pressure To Centrifugal Pump



Model Construction Data

Model	LL, LM, LH	
Sizes Available	1/2"A-4"	Standard Materials **Cast:** Low Lead Bronze, Iron, Carbon Steel, 316 STS
	4" & up	**Fabricated:** Carbon Steel, 316 STS
	1/2"A-3"	**Non-Metallic:** PVC, PP, PVDF (Kynar™)

Model Specifications

Model	LL Low Head	LM Medium Head	LH High Head
Based on water at Sp. Gr. = 1.0			
Motive medium pressure range	15-200 psig (100-1380 kPag)	15-200 psig (100-1380 kPag)	15-200 psig (100-1380 kPag)
Nominal motive medium pressure–psig/psig of discharge (kPag/kPag)	2 psig (15 kPag) (Sp. Gr. 1.0)	1.5 psig (10 kPag) (Sp. Gr. 1.0)	1 psig (7 kPag) (Sp. Gr. 1.0)
Discharge head pressure range	to 50 ft. (15.2 m)–H_2O	40 to 80 ft. (12.2-24.4 m)–H_2O	80 ft. (24.4 m) or more–H_2O
Suction lift	up to 27 ft. (8.2 m)–H_2O	up to 27 ft. (8.2 m)–H_2O	up to 27 ft. (8.2 m)–H_2O
Minimum NPSH	3 ft. (0.9 m)–H_2O	3 ft. (0.9 m)–H_2O	3 ft. (0.9 m)–H_2O

Pumping Liquid/Steam Motive
Models GL, GH

Another method of pumping liquids is to use steam as the motive. This type of jet pump works best in applications where a minimal amount of infusion of the motive media with the liquid to be transported is required. Quiet operating steam motive jet pumps, like liquid motive pumps, are simply designed with no packing glands and no moving parts to wear out. These pumps are attractive to the process industry because of their low initial cost, ease of operation and consistently low maintenance cost.

*Penberthy **G Series** jet pumps, specifically **Models GL and GH** are well-suited for operation in a variety of environments. These steam motive jet pumps can be used to drain sumps, drain or fill tanks and elevate or lift liquids. Industries that would benefit from the use of Penberthy G Series jet pumps include: chemical processing, textile manufacturing, food processing, water treatment and petroleum production & refining. Additional uses could be for: distilling & brewing, agricultural processing, pharmaceutical processing, sterilization, HVAC, pulp & paper manufacturing, power generation, mining, plastics production, automotive manufacturing, plating, ground water evaluation and clean-up operations in a variety of industries.*

Models Available

GL, GH

Selection Guide

Selecting the correct steam motive jet pumps for a specific application requires specific operating information. Complete the application form with the following required information: MOTIVE, SUCTION and DISCHARGE. Once that information has been determined, your Penberthy sales representative can help select the exact pump for your specific operation.

MOTIVE:
- Steam
- Pressure (Available)
- Flow Rate (Available volume)
- Temperature

SUCTION:
- Liquid
- Suction Lift or Static Head
- Specific Gravity/Viscosity
- Temperature/Vapor Pressure
- Required Pumping Capacity

DISCHARGE:
- Discharge Head (That unit must overcome)

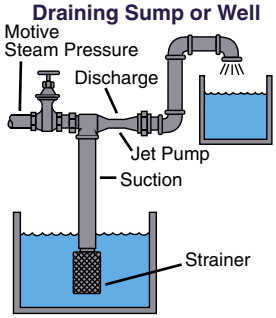
All conditions are measured at the Motive, Suction and Discharge ports.

Model Specifications

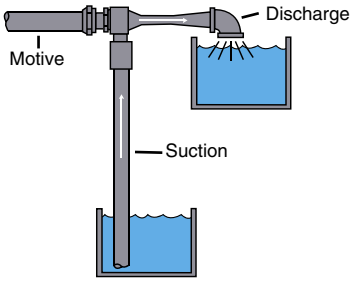
Model	GL Low Head	GH High Head
Motive medium	Steam	Steam
Motive steam pressure to elevate liquid 50 ft. (15.2 m)	150 psig (1035 kPag)	75 psig (520 kPag)
Motive steam pressure range	60–150 psig (415-1035 kPag)	35–150 psig (240-1035 kPag)
Suction lift–water temp. to 120° F (49° C)	up to 20 ft. (6.1 m)	up to 20 ft. (6.1 m)
Minimum NPSH	13 ft. (4 m)	13 ft. (4 m)

Typical Applications

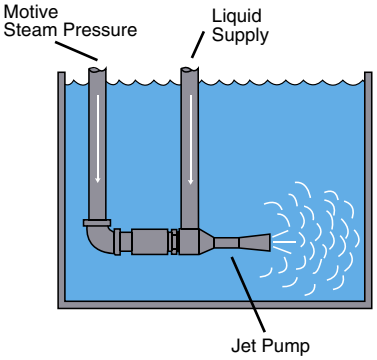
Draining Sump or Well



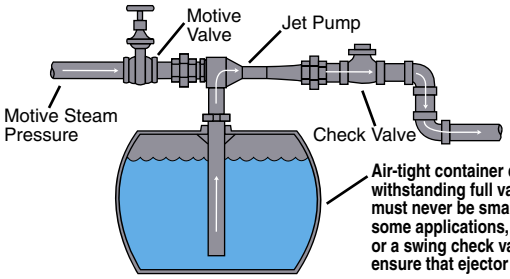
Lifting Or Elevating Liquids



Aeration Or Agitation

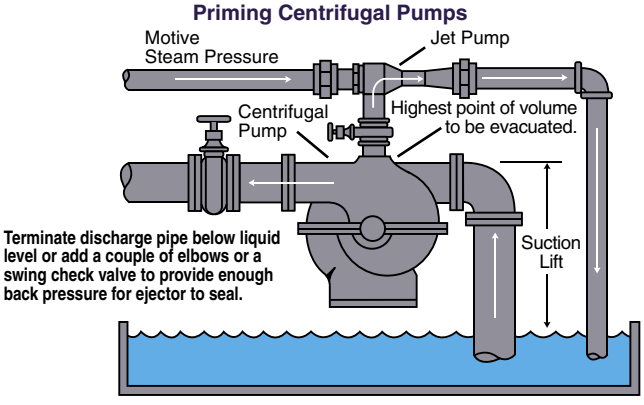


Producing The Best Possible Vacuum



Air-tight container capable of withstanding full vacuum. Discharge line must never be smaller than jet size. In some applications, a couple of elbows or a swing check valve is necessary to ensure that ejector will seal.

Priming Centrifugal Pumps



Terminate discharge pipe below liquid level or add a couple of elbows or a swing check valve to provide enough back pressure for ejector to seal.

Model Construction Data

Model	GL, GH	
Sizes Available	1/2"A-4"	Standard Materials
		Cast: Low Lead Bronze, Iron, Carbon Steel, 316 STS
	4" & up	**Fabricated:** Carbon Steel, 316 STS

Pumping Gas/Steam or Gas Motive
Models GL, GH, U, L, 2NC

Penberthy jet pumps can also use steam or a gas (air) as the operating media for exhausting, evacuating or priming operations. Primary uses of these types of pumps are for exhausting or evacuating gases. ***Exhausting*** *means removing gases from an area at a continuous rate while maintaining pressure at a constant level.* ***Evacuation*** *means drawing gases from a defined volume by pumping the vessel down from an initial pressure to a final lower pressure. These steam/gas motive jet pumps meet the industry's most stringent requirements, while providing a simple, low-cost method of transporting gases, operating flawlessly even in the harshest work environments.*

Penberthy ***Models GL and GH*** *operate at pressures from 20 to 120 psig (140 to 830 kPag), the overall capacity being slightly higher when using air as the operating media.* ***U and L Models*** *are single-stage ejectors while the* ***2NC*** *is a two-stage, non-condensing ejector using steam as the operating media. All these units provide maintenance-free pumping capabilities. Some uses for steam/gas motive jet pumps include: creating vacuums, exhausting vapors from process systems, evacuating tanks & vessels, priming, fume removal, fluid concentration, humidifying and drying. Industries that could benefit from the use of these jet pumps might include: chemical processing, textile manufacturing, food processing, petroleum production & refining, sterilization and HVAC.*

Models Available

GL, GH, U, L, 2NC

Selection Guide

As with pumping gas with liquid motive, steam/gas motive jet pumps require similar information in order to determine the specific jet pump model to fit a particular gas pumping application. These typical applications also involve either *exhausting* or *evacuating*. Complete the application form with the required information as shown below. Then consult your Penberthy sales representative on the proper pump for your specific application.

