# **PENBERTHY** SERIES ELL, HLM, SRH, NWH, CTE AND XL-32 FOR HEATING LIQUIDS

Practical, simple and cost-effective alternatives for heating liquids in-line or in an open tank


## FEATURES

- Simple design with no moving parts to wear out.
- No packing glands.
- No lubrication required.
- Virtually maintenance-free.
- Easy to install without special structures or foundations.
- Cast or fabricated constructions.
- Variety of materials to suit specific characteristics of the process liquids.
- Critical flow paths machined smoothly with no abrupt turns or steps, producing the most efficient flow during the motive function.

## GENERAL APPLICATION

Applications for inline heaters include: circulating cleaning solutions, pasteurization, producing scalding sprays, sterilization, heating water, blanching, exchanging heat, degreasing, heating slurries, laundering, cooking, pickling, bonderizing, quenching and tempering. For open tank heaters: cooking grain, mash or starch, heating and circulating, mixing.

## TECHNICAL DATA

| | |
|---|---|
| Materials: | Low lead bronze, iron, carbon steel, 316 SS |
| Sizes: | ¼" to 12" |
| Pressure (max): | 150 psig (10.3 barg) |
| Temperature (max): | to 216°F (102°C) |

## PRODUCT OVERVIEW

Two series of Penberthy steam jet heaters are used for heating liquids in line. Four individual models are available for heating liquids in tanks.

Models ELL, HLM and SRH in-line mixers can heat in-line while transporting the process media. Steam jet heaters optimize the condensation of steam into the motive medium to heat the fluid.

NWH water heaters, CTE circulating tank eductors and XL-32 heaters are open tank heaters that combine steam and liquid in vessels where contents may be recirculated.

**Operation**
Steam jet heaters optimize the condensing of steam into operating liquids to provide efficient fluid heating. They are essentially jet pumps and, as such, operate on the principle of one fluid entraining a second fluid.

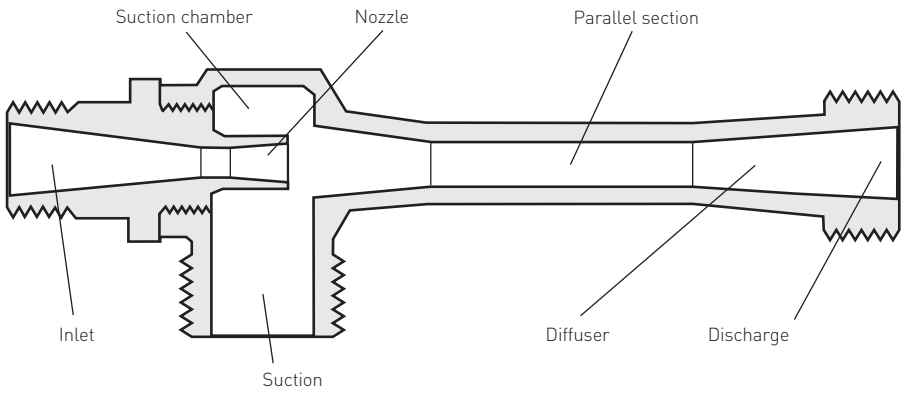
Steam jet heaters have three common features (designations may vary according to design): inlet, suction and discharge.

Inlet - The operating liquid (sometimes called the motive) under pressure enters the inlet and travels through the nozzle into the suction chamber. The nozzle converts the pressure of the operating liquid into a high velocity stream, which emerges from the discharge side of the inlet nozzle.

Suction - Pumping action begins when steam in the suction chamber is entrained by the high velocity operating liquid stream emerging from the inlet nozzle, lowering the pressure in the suction chamber. The resulting action causes the steam in the suction chamber to flow toward the discharge.

Discharge (sometimes called outlet) - The entrained steam in the suction chamber mixes and condenses into the operating liquid and acquires part of its energy, flowing into the parallel section. In the diffuser section, part of the velocity of the mixture is converted into a pressure greater than the suction pressure, but lower than the inlet pressure.