If Exhausting (Continuous Suction Flow)

MOTIVE:

Gas/Steam:

- Pressure (Available)
- Flow Rate (Available volume-scfm)
- Temperature
- Molecular Weight (Gas only)

SUCTION:

Gas/Steam:

- Pressure (Inches Hg Abs-kg/cm^2 Hg Abs)
- Flow Rate-scfm
- Temperature
- Molecular Weight

DISCHARGE:

- Pressure (That unit must overcome)

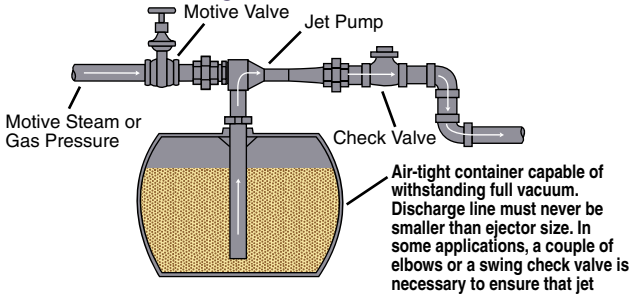
If Evacuating (Sealed Vessel-Pump Down)

- Volume of Space To Evacuate
- Required Evacuation Time (minutes)

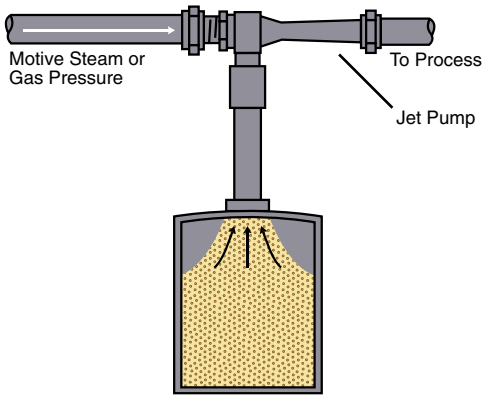
All conditions are measured at the Motive, Suction and Discharge ports.

Typical Applications

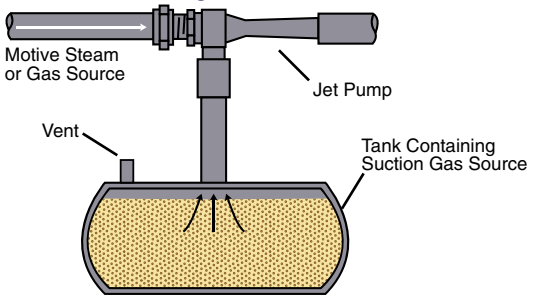
Producing The Best Possible Vacuum



Reducing Pressure



Moving Gases



Model Construction Data

Model	GL, GH		U, L, 2NC	
Sizes Available	1/2"A-4"	Standard Materials **Cast:** Low Lead Bronze, Iron, C. Steel, 316 STS	1H-18H	Standard Materials **Cast:** Carbon Steel, Iron Body, 316 STS Nozzle or All 316 STS
	4" & up	**Fabricated:** Carbon Steel, 316 STS		
	1/2"A-3"	**Non-Metallic:** PVC, PP, PVDF (Kynar™)		

Model Specifications

Model	GL	GH	U	L	2NC
Motive medium	Steam, Gas	Steam, Gas	Steam	Steam	Steam
Motive medium pressure range	60-120 psig (415-830 kPag)	20-80 psig (140-550 kPag)	80-200 psig (550-1380 kPag)	80-200 psig (550-1380 kPag)	100-200 psig (690-1380 kPag)
Application range, inches Hg Abs(kg/cm^2 Abs)	6-30 (.18-1.04)	6.5-30 (.2-1.04)	6-12 (.18-.36)	3-6 (.09-.18)	0.5-3 (.002-.09)
Functions	Evac/Exh/Prime	Evac/Exh/Prime	Evac/Exh	Evac/Exh	Evac/Exh

Pumping Gas/Liquid Motive
Models LM, ELL, FL

In many process operations, it is necessary to evacuate or move a gas. One method of doing this is to use a Penberthy liquid jet pump. These specially designed liquid motive jet pumps offer many advantages over other methods of evacuating or moving gases. The simple design for these units features no moving parts, consequently there is no need for lubrication. As a result, there is little chance of the jet pump wearing out.

These jet pumps are a low-cost alternative when compared to other methods of moving gases. Installation is easy, the units are compact and can easily be adapted to almost any installation requirements. Plus, no moving parts means trouble-free operation.

Penberthy ***Models LM, ELL and FL*** *are perfect for many gas pumping operations where more costly and complicated pumps have been used. Imagine being able to use a jet pump to: create a vacuum, evacuate gases from tanks and vessels, scrub a gas to remove contaminants, remove fumes, for gas condensation, drying, distillation, deaeration and more.*

Typical industries that could use liquid motive jet pumps might include: textile manufacturing, chemical processing, food processing, water treatment, petroleum production, sterilization, tire making, HVAC and distilling & brewing.

Models Available

LM, ELL, FL

Selection Guide

Typical applications involve either *exhausting* or *evacuating*. Similar information is needed in order to determine the specific jet pump for your application. Fill in the needed information on the application form below, and then consult your Penberthy sales representative on the correct pump match.

If Exhausting (Continuous Suction Flow)

MOTIVE:

- Liquid
- Pressure (Available)
- Flow Rate (Available volume)
- Specific Gravity
- Temperature

SUCTION:

- Gas To Be Pumped
- Pressure (Vacuum)
- Flow Rate
- Temperature/Molecular Weight

DISCHARGE:

- Pressure (That unit must overcome)

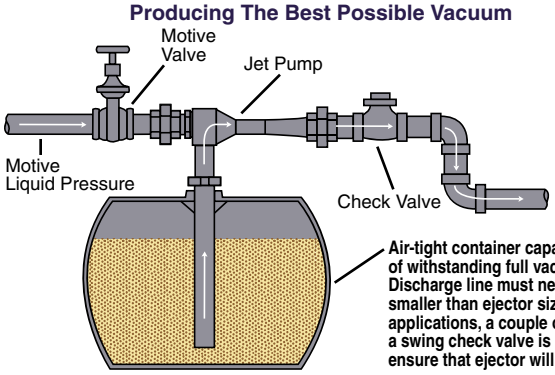
If Evacuating (Sealed Vessel-Pump Down)

- Volume of Space To Evacuate
- Required Evacuation Time (minutes)

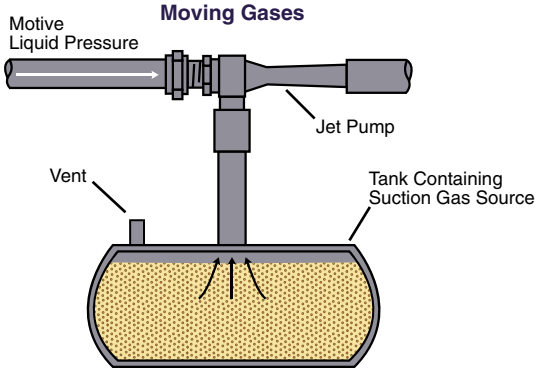
All conditions are measured at the Motive, Suction and Discharge ports.

Typical Applications

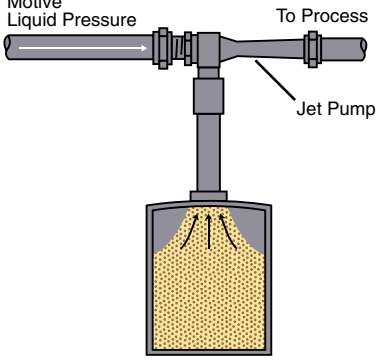
Producing The Best Possible Vacuum



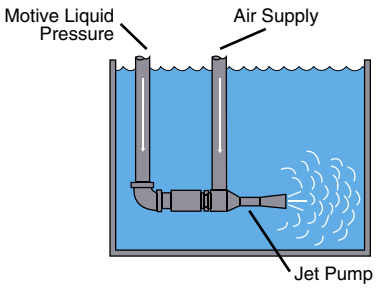
Moving Gases



Reducing Pressure



Aeration Or Agitation



Model Specifications

Model	LM	ELL	FL
Motive medium	Liquid	Liquid	Liquid
Motive medium pressure range	20-200 psig (140-1380 kPag)	20-200 psig (140-1380 kPag)	20-100 psig (140-690 kPag)
Application range, inches Hg Abs (kg/cm² Abs)	1-27 (.03-.93)	1-27 (.03-.93)	27-30 (.93-1.04)
Functions	Evac/Exh/Prime	Evac/Exh/Prime	Exh

Model Construction Data

Model	LM, ELL		FL	
Sizes Available	1/2"A-4"	Standard Materials **Cast:** Low Lead Bronze, Iron, Carbon Steel, 316 STS	1"A-4"B	Standard Materials **Cast:** Iron, Carbon Steel, 316 STS
	4" & up	**Fabricated:** Carbon Steel, 316 STS		
	1/2"A-3"	**Non-Metallic:** PVC, PP PVDF (Kynar™)		

Heating Liquids/In-Tank
Models NWH, CTE, XL-32, RJ

There is a definite benefit to being able to heat a liquid in an open tank. Penberthy jet pump in-tank heaters optimize and streamline the operation by completing two jobs at the same time—both heating and circulating the mixture. Installed submerged in the tank, open tank heaters are especially suited for cooking, heating & circulating liquids and they maximize the condensation of steam into operating liquids to provide fluid heating. ***Model NWH*** *is an inexpensive basic heater.* ***Model CTE*** *is more versatile and produces strong mixing during the heating process.* ***Model XL-32*** *provides the highest steam flow for a given pipe size, as well as providing near noiseless operation with as little as 3 psig of steam pressure. The CTE, NWH and XL-32 produce temperature rise of up to 120°F (49°C) with a final tank temperature of 160°F (71°C).* ***Model RJ (Ring Jet) Heater*** *operates at steam pressures from 5 to 150 psig (1035 kPag) above the submergence (head pressure), achieving final tank temperatures up to 179°F (82°C).*

Because Penberthy jet heaters operate on a simple heat transfer principle, they are efficient and cost-effective. In-tank jet heaters are particularly well-suited for these applications: continuous heating, cooking grain, direct contact heat transfer, cooking mash, cooking starch and homogeneous liquid/temperature distribution throughout a tank. By using imaginative engineering, uses for these units is virtually endless!

Models Available

NWH, CTE, XL-32, RJ

Selection Guide

It is necessary to identify some basic information in order to correctly match the proper in-tank jet heater with your specific application. Simply complete the application form with the required information below, and then contact your Penberthy sales representative to order the in-tank jet heater that is just right for your operation.

MOTIVE:

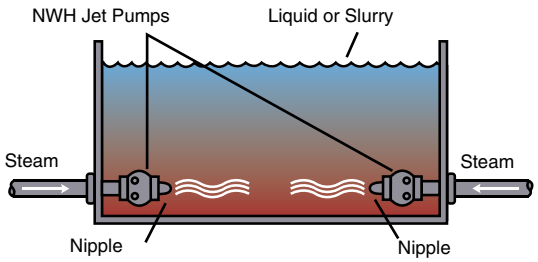
- Steam Pressure (Available)
- Flow Rate (Volume available)
- Temperature

OTHER:

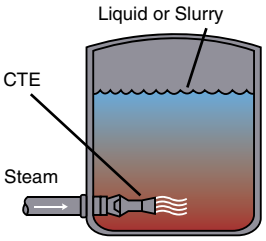
- Tank Liquid (Heat capacity)
- Initial Temperature
- Tank Volume (Capacity)
- Final Temperature
- Heating Time (minutes)

Typical Applications

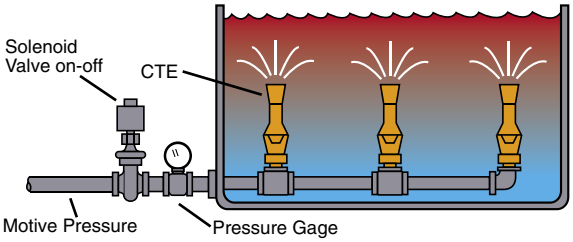
Heating Liquid In-Tank with Model NWH



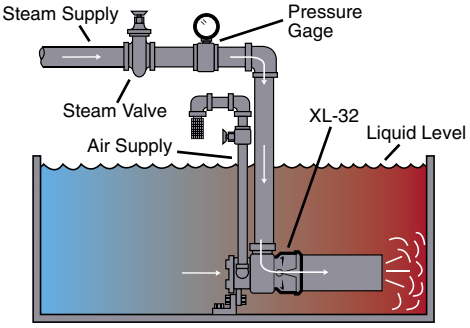
Heating Liquid In-Tank with Model CTE



Heating Liquids with Circulating Tank Eductors



Heating Liquids In Open Tank With XL-32 Heater



Model Construction Data

Model	NWH		CTE		XL-32		RJ	
Sizes Available	1/4"–2"	Standard Materials	3/8"–4"	Standard Materials	1/2"–2"	Standard Materials	1"–3"	Standard Materials
		Cast: Low Lead Bronze, Carbon Steel, 316 STS		**Cast:** Low Lead Bronze, Iron, Carbon Steel, 316 STS		**Cast:** Low Lead Bronze		**Cast:** Low Lead Bronze, Iron, Carbon Steel, 316 STS
			4" & up	**Fabricated:** Carbon Steel, 316 STS				

Model Specifications

Model	NWH Water Heater	CTE-Circulating Tank Eductor	XL-32 Heater	RJ Heater
Motive steam pressure	up to 120 psig (830 kPag)	up to 140 psig (966 kPag)	up to 140 psig (966 kPag)	up to 150 psig (1035 kPag)
Max. water temp. rise (ΔT)	up to 120°F (49° C)	up to 120°F (49° C)	up to 120°F (49° C)	up to 120°F (49° C)
Max. final tank temp.	up to 160°F (71° C)	up to 160°F (71° C)	up to 160°F (71° C)	up to 179°F (82° C)

Heating Liquids/In-Line
Models ELL, HLM, SRH, FHS

Many process operations can be heated in-line. With Penberthy in-line mixers, you can heat in-line while transporting the process media from one location to another. Steam jet heaters optimize the condensing of steam into the motive media to provide fluid heating. ***Models ELL and HLM*** *are ejector-type heaters capable of operating at steam pressures lower than the operating liquid. They offer much higher thermal input than a comparable SRH, while incurring a higher inlet to discharge pressure drop.*

The ***SRH (Steam Ring Heaters)*** *are compact in-line units with low-pressure drop. SRH units inject steam through a ring shaped opening within an enlargement in the pipeline. They provide fast temperature correction noiselessly and because the liquid flow area is unrestricted, pressure drop across the nozzle are minimized.*

Penberthy ***Model FHS (Fluid Heating System)*** *units are complete, engineered systems, including an in-line heater, pneumatic temperature controller, steam control valve, thermometer, strainer, check valve and associated piping. Penberthy in-line jet heaters may be used in these automated systems.*

Penberthy in-line jet heaters are perfect for many types of industries including: food processing, petroleum production & refining, chemical processing, distilling/ brewing and many other process operations. If you have a heating problem, a Penberthy jet heater may be the solution.

Models Available

ELL, HLM, SRH, FHS

Selection Guide

In order to pair the correct in-line jet heater with your specific application, it is required that certain information be provided. Supply the required information on the application form below, and then call your Penberthy sales representative for directions on ordering the correct in-line jet heater for your specific uses.

MOTIVE:

- Liquid
- Pressure (Available)
- Flow Rate (gpm/kPag to be heated)
- Specific Gravity
- Inlet Temperature

SUCTION:

- Steam Pressure (Available)
- Steam Temperature
- Flow Rate (Available volume)

DISCHARGE:

- Pressure (That unit must overcome)
- Desired Temperature Rise

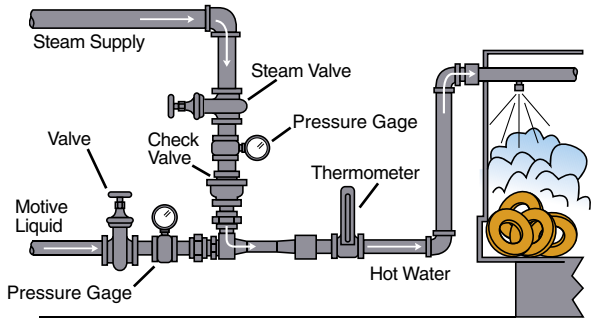
All conditions are measured at the Motive, Suction and Discharge ports.

Model Construction Data

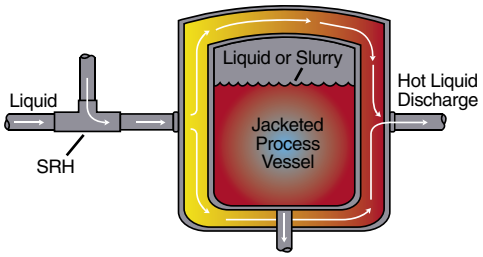
Model	ELL, HLM		SRH	
Sizes Available	1/2"A-4"	Standard Materials **Cast:** Low Lead Bronze, Iron, Carbon Steel, 316 STS	1 1/2", 2", 3", 6"	Standard Materials **Flanged:** Low Lead Bronze, Iron, Carbon Steel, 316 STS
	4" & up	**Fabricated:** Carbon Steel, 316 STS		

Typical Applications

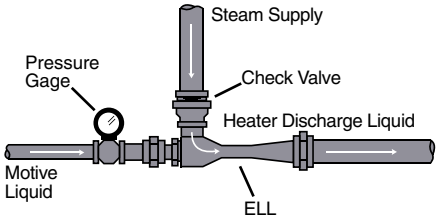
Parts Washer



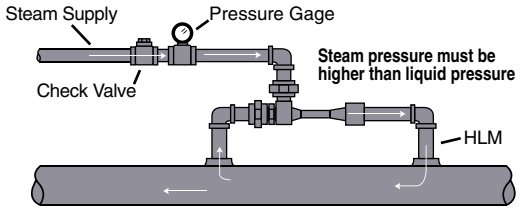
Heating Liquid In-Tank with Model SRH



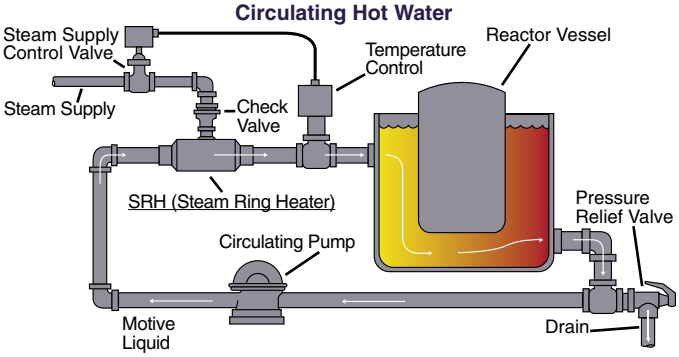
Heating Liquids In-Line



Adding Small Amounts Of Steam To A Large Flow Of Water



Circulating Hot Water



Model Specifications

Model	ELL Low Steam Pressure	HLM High Steam Pressure	SRH Steam Ring Heater	FHS Liquid Heating System
Steam Pressure	up to 45 psig (310 kPag)	up to 120 psig** (830 kPag)	up to 150 psig (1035 kPag)	up to 150 psig (1035 kPag)
Max. water temp. rise (ΔT)*	up to 182°F (83° C)	up to 216°F (102° C)	up to 200°F (93° C)	up to 140°F (60° C)
Max. capacity	5000 gpm (18925 lpm)	5000 gpm (18925 lpm)	500 gpm (1893 lpm)	500 gpm (1893 lpm)

** Based on 60˚F (16° C) inlet water*

*** Maximum steam pressure for iron body material, 60 psig (414 kPag)*

Mixing Liquids
Models CTE, TME

If any part of your processing operation requires mixing, then Penberthy circulating tank eductors, also known as in-tank mixers, may provide a low cost alternative over other mechanical methods. These units promote more thorough mixing action than either mechanical mixing or air sparging. The flow pattern is easily controlled and provides more complete integration of substances in a wide variety of viscosities and liquids. Penberthy in-tank mixers are inherently non-clogging, and with no moving parts require little or no maintenance. Slurries containing abrasive solids can wear out mechanical mixer blades, involving constant maintenance and process down time.