TYPICAL STEAM JET HEATER (OR JET PUMP)



## USING LIQUID AS THE OPERATING (inlet) MEDIUM, STEAM AS A SUCTION STREAM HEAT SOURCE

Models ELL, HLM and SRH are available for heating liquids in line. These models are ejector-type heaters capable of operating at steam pressures lower than the operating liquid pressure. They offer much higher BTU input than a comparable steam ring heater, while incurring a higher inlet-to-discharge pressure drop.

ELL and HLM models are typically used as single pass devices. The SRH-steam ring heater is a low pressure drop inline heater for single pass or multipass applications.

These inline heaters provide heat and operating pressure for cleaning solution circulation, producing scalding sprays, heating water and slurries, exchanging heat and cooking. The table lists the operating parameters of each.

**TABLE 1 - MODEL SPECIFICATIONS**

| Model | ELL Low steam pressure | HLM High steam pressure | SRH Steam ring heater |
|---|---|---|---|
| Steam pressure | up to 45 psig (310 kPag) | up to 120 psig** (830 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) |
| Max. capacity | 5000 gpm (18925 lpm) | 5000 gpm (18925 lpm) | 500 gpm (1893 lpm) |

* Based on 60°F inlet water

** Max. steam pressure for iron body material, 60 psig

## SELECTING THE APPROPRIATE HEATER

To choose the appropriate inline heater for the application, compare the available steam pressure to the line pressure of the liquid to be heated. If the steam pressure is lower than or equal to the liquid pressure, an ELL or HLM heater must be used. If the steam pressure is higher than the liquid pressure, the ELL, HLM or SRH can be used. In this latter case, the ELL and HLM offer higher steam flows than the SRH (see Table 1). In on/off heating applications or during periods when steam input is halted, the ELL and HLM produce very large pressure drops. The SRH maintains its low pressure drop characteristics even when steam input is removed.

When using the HLM or ELL heater and when the discharge pressure exceeds one third of the operating pressure, the heater discharge pressure should be lowered during start-up, until the heater is operating, i.e. until both steam and water flows are established.

## ELL, HLM MODELS

Each of the two models is available in 15 sizes from ½" to 12" suction and discharge.
Units are cast construction in ½" through 4" sizes. Sizes 4" through 12" are available in fabricated construction.

**Cast unit connections**
Units ½" through 3" in size have NPT inlet, suction and discharge connections. 4" size has NPT inlet and flanged suction and discharge. Flanges on cast units are flat faced with holes, sizes and spacing corresponding to 150 lb ANSI flanges.

**Fabricated unit connections**
All fabricated ELL and HLM units, 4" through 12" sizes, have flat faced flanges with holes, sizes and spacing corresponding to 150 lb ANSI flanges.

**NOTE**
Always specify material, model and until size when ordering.

**TABLE 2 - MODEL CONSTRUCTION DATA**

| Model | ELL, HLM | Standard materials |
|---|---|---|
| Sizes available | ½"A - 4" | Cast: Low lead bronze, iron, C. steel, 316 STS |
| | 4" and up | Fabricated: Carbon steel, 316 STS |

The ELL and HLM heaters operate with direct connections from steam and liquid lines.
Though application and performance characteristics vary between the two, steam consumption is equal for a given temperature rise. As a general rule, steam flow is calculated as follows:

$$Q_s = \frac{Q_m \, \Delta T}{120}$$

Where:
$Q_s$ = steam flow in lbs/min
$Q_m$ = operating liquid in gpm
$\Delta T$ = temperature rise in °F

The following general operating characteristics will help in selecting the correct model heater:

ELL operates on generally low to medium suction steam pressure (from 25" Hg vacuum to 45 psig). Performance capabilities include up to 182°F temperature rise and up to 94 psig discharge pressure.

HLM operates over the widest range of performance characteristics and is usually the choice for most heating applications. It operates in a high steam pressure range (up to 120 psig), produces a high temperature rise (up to 216°F) at a high discharge pressure (up to 184 psig).