Penberthy ***Models CTE and TME*** *in-tank mixers answer the demand for more efficient, low-cost liquid and slurry mixing. These models can be used in numerous applications including: hazardous waste & waste water processing, cooling tower circulation, tank truck agitation, additive infusion, blended solution agitation, plating tank agitation and separation prevention of non-mixable liquids or stratification of dissimilar liquids. Industries that could use eductors include: chemical processing, food processing, electroplating, fertilizer agrichemical processing and petrochemical processing.*

Models Available

CTE, TME

Selection Guide

Fitting these specialized jet pump/tank eductors to your specific situation requires some data that only you can provide. Complete the application form with the required information below, and then contact your Penberthy sales representative to review the final details that will make selection of the correct tank eductor for your specific application an easy job.

MOTIVE:

- Operating Liquid(s) Involved
- Pressure (Available)
- Flow Rate (Volume available)
- Temperature
- Specific Gravity/Viscosity

TANK:

- Tank Size (Dimensions)
- Tank Shape
- Maximum Volume (Total amount to be mixed)

TIME:

- Time required to achieve uniformity (Turnover rate)

OTHER:

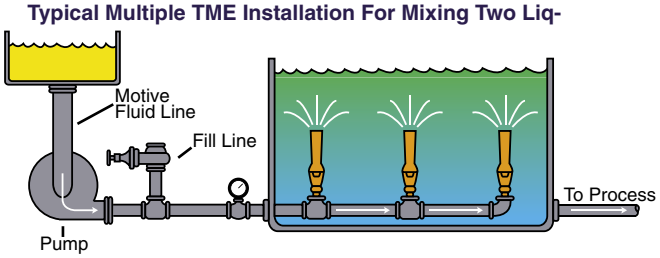
- Solids That Are Involved For Suspension

Model Specifications

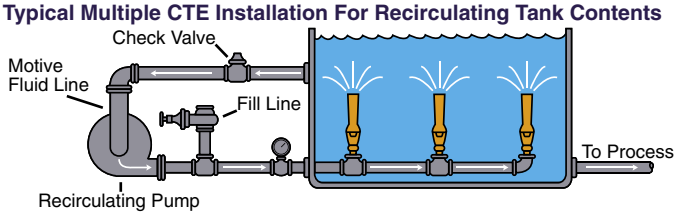
Model	CTE Circulating Tank Eductor	TME Tank Mixing Eductor
Pressure differential of inlet to tank pressure	10-100 psig (70-690 kPag)	10-50 psig (70-345 kPag)
Mixing ratio	3:1	4:1
Max. operating liquid viscosity	up to 2,000 cPs	up to 2,000 cPs

Typical Applications

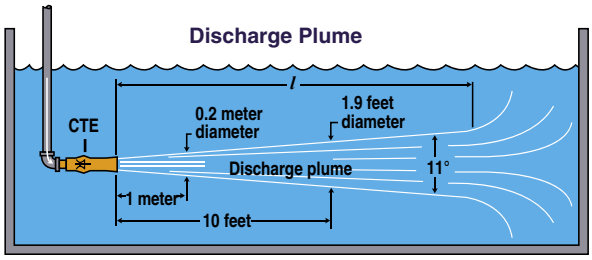
Typical Multiple TME Installation For Mixing Two Liq-



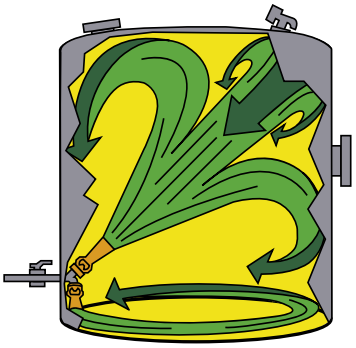
Typical Multiple CTE Installation For Recirculating Tank Contents



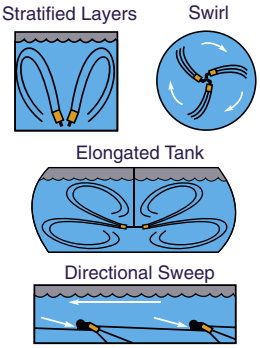
Discharge Plume



Agrichemical Mixing

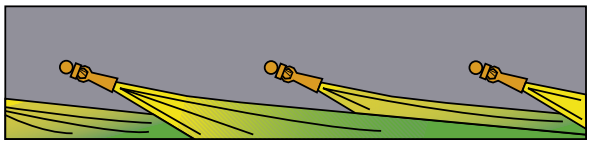


Different Mixing Configurations

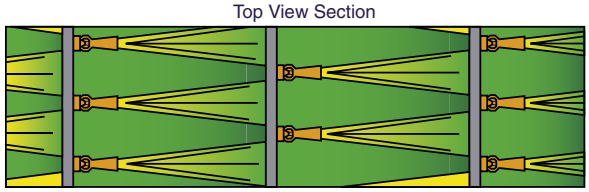


Electrocoating Processes

Side View Section

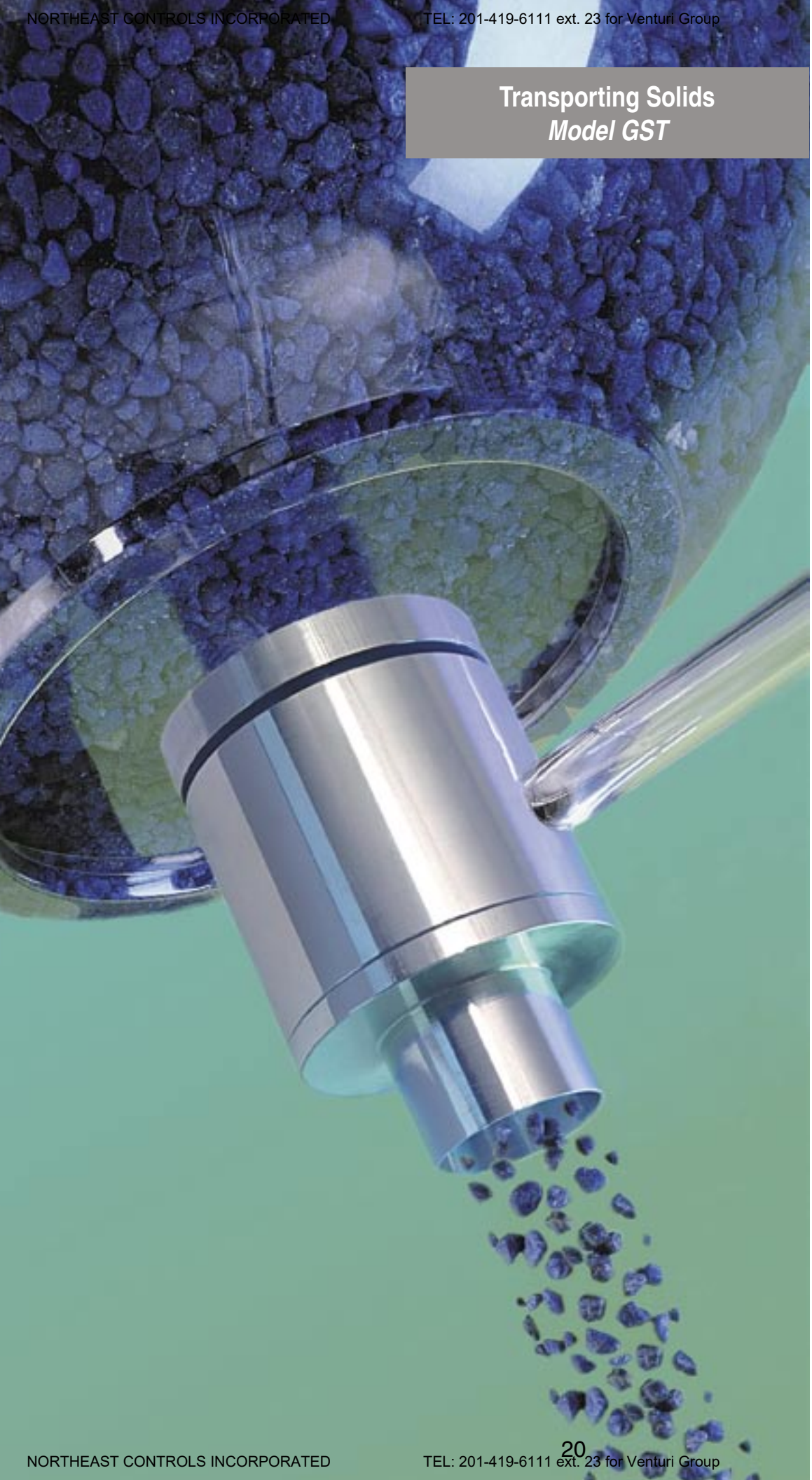


Top View Section



Model Construction Data

Model	CTE		TME	
		Standard Materials		Standard Materials
Sizes Available	3/8"-4"	**Cast:** Low Lead Bronze, Iron, Carbon Steel, 316 STS	3/8", 1/2", 3/4", 1", 1 1/2"	**Non-Metallic:** 25% Glass-Filled PP
	4" & up	**Fabricated:** Carbon Steel, 316 STS		
	3/8"-3"	**Non-Metallic:** PVC, PP, PVDF (Kynar™)		



Transporting Solids
Model GST

Jet pumps may also be used to transport dry solids using a gas (e.g., air) as its motive source. The Penberthy ***Model GST*** *(gas-operated solids transport) jet pump is designed to pneumatically convey powders and bulk solids via dilute phase through a closed piping system.*

An excellent replacement for conventional auger or belt conveyors, the Model GST has the advantage of ambient pressure solids introduction of vacuum conveying systems and the discharge capabilities of positive pressure conveying systems. These jet pumps use the tendency of a moving stream of air to shear towards a boundary surface. This is known as the Coanda effect. This shearing effect and the geometry of the jet pump causes entrainment of ambient air and solid material in front of the jet pump. This entrained air and solid material are then transported down a length of pipe.

Unlike vacuum-based systems, the Model GST is a true pump that entrains the material at the source and pushes the air/solids mixture through the system. Working in a closed piping system, there is little opportunity for material loss or external contamination. In general, piping and feed requirements that provide good material flow in an existing vacuum or blower system are applicable to the GST. The material feed is at ambient pressure, thus eliminating the need for rotary valves and/or blow tanks. In certain applications, these units used alone can replace the function of some dual vacuum/positive pressure systems.

Models Available

GST

Selection Guide

To size which Model GST would be the most efficient for your dry solids transport application, the following information is required. Once you have determined this information, simply contact your local Penberthy sales representative who will help to size and specify the Model GST unit to fit your needs.

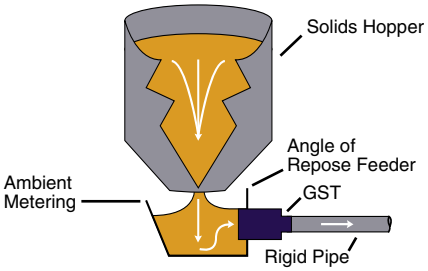
SOLIDS INFORMATION:
- Density (Weight of material)
- Geometry (Shape and size)
- Amount of Material To Be Moved
- Required Time To Move This Amount

OPERATING AIR/(GAS) INFORMATION:
- Amount of Pressure and Flow Available

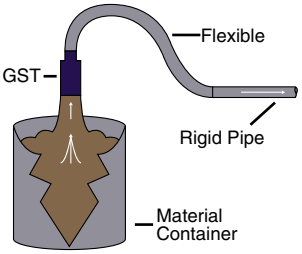
DISCHARGE PIPING INFORMATION:
- Material of Construction
- Size & Schedule
- Total Length Involved
- Number of Bends/Elbows
- Vertical Lift
- Other Restrictions To Consider (e.g., Filter Elements)

Typical Applications

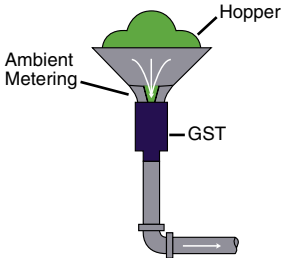
Solids Transport From Hopper



Solids Transport Through Flexible Tubing



Direct Solids Transport From Hopper



Industry Applications:
Potential applications for the Model GST include but are not limited to: moving bulk solids & powders and particle collection/evacuation. Industries that could benefit from using this method of transporting dry solid material include: feed & grain operations, plastic/resin manufacturers & users, particulate chemical manufacturers & users, mining operations, foundries, sugar/salt mills, fertilizer handling operations and general manufacturing.

Model Construction Data

Model	GST	
Sizes Available	1 1/2"-6"	Standard Materials **Cast:** Low Lead Bronze, 316 STS, Aluminum **Non-Metallic:** CPVC

Model Specifications

Model	GST				
Pump Size	1 1/2″	2″	3″	4″	6″
Motive Pressure Range*	5-35 psig (35-240 kPag)	5-60 psig (35-415 kPag)	5-90 psig (35-620 kPag)	5-120 psig (35-830 kPag)	5-200 psig (35-1380 kPag)

** Please note that under certain application conditions, the Penberthy Model GL or GH units may be used.*

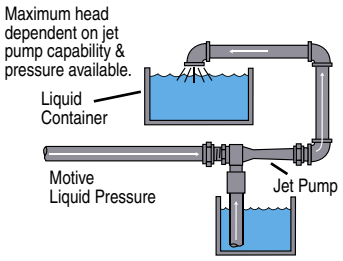
Sanitary — *Models SLL, SLM, SLH, SGL, SGH & SHLM*

For pumping liquids, slurries or gases and steam heating liquids in sanitary applications, Penberthy has a complete line of jet pumps that meet the strictest criteria. Penberthy Sanitary Jet Pumps perform flawlessly in food & beverage, dairy, pharmaceutical, biotechnology and other unique chemical processing applications where cleanliness is required. These jet pumps are all 3-A certified with no moving parts to wear out. Simple, three-piece sanitary 316 design allows for effortless clean-up, while sanitary flange connections allow easy assembly/ disassembly. Because of these unique design features, these jet pumps are compatible with CIP/SIP techniques and fit most process operations.

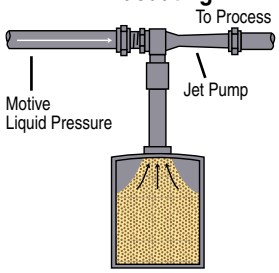
***Models SLL, SLM & SLH** can pump liquids and transport and mix slurries using a liquid motive. For pumping gases using a liquid motive, the **Model SLM** is recommended, while **Models SGL & SGH** are specified for pumping gases or steam using a gas or steam motive. The **Model SHLM** is a duty-specific eductor that heats liquids using a liquid motive. These specialized jet pumps are perfect for a wide range of processes where sanitation procedures are critical. In these environments, they can operate continuously under the most demanding conditions, performing many operations where mechanical devices are not feasible. Penberthy Sanitary Jet Pumps integrate seemlessly with other process functions to improve productivity and profitability!*

Typical Applications

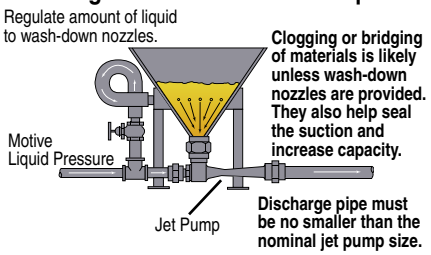
Lifting Or Elevating Liquids



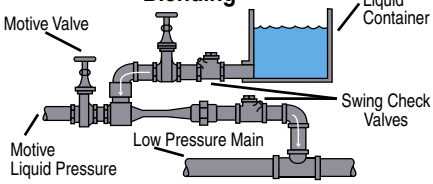
Evacuating



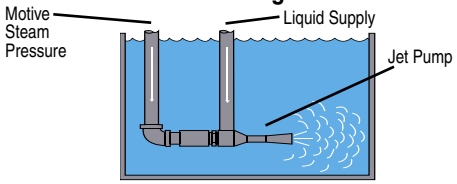
Handling Granular Solids With Liquids



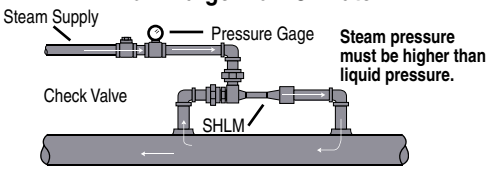
Blending



Aeration Or Agitation



Adding Small Amounts Of Steam To A Large Flow Of Water



Selection Guide

Models SLL, SLM, SLH

MOTIVE:
- Liquid
- Pressure (Available)
- Flow Rate (Available volume)
- Specific Gravity/Viscosity
- Temperature/Vapor Pressure

SUCTION:
- Liquid
- Suction Lift or Static Head
- Specific Gravity/Viscosity
- Temperature/Vapor Pressure
- Required Pumping Capacity

DISCHARGE:
- Pressure or Discharge Head (That unit must overcome)

Models SGL, SGH

If Exhausting (Continuous Suction Flow)

MOTIVE:
- Steam or Gas
- Pressure (Available)
- Flow Rate (Available volume)
- Temperature

SUCTION:
- Gas To Be Pumped
- Pressure (Vacuum)
- Flow Rate
- Temperature/Molecular Weight

DISCHARGE:
- Pressure (That unit must overcome)

If Evacuating (Sealed Vessel-Pump Down)
- Volume of Space To Evacuate
- Required Evacuation Time (minutes)

Model SHLM

MOTIVE:
- Liquid
- Pressure (Available)
- Flow Rate (gpm/lpm to be heated)
- Specific Gravity
- Inlet Temperature

SUCTION:
- Steam Pressure (Available)
- Flow Rate (Available Volume)

DISCHARGE:
- Pressure (That unit must overcome)
- Desired Temperature Rise

All conditions are measured at the Motive, Suction and Discharge ports.