**Heater selection using performance charts**
The following information is required to select the correct model:
- Operating liquid (for liquids other than water, consult the factory)
- Operating liquid inlet pressure, psig ($h_m$)
- Desired operating liquid capacity, gpm ($Q_m$)
- Operating liquid inlet temperature, °F (contact the factory when operating liquid inlet temperature exceeds 100°F)
- Desired temperature rise, °F ($\Delta T$)
- Available steam pressure, psig ($h_s$)
- Minimum discharge pressure required, psig ($h_d$)
- Quality of steam available, i.e. saturated or superheated

## ELL, HLM MODELS

Evaluating both the ELL and HLM is recommended before choosing the model that best fits the operating conditions, by using the following procedure:

Step 1 - Refer to the heater performance chart for the selected model.
Locate the operating liquid (water) pressure psig ($h_m$) for your application.
Step 2 - In this ($h_m$) row, read across to find the desired temp. rise °F and note the steam pressure ($h_s$), disch. press. psig (hd) and liquid flow ($Q_m$).
Step 3 - The performance charts indicate the capacities of 1½" units. To select units closest to actual requirements (one that equals or exceeds the required flow) it may be necessary to calculate several sizes other than 1½" (refer to the example).

**Example**
To heat operating liquid 100 gpm water ($Q_m$) from 60 to 185° (ΔT 125°F)
Operating liquid, psig ($h_m$): 40
Available steam pressure ($h_s$): 150
Minimum discharge pressure required ($h_d$): 25

From the HLM performance chart:
Opposite 40 psig operating liquid inlet pressure ($h_m$) locate desired temperature rise (ΔT) 125°F (between 121 and 132). The required steam pressure (hs) will be between 40 and 45 psig. The discharge pressure ($h_d$) is greater than the minimum pressure required. The liquid flow ($Q_m$) is 23 gpm which is below the requirement of 100 gpm.

To select a larger unit for the 100 gpm requirement, try the next available sizes - the 2", 2½" and 3" units using the capacity factors in the chart.

2" size CF = 1.82
Heating capacity = 23*1.82 = 41 gpm (too low)
2½" size CF = 3.17
Heating capacity = 23*3.17 = 73 gpm (too low)
3" size CF = 5.92
Heating capacity = 23*5.92 = 136 gpm (exceeds requirements)

Repeat this procedure for the ELL
In this example, the ELL-3 comes closest to fitting the requirements. However, the steam pressure supplied to the ELL-3 would have to be throttled down from 150 psig to only 8 psig. This degree of throttling may be impractical, so the HLM-3 would be the more appropriate choice.

## ELL, HLM MODELS - PERFORMANCE

**TABLE 3 - 1½ MODEL ELL HEATER PERFORMANCE CHART (water)**

| Operating water, psig ($h_m$) | Data description | Steam pressure ($h_s$) | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Inches Hg. vacuum | | | | | Pounds per square inch gauge | | | | | | | | | | | | | | | | | | | | | | |
| | | 25" | 20" | 15" | 10" | 5" | 0 | 2 | 4 | 5 | 6 | 8 | 10 | 12 | 14 | 15 | 16 | 18 | 20 | 22 | 24 | 25 | 26 | 28 | 30 | 35 | 40 | 45 |
| 20 | * | - | - | 40 | 60 | 77 | 100 | 115 | 126 | 133 | 140 | 150 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | ** | - | - | 0 | 0 | 8 | 10 | 12 | 14 | 14 | 14 | 14 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | *** | - | - | 10 | 10 | 10 | 15 | 15 | 15 | 14 | 14 | 14 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 30 | * | 9 | 24 | 36 | 56 | 69 | 86 | 100 | 113 | 118 | 123 | 136 | 144 | 154 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | ** | 0 | 5 | 8 | 15 | 18 | 19 | 20 | 21 | 21 | 21 | 21 | 21 | 21 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | *** | 21 | 21 | 21 | 21 | 20 | 20 | 19 | 18 | 18 | 18 | 17 | 17 | 15 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 40 | * | 11 | 25 | 36 | 52 | 85 | 80 | 90 | 99 | 105 | 111 | 128 | 132 | 143 | 153 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | ** | 5 | 6 | 13 | 18 | 22 | 25 | 26 | 27 | 28 | 29 | 29 | 30 | 30 | 30 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | *** | 23 | 23 | 23 | 23 | 22 | 22 | 22 | 22 | 21 | 21 | 20 | 20 | 19 | 19 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 50 | * | 14 | 22 | 36 | 48 | 60 | 79 | 83 | 92 | 96 | 100 | 111 | 122 | 130 | 139 | 145 | 150 | - | - | - | - | - | - | - | - | - | - | - |
| | ** | 8 | 10 | 11 | 19 | 24 | 27 | 30 | 31 | 32 | 34 | 35 | 36 | 36 | 37 | 37 | 37 | - | - | - | - | - | - | - | - | - | - | - |
| | *** | 25 | 25 | 25 | 25 | 25 | 25 | 24 | 24 | 24 | 23 | 23 | 22 | 22 | 22 | 21 | 21 | - | - | - | - | - | - | - | - | - | - | - |
| 60 | * | 14 | 22 | 31 | 43 | 57 | 71 | 76 | 84 | 89 | 94 | 104 | 112 | 120 | 126 | 131 | 134 | 147 | - | - | - | - | - | - | - | - | - | - |
| | ** | 12 | 14 | 16 | 24 | 28 | 29 | 32 | 33 | 34 | 36 | 39 | 41 | 42 | 43 | 43 | 41 | 41 | - | - | - | - | - | - | - | - | - | - |
| | *** | 27 | 27 | 27 | 27 | 27 | 27 | 26 | 26 | 26 | 26 | 25 | 25 | 24 | 24 | 24 | 23 | 23 | - | - | - | - | - | - | - | - | - | - |
| 70 | * | 14 | 34 | 36 | 47 | 56 | 64 | 73 | 78 | 83 | 88 | 96 | 105 | 112 | 122 | 125 | 128 | 140 | 148 | - | - | - | - | - | - | - | - | - |