Model Specifications

Model	Motive Medium/ Suction Medium	Operating Motive Pressure	Discharge Head	Maximum Capacity	Max. Water Temp. Rise (ΔT)	Suction Lift	Minimum NPSH
SLL	Liquid/Liquid	15-200 psig (1-14 barg)	up to 50 ft. (15 m)			up to 27 ft. (8.2 m) - H_2O	3 ft. (0.9 m) - H_2O
SLM	Liquid/Liquid	15-200 psig (1-14 barg)	up to 80 ft. (up to 24 m)			up to 27 ft. (8.2 m) - H_2O	3 ft. (0.9 m) - H_2O
SLH	Liquid/Liquid	15-200 psig (1-14 barg)	80 ft. or more (24 m)			up to 27 ft. (8.2 m) - H_2O	3 ft. (0.9 m) - H_2O
SLM	Liquid/Gas	20-200 psig (1.4-14 barg)	0-20 psig (0-1.4 barg)				
SGL	Gas or Steam/ Gas or Steam	60-150 psig (4-10 barg)	0-12 psig (0-0.8 barg)			up to 20 ft. (6.1 m) - H_2O	13 ft. (4 m)
SGH	Gas or Steam/ Gas or Steam	20-150 psig (1.4-10 barg)	0-21 psig (0-1.4 barg)			up to 20 ft. (6.1 m) - H_2O	13 ft. (4 m)
SHLM	Gas or Steam/ Gas or Steam	to 120 psig (8 barg)		5000 gpm (18930 lpm)	up to 216° F (102° C)		

Sanitary Circulating Tank Eductor
Model SCTE

In sanitary process operations, the mixing and heating of a variety of liquid components is often required. For mixng and blending everything from fluids to heavy slurries, circulating tank eductors provide the perfect mix of efficiency and cost-savings. The Penberthy ***Model SCTE*** *jet pump offers an effective alternative to other mechanical in-tank mixing methods in sanitary applications. Whether used in food & beverage or dairy processing, or pharmaceutical, biotechnology or other specialized chemical processing applications, the Model SCTE functions effortlessly.*

This simple, one-piece unit is constructed of durable, corrosion-resistant 316 stainless steel and is 3-A certified. An inherently non-clogging device, the unit has no moving parts to wear out, which is especially beneficial when processing abrasive mixtures— that means little or no maintenance! The jet pump's design also promotes more thorough mixing than more expensive mechanical mixing systems. Its powerful flow pattern provides complete integration of a wide range of substances in many types of liquids. In situations where sanitary conditions must be maintained, clean-up is fast and easy. The Model SCTE is compatible with CIP/SIP techniques. With its flexibility and many uses, the Model SCTE can integrate easily into numerous sanitary process operations!

3-A® 61-00

Models Available

SCTE

Selection Guide

Fitting these sanitary jet pump/tank eductors to your specific situation requires some data that only you can provide. Complete the application form with the required information below, and then contact your Penberthy sales representative to review the final details that will make selection and sizing of the correct tank eductor for your specific application an easy job.

MOTIVE:

- Operating Liquid(s) Involved
- Pressure (Available)
- Flow Rate (Volume available)
- Temperature
- Specific Gravity/Viscosity

TANK:

- Tank Size (Dimensions)
- Tank Shape
- Maximum Volume (Total amount to be mixed)

TIME:

- Time required to achieve uniformity (Turnover rate)

OTHER:

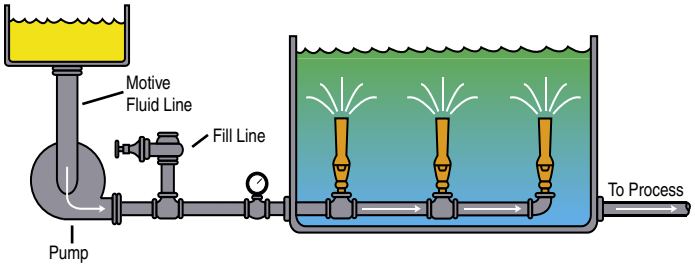
- Solids That Are Involved For Suspension

Model Specifications

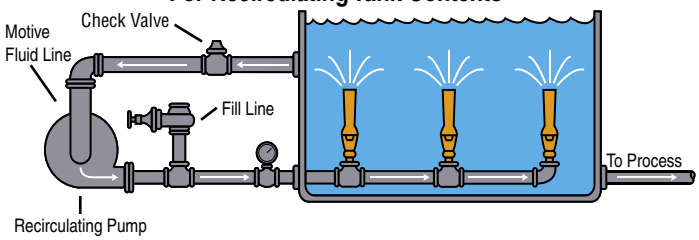
Model	SCTE Circulating Tank Eductor
Pressure differential of inlet to tank pressure	10-100 psig (70-690 kPag)
Mixing ratio	3:1
Max. operating liquid viscosity	up to 2000 cPs

Typical Applications

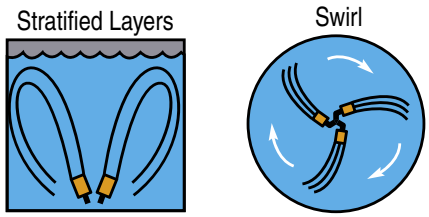
Typical Multiple SCTE Installation For Mixing Two Liquids

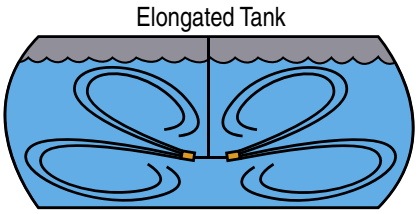


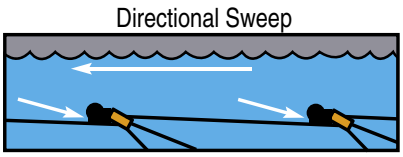
Typical Multiple SCTE Installation For Recirculating Tank Contents

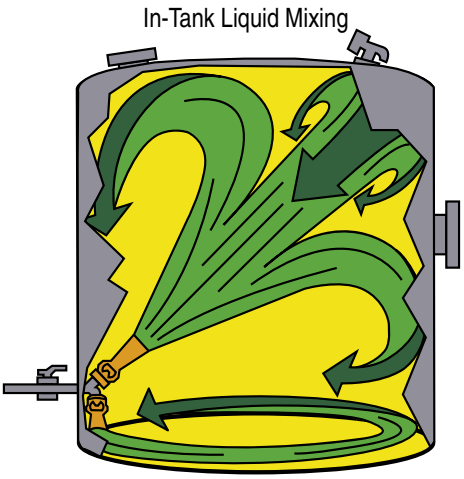


Different Mixing Configurations









Automatic Injectors
Standard, High & Low-Pressure

Ever since 1886, Penberthy Automatic Injectors have been key to building the company's reputation. Defined as a boiler feeding pump, the basic, time-tested design has changed little over the years. Using the velocity and condensation of a jet of steam from the boiler to lift and force into the same boiler a stream of water, these units are a testament to both operating simplicity and efficiency. Penberthy Automatic Injectors offer many benefits over more expensive mechanical pumps, where cold water make-up is used. These benefits include: durable construction, compact design with no mechanical parts, no foundation or floor space required, no external power source needed, low initial cost, easy to operate and virtually maintenance-free. Plus, the unique design allows warm water to feed the boiler without preheating.

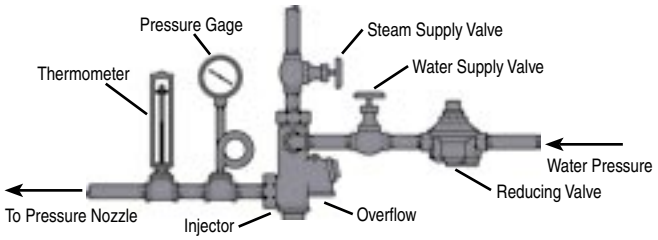
These units are available in ***Standard, High-Pressure and Low-Pressure Models*** *in a wide range of sizes and specifications. Typical applications include: primary boiler feed service, stand-by boiler feed service, preheating make-up water, injection of feedwater treatment compounds and high pressure/high temperature water supply. Over the years, Penberthy Automatic Injectors have performed flawlessly in unforgiving boiler room settings all around the globe. They can do the same for you!*

Models Available

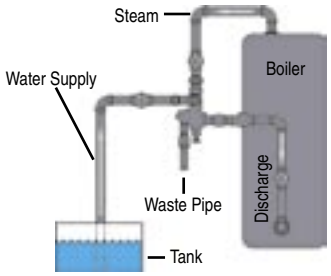
Standard, High-Pressure, Low-Pressure

Typical Applications

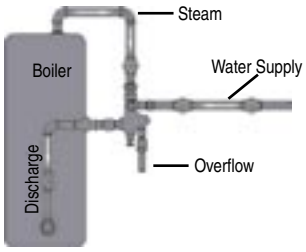
For Pressure Washing



Installation For Suction Lift



Installation For Water Pressure Supply



Selection Guide

Automatic injectors can be properly selected by focusing on information relating to the operating conditions of the application under which the injectors will be working. Once that information has been collected, your Penberthy sales representative can help select the proper automatic injector for the situation.

Standard Models Available

Size No.	*Boiler Horsepower Rating	Pipe Size Conn. In.
11-21	12	3/8
AA-21	25	1/2
BB-21	50	3/4
CC-21	85	1
DD-21	150	1 1/4
EE-23	250	1 1/2
FF-23	425	2
GG-21	600	2 1/2

Standard Injectors: Operating Specifications

Suction Lift Applications	
Minimum Operating Pressure	25 psi (172.5) steam pressure with 3ft. (0.9 m) lift and 74° F (23° C) water
Maximum Operating Pressure	up to 140 psi (965 kPa) steam pressure with 3ft. (0.9 m) lift and 74° F (23° C) water
Lift Water	20 ft. (6.1 m) @ 60-80 psi (414-552 kPa) steam pressure with 74° F (23° C) water
Maximum Temperature of Suction Water	3ft. (0.9 m) lift and steam pressure as follows: 120° F (49 °C) @ 60-80 psi (414-552 kPa) 115° F (46 °C) @ 100 psi (689 kPa) 105° F (40.5 °C) @ 120 psi (830 kPa) 90° F (29 °C) @ 140 psi (1380 kPa)

High-Pressure Models Available

Size No.	*Boiler Horsepower Rating	Pipe Size Conn. In.
00-326	12	3/8
AA-328	27	1/2
BB-330	50	3/4
CC-332	90	1
DD-334	140	1 1/4
EE-336	275	1 1/2
FF-338	450	2
GG-340	650	2 1/2

High-Pressure Injectors: Operating Specifications

Suction Lift Applications	
Minimum Operating Pressure	50 psi (345 kPa) steam pressure with 3ft. (0.9 m) lift and 74° F (23° C) water
Maximum Operating Pressure	up to 200 psi (1380 kPa) steam pressure with 3ft. (0.9 m) lift and 74° F (23° C) water
Lift Water	20 ft. (6.1 m) @ 80-120 psi (552-830 kPa) steam pressure with 74° F (23° C) water
Maximum Temperature of Suction Water	3ft. (0.9 m) lift and steam pressure as follows: 120° F (49° C) @ 120 psi (830 kPa) 115° F (46° C) @ 140 psi (689 kPa) 105° F (40.5° C) @ 170 psi (830 kPa) 85° F (29° C) @ 200 psi (1380 kPa)

Low-Pressure Models Available

Size No.	*Boiler Horsepower Rating	Pipe Size Conn. In.
00-526	12	3/8
AA-528	25	1/2
BB-530	50	3/4
CC-532	85	1
DD-534	125	1 1/4
EE-536	240	1 1/2
FF-538	400	2

Low-Pressure Injectors: Operating Specifications

Suction Lift or Water Supply Applications	
Minimum Operating Pressure	15 psi (100 kPa) steam pressure with 3ft. (0.9 m) lift and cold water
Maximum Operating Pressure	up to 100 psi (689 kPa) steam pressure with 3ft. (0.9 m) lift and cold water
Lift Water	3 ft. (0.9 m) lift max @ 20-100 psig steam (138-689 kPag) pressure

*Boiler horsepower rating based on supplying approximately 7 gallons of water per horsepower per hour with 3 ft suction lift and 140 psi steam pressure.

Each injector is supplied with all bronze pipe stainer one size larger than injector connection for installation at end of suction pipe.

Size 00-326 through DD-334 are provided with relief valve to facilitate starting at the lower steam pressures.

Size 00-326 injector is supplied with two small strainers for insertion in the steam and water supply union connections.

Automatic Sump Drainers
Models 2R-W, 2R-WL, 2R-S, 2R-SL

Do you have underground cable, wiring or piping with maintenance pits? These areas often have no electrical service readily available. So, in applications such as these, Penberthy Submersible Automatic Sump Drainers provide practical solutions. These reliable, failsafe units create a powerful pumping action by using either liquid or saturated steam as the operating medium ... all without electricity! Advantages such as these allow these units to function effectively in either primary pumping operations or on standby when electrical failure occurs. As a result, these units cannot be flooded out, require minimal upkeep and are unaffected by power outages. Capitalizing on a time-proven design, these units are available in either a space-saving non-loop design or an efficient loop configuration.They feature durable construction for long life, simple design, no need for electricity, no moving parts in jet pump to wear out, low initial cost, easy installation and are virtually maintenance-free.

***Model 2R-W** (non-loop) & **Model 2R-WL** (loop) operate with a liquid motive, while **Model 2R-S** (non-loop) & **Model 2R-SL** (loop) use a steam motive. Typical applications include: sump evacuation, steam service/ boiler room operations, general manufacturing installations, in-plant services and manufacturing processes of many types. So, in areas where access is limited, Penberthy Submersible Automatic Sump Drainers are the perfect choice!*

Models Available

2R-W, 2R-WL, 2R-S, 2R-SL

Selection Guide

Submersible Automatic Sump Drainers can be properly selected by focusing on the following information:

MOTIVE:
- Water or Steam
- Pressure (Available)
- Flow rate (Available volume)

SUCTION:
- Required Pumping Capacity

DISCHARGE:
- Pressure or Discharge Head (That unit must overcome)

Model Specifications: 2R-W, 2R-WL

Model	Pipe Connect (Outlet)	Pipe Connect (Inlet)	High Water	Drainer Diam.
2R-W	1 1/4" (31.8 mm)	3/4" (19.1 mm)	13 1/2" (343 mm)	12 7/8" (327 mm)
2R-WL	1 1/4" (31.8 mm)	3/4" (19.1 mm)	13 1/2" (343 mm)	12 7/8" (327 mm)

Model Specifications: 2R-S, 2R-SL

Model	Pipe Connect (Outlet)	Pipe Connect (Inlet)	High Water	Drainer Diam.
2R-S	1 1/4" (31.8 mm)	3/4" (19.1 mm)	13 1/2" (343 mm)	12 7/8" (327 mm)
2R-SL	1 1/4" (31.8 mm)	3/4" (19.1 mm)	13 1/2" (343 mm)	12 7/8" (327 mm)

2R-W/2R-WL Capacities: gph (lph) of Suction Flow

Model	Discharge Head in feet (meters)	Operating Water Pressure psig (kPag)									
		10 (69)	15 (103)	20 (138)	30 (207)	40 (276)	60 (414)	80 (552)	100 (689)	120 (827)	150 (1034)
2R-W	5 (1.5)	216 (817)	308 (1165)	417 (1578)	547 (2070)	888 (3361)	897 (3395)	1,071 (4053)	1,008 (3815)	999 (3781)	984 (3724)
	6 (1.8)		302 (1143)	401 (1517)	514 (1945)	740 (2600)	838 (3171)	1,060 (4012)	1,008 (3815)	999 (3781)	984 (3724)
	9 (2.7)				403 (1525)	559 (2115)	803 (3034)	1,048 (3466)	1,008 (3815)	999 (3781)	984 (3724)
	12 (3.7)					452 (1710)	702 (2657)	820 (3103)	1,008 (3815)	999 (3781)	984 (3704)
	15 (4.6)						629 (2360)	817 (3092)	966 (3656)	999 (3781)	984 (3724)
	18 (5.5)							708 (2699)	914 (3449)	999 (3481)	984 (3724)
2R-WL	5 (1.5)	240 (908)	342 (1294)	463 (1752)	608 (2301)	742 (2808)	930 (3520)	1,190 (4504)	1,120 (4239)	1,110 (4201)	1,093 (4137)
	6 (1.8)		335 (1267)	446 (1688)	571 (2161)	622 (2354)	1,042 (3943)	1,178 (4498)	1,120 (4239)	1,110 (4201)	1,093 (4137)
	9 (2.7)			273 (1033)	448 (1695)	621 (2350)	892 (3376)	1,164 (4405)	1,120 (4239)	1,110 (4201)	1,093 (4137)
	12 (3.7)				321 (1214)	502 (1400)	780 (2952)	1,022 (3868)	1,120 (4239)	1,110 (4201)	1,093 (4137)
	15 (4.6)					344 (1302)	684 (2588)	908 (3436)	1,073 (4061)	1,110 (4201)	1,093 (4137)
	18 (5.5)					207 (783)	542 (2051)	788 (2982)	1,015 (3841)	1,107 (4149)	1,093 (4137)