| | ** | 13.5 | 16 | 18 | 28 | 30 | 35 | 38 | 38 | 38 | 39 | 42 | 44 | 44 | 44 | 44 | 44 | 44 | 44 | - | - | - | - | - | - | - | - | - |
| | *** | 29 | 29 | 29 | 29 | 29 | 29 | 29 | 20 | 20 | 20 | 27 | 27 | 27 | 27 | 26 | 26 | 26 | 26 | - | - | - | - | - | - | - | - | - |
| 80 | * | 10 | 20 | 32 | 44 | 54 | 82 | 88 | 78 | 80 | 82 | 90 | 97 | 104 | 112 | 115 | 118 | 127 | 144 | 150 | - | - | - | - | - | - | - | - |
| | ** | 17 | 18 | 21 | 26 | 32 | 37 | 38 | 40 | 42 | 44 | 45 | 46 | 49 | 48 | 48 | 48 | 48 | 48 | 48 | - | - | - | - | - | - | - | - |
| | *** | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 30 | 30 | 29 | 29 | 29 | 28 | 28 | 28 | 28 | 28 | - | - | - | - | - | - | - | - |
| 90 | * | 10 | 22 | 30 | 42 | 50 | 64 | 65 | 72 | 76 | 80 | 88 | 92 | 100 | 108 | 111 | 113 | 120 | 128 | 138 | 141 | - | - | - | - | - | - | - |
| | ** | 20 | 22 | 23 | 27 | 35 | 39 | 42 | 44 | 45 | 48 | 58 | 52 | 53 | 56 | 56 | 57 | 59 | 59 | 59 | 59 | - | - | - | - | - | - | - |
| | *** | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 31 | 31 | 31 | 31 | 30 | 30 | 29 | 29 | - | - | - | - | - | - | - |
| 100 | * | 7 | 17 | 26 | 40 | 48 | 68 | 70 | 72 | 74 | 80 | 86 | 92 | 95 | 99 | 102 | 108 | 114 | 120 | 127 | 134 | 140 | 144 | 149 | 154 | 172 | 182 | - |
| | ** | 23 | 24 | 26 | 29 | 35 | 42 | 44 | 46 | 48 | 51 | 54 | 56 | 57 | 58 | 59 | 60 | 63 | 65 | 67 | 69 | 70 | 71 | 72 | 73 | 76 | 76 | - |
| | *** | 33 | 33 | 33 | 33 | 33 | 33 | 33 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 31 | 31 | 31 | 31 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | - |
| 120 | * | 7 | 10 | 20 | 37 | 44 | 59 | 63 | 67 | 69 | 73 | 76 | 82 | 88 | 92 | 97 | 101 | 106 | 111 | 116 | 121 | 125 | 127 | 132 | 137 | 155 | 169 | 180 |
| | ** | 28 | 30 | 32 | 34 | 37 | 48 | 51 | 53 | 54 | 56 | 59 | 61 | 64 | 67 | 68 | 69 | 71 | 73 | 76 | 78 | 80 | 81 | 82 | 83 | 86 | 90 | 90 |
| | *** | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 35 | 35 | 35 | 35 | 35 | 34 | 34 | 34 | 33 | 33 | 33 | 32 | 32 | 32 | 32 | 32 |
| 140 | * | 6 | 14 | 24 | 34 | 43 | 54 | 58 | 61 | 63 | 67 | 74 | 80 | 84 | 88 | 91 | 94 | 98 | 104 | 108 | 112 | 114 | 118 | 124 | 130 | 140 | 156 | 168 |
| | ** | 34 | 38 | 38 | 41 | 43 | 50 | 54 | 58 | 60 | 62 | 68 | 69 | 72 | 74 | 75 | 76 | 78 | 80 | 83 | 85 | 88 | 88 | 91 | 94 | 94 | 94 | 94 |
| | *** | 39 | 39 | 39 | 39 | 39 | 39 | 39 | 39 | 39 | 39 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 |