2R-S/2R-SL Capacities: gph (lph) of Suction Flow

Model	Discharge Head in feet (meters)	Operating Steam Pressure psig (kPag)									
		10 (69)	15 (103)	20 (138)	30 (207)	40 (276)	60 (414)	80 (552)	100 (689)	120 (827)	150 (1034)
2R-S	5 (1.5)	249 (942)	409 (1548)	524 (1983)	686 (4590)	940 (3557)	1,044 (3951)	1,035 (3917)	990 (3747)	963 (3644)	904 (3421)
	6 (1.8)		383 (1449)	476 (1801)	644 (2437)	862 (3262)	1,040 (3936)	1,035 (3917)	944 (3573)	963 (3614)	904 (3421)
	9 (2.7)				562 (2127)	721 (2728)	1,026 (3883)	1,040 (3936)	998 (3777)	963 (3644)	904 (3421)
	12 (3.7)					557 (2108)	880 (3330)	1,042 (3943)	990 (3747)	945 (3576)	904 (3421)
	15 (4.6)						703 (2660)	1,038 (3928)	990 (3747)	945 (3576)	904 (3421)
	18 (5.5)							873 (3304)	988 (3739)	864 (3270)	904 (3421)
2R-SL	5 (1.5)	328 (1241)	454 (1748)	582 (2202)	773 (2925)	1,044 (3951)	1,160 (4390)	1,150 (4352)	1,100 (4163)	1,070 (4049)	1,005 (3803)
	6 (1.8)		437 (1654)	529 (2002)	715 (2706)	958 (3626)	1,158 (4383)	1,140 (4314)	1,104 (4178)	1,070 (4049)	1,005 (3803)
	9 (2.7)				625 (2365)	801 (3031)	1,140 (4314)	1,155 (4371)	1,109 (4197)	1,070 (4049)	1,005 (3803)
	12 (3.7)					619 (2342)	978 (3701)	1,158 (4383)	1,100 (4163)	1,050 (3974)	1,005 (3803)
	15 (4.6)						781 (2956)	1,154 (4367)	1,100 (4163)	1,050 (3974)	1,005 (3803)
	18 (5.5)							970 (3671)	1,098 (4195)	1,050 (3974)	1,005 (3803)

Water Consumption – gph (lph)

2R-W	135 (510)	165 (624)	180 (681)	225 (851)	225 (851)	300 (1135)	345 (1305)	390 (1476)	420 (1599)	471 (1782)
2R-WL	135 (510)	165 (624)	180 (681)	225 (851)	225 (851)	300 (1135)	345 (1305)	390 (1476)	420 (1599)	471 (1782)

Steam Consumption – lbs./min. (kg/min.)

2R-S	0.47 (.21)	0.59 (.27)	0.69 (.31)	0.89 (.40)	1.10 (.50)	1.50 (.66)	1.80 (.83)	2.20 (1.0)	2.60 (1.2)	3.10 (1.4)
2R-SL	0.54 (.24)	0.66 (.30)	0.77 (3.5)	0.99 (.45)	1.20 (.54)	1.60 (.73)	2.00 (.93)	2.50 (1.1)	2.90 (1.3)	3.50 (1.6)

** All suction flow rates are based upon water at 70° F (21° C)

Problems/Solutions Using Jet Pumps

WATER/WASTE WATER TREATMENT

Problem: 1) A water treatment plant wanted to entrain activated carbon as a filtering media to treat and regenerate application material to meet EPA regulations prior to disposing in a sewer.
Solution: A Penberthy Model ELL was used to hydraulically transport the carbon media. Model LM could also have been used.
Problem: 2) A treatment facility needed to pump and mix a variety of chemicals in a water stream to control pH levels.
Solution: Using a Penberthy L Series liquid motive jet, they were able to do this in-line.

AUTOMOTIVE INDUSTRY

Problem:
1) Assemblers had to hold windshields in place during assembly.
Solution: Using a Penberthy G Series jet, they were able to generate a vacuum to hold the windshield while it was positioned.
Problem: 2) A tire manufacturer needed to evacuate steam from a bladder in order for the tire to be removed from the tire press.
Solution: A Penberthy G Series jet was installed to evacuate the steam and speed up the production cycle.
Problem: 3) Settling of materials in electrocoat and pretreatment tanks in automotive paint lines had to be eliminated in order to improve overall paint quality.
Solution: Installation of Penberthy Model TME (Tank Mixing Eductors) provided low electrical conductivity and smooth mixing flow characteristics, improving paint finishes.

ENVIRONMENTAL GROUND WATER TESTING

Problem: A chemist required an efficient method of extracting ground water samples for chemical analysis.
Solution: Using Penberthy Series L jet pumps, samples were taken and transferred to holding tanks for evaluation and testing.

RAILCAR CLEANING

Problem: Railcars need an effective method of removing a variety of powdered materials.
Solution: A simple and effective method would be to use a Penberthy GST Model jet using compressed air as the motive.

BARGE TERMINALS/ BARGE CLEANING

Problem:
Barge terminal operators need a cost-effective method of removing rainwater from barges.
Solution: Penberthy Model L Series jet pumps are used to hydraulically pump the water from the barge. This water is transported into another barge for testing and treatment before being discharged back into the river.

BREWERIES

Problem: A brewery needed to heat liquids as part of the pasteurization process.
Solution: Using a Penberthy Model SRH, the liquid was heated and pasteurized in-line. In this application, processing was improved by over 30%.

WATER COLLECTION PITS

Problem: A number of businesses and homeowners needed an effective way to remove water from sump pits during flooding.
Solution: Penberthy Sump Drainer and L Series jets provided a reliable methods of removing the water using no electrical power.

Problems/Solutions Using Jet Pumps

CORN PROCESSING PLANTS

Problem: A corn processing plant needed an inexpensive and efficient method of removing carbon dust from the bottom of their furnaces.
Solution: They attached a perforated pipe to the suction inlet of a Penberthy Model LM jet, and using water as the motive, a vacuum was created sucking up the carbon dust.

PLASTICS INDUSTRIES

Problem: The company needed an effective means of detecting leaks in molds.
Solution: By using a Penberthy Model LM jet with the suction hooked up to the mold, they were able to generate a vacuum which detected leaks in the mold or seals.

MIXING/BLENDING APPLICATIONS

Problem: 1) A storage tank manufacturer needed to move dry solids–diatomaceous earth–into a blending tank.
Solution: Using a Penberthy Model LM with a Penberthy Washdown Hopper, they were able to mix the earth with the motive fluid and transport it into the blending tank. Once in the tank, a Penberthy Model CTE was used to provide continuous in-tank mixing.

BOAT DOCKS

Problem: Boats sitting in a marina during the winter months became immobilized due to ice build-up.
Solution: Using a Penberthy Model CTE, warmer water was brought to the surface preventing the water from freezing.

TANK HEATING

Problem: A company needed to maintain a minimum liquid temperature in their tanks, regardless of outside ambient temperatures.
Solution: Using a Penberthy Model CTE as an in-tank heater in conjunction with a simple temperature control system, steam was mixed with the liquid when the outside temperature fell below a certain level.

TRANSPORTING SOLIDS

Problem: A manufacturer of silo systems for wastewater treatment that used wetting cones with powdered activated carbon needed a means of moving the resulting slurry.
Solution: By installing various Penberthy Series L liquid motive jets at the bottom of each cone, the manufacturer was able to move the slurry away using water as the motive.

FOOD PROCESSING

Problem: A processor of potato chips wanted to heat water in a blancher to remove potato skins.
Solution: A Penberthy Model SRH was installed at the bottom of a tank. The water draining from the tank had sufficient head pressure to mix with the steam to allow recirculation back into the tank as well as reaching desired temperature.

HEATING SYSTEMS

Problem: Condensation pits associated with underground heating systems needed to be emptied.
Solution: A Penberthy Model 2-R Sump Drainer was installed in each pit. This stand-alone system uses water as the motive and requires no electrical power.

Additional Jet Pump Products

Wrench-Flat Design:
All Penberthy jet pumps from 1/2″ to 3″ have a standard wrench flat to allow ease of assembly. This eliminates the need for a pipe wrench and minimizes damage to the body.

Flocculant Dispersers:
When powder must be combined with water to create chemical concentrations, Penberthy Model 62DP Flocculant Dispersers provide the perfect mix. Dispersers can effectively wet 5 pounds of powder for every 10 to 15 gallons of water operating with supply water pressures from 20 to 100 psig.

Ceramic Nozzle Jet Pumps:
When dealing with solids or slurries the interior of the jet nozzle can wear quickly. To minimize this wear the nozzle is lined with ceramic material. The body is cast stainless steel. This design allows either part to be replaced.

Fluoroelastomer Lined Jet Pumps:
For erosive or corrosive applications dealing with solids or slurries, the interior of the jet pump body and/or nozzle can erode quickly. Lining the jet pump with fluoroelastomeric material will significantly increase the service life of these units, minimizing premature erosion to the body.

Tefzel™ Lined Eductors:
In erosive/corrosive applications, Penberthy Tefzel™ Lined Eductors offer a durable lined interior surface that performs flawlessly, even when subjected to internal temperatures of up to 300°F. Tefzel™ lining can extend jet pump service life in cases where abrasive solids and slurries accelerate wear.

In addition to its standard line of jet pumps, Penberthy offers a variety of components and specialty products. These devices either complement existing jet pumps or are complete stand-alone systems. Penberthy also provides full application assistance to help solve your pumping, mixing and heating applications. For more information about any jet pump product or related jet pump accessory, please contact Penberthy direct or your nearest distributor.

PENTAIR VALVES & CONTROLS

Form No. PEN008REV50310M Printed in USA