* Temp rise - °F (ΔT)
** Disch press - psig ($h_d$)
*** Liquid flow - gpm ($Q_m$)

**NOTE**
All data based on 32°-100°F operating liquid temperatures. For other temperatures, consult factory.

**CAUTION**
*Attempted operation within the areas to the right of the figures will cause uncondensed steam to discharge from the heater.*

## ELL, HLM MODELS - PERFORMANCE

### TABLE 4 - 1½ MODEL HLM HEATER PERFORMANCE CHART (water)

| Operating water, psig ($h_m$) | Data description | Steam pressure ($h_S$) | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Inches Hg. Vacuum | | | | | Pounds per square inch gauge | | | | | | | | | | | | | | | |
| | | 25" | 20" | 15" | 10" | 5" | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 |
| 10 | * | - | - | 24 | 32 | 40 | 55 | 64 | 106 | 127 | 144 | 166 | - | - | - | - | - | - | - | - | - | - | - |
| | ** | - | - | 4 | 4 | 6 | 17 | 20 | 24.5 | 30.5 | 34 | 30 | - | - | - | - | - | - | - | - | - | - | - |
| | *** | - | - | 17 | 17 | 16 | 16 | 15 | 15 | 14 | 14 | 12 | - | - | - | - | - | - | - | - | - | - | - |
| 20 | * | - | 15 | 20 | 25 | 34 | 61 | 64 | 80 | 88 | 107 | 120 | 134 | 152 | - | - | - | - | - | - | - | - | - |
| | ** | - | 4 | 7 | 10 | 15 | 20 | 25 | 30 | 35 | 30 | 42 | 46 | 51 | - | - | - | - | - | - | - | - | - |
| | *** | - | 20 | 20 | 20 | 20 | 20 | 19 | 19 | 18 | 18 | 18 | 17 | 16 | - | - | - | - | - | - | - | - | - |
| 30 | * | 1 | 12 | 18 | 23 | 30 | 55 | 58 | 65 | 77 | 90 | 103 | 114 | 128 | 140 | 153 | 185 | - | - | - | - | - | - |
| | ** | 5 | 7 | 8.5 | 11 | 15 | 22 | 27 | 33 | 37 | 41 | 45 | 52 | 55 | 60 | 65 | 75 | - | - | - | - | - | - |
| | *** | 23 | 23 | 23 | 23 | 22 | 23 | 23 | 22 | 22 | 22 | 22 | 22 | 20 | 20 | 19 | 18 | - | - | - | - | - | - |
| 40 | * | 4 | 10 | 14 | 20 | 27 | 42 | 54 | 57 | 67 | 81 | 91 | 102 | 121 | 132 | 144 | 170 | 190 | - | - | - | - | - |
| | ** | 8 | 11 | 14 | 17 | 20 | 25 | 28 | 32 | 37 | 42 | 48 | 53 | 57 | 62 | 68 | 77 | 80 | - | - | - | - | - |
| | *** | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 24 | 24 | 24 | 23 | 23 | 23 | 22 | 21 | 21 | - | - | - | - | - |
| 50 | * | 3 | 6 | 14 | 19 | 22 | 36 | 47 | 57 | 68 | 80 | 90 | 102 | 112 | 122 | 132 | 161 | 180 | 200 | - | - | - | - |
| | ** | 12 | 15 | 17 | 21 | 23.5 | 30 | 35 | 40 | 45 | 50 | 55 | 64 | 68 | 70 | 75 | 85 | 96 | 101 | - | - | - | - |
| | *** | 28 | 28 | 28 | 28 | 28 | 27 | 27 | 27 | 26 | 26 | 26 | 26 | 25 | 25 | 24 | 23 | 23 | 22 | - | - | - | - |
| 60 | * | 2 | 8 | 12 | 18 | 22 | 34 | 44 | 54 | 64 | 73 | 82 | 92 | 100 | 110 | 120 | 142 | 162 | 184 | 204 | - | - | - |
| | ** | 14 | 19 | 21 | 24 | 27 | 35 | 36 | 44 | 50 | 55 | 61 | 66 | 71 | 75 | 80 | 83 | 101 | 104 | 105 | - | - | - |
| | *** | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 29 | 29 | 29 | 28 | 28 | 28 | 27 | 27 | 25 | 25 | 24 | 24 | - | - | - |
| 70 | * | 3 | 7 | 12 | 17 | 21 | 33 | 42 | 51 | 60 | 69 | 78 | 85 | 94 | 103 | 112 | 130 | 148 | 168 | 188 | 200 | - | - |
| | ** | 18 | 21 | 25 | 28 | 31 | 38 | 43 | 48 | 53 | 58 | 65 | 69 | 73 | 79 | 85 | 92 | 104 | 103 | 122 | 133 | - | - |
| | *** | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 31 | 31 | 31 | 31 | 30 | 30 | 30 | 30 | 29 | 28 | 27 | 26 | 26 | - | - |
| 80 | * | 4 | 8 | 12 | 15 | 20 | 32 | 40 | 46 | 55 | 64 | 71 | 80 | 90 | 95 | 105 | 115 | 142 | 154 | 165 | 174 | 212 | - |
| | ** | 22 | 26 | 29.5 | 31 | 34 | 42 | 48 | 52 | 57 | 62 | 65 | 72 | 72 | 79 | 86 | 91 | 107 | 113 | 128 | 138 | 142 | - |
| | *** | 33 | 33 | 33 | 33 | 33 | 33 | 33 | 33 | 33 | 32 | 32 | 32 | 32 | 31 | 31 | 31 | 30 | 30 | 29 | 28 | 27 | - |
| 90 | * | 3 | 8 | 11 | 15 | 20 | 30 | 37 | 44 | 51 | 60 | 69 | 76 | 86 | 91 | 97 | 116 | 132 | 146 | 160 | 175 | 196 | 215 |
| | ** | 27 | 29 | 33 | 36 | 38 | 43 | 51 | 55 | 61 | 66 | 72 | 76 | 81 | 85 | 90 | 101 | 112 | 120 | 131 | 140 | 144 | 163 |
| | *** | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 34 | 34 | 34 | 34 | 34 | 34 | 33 | 33 | 32 | 32 | 31 | 31 | 29 | 29 |
| 100 | * | 2 | 6 | 10 | 14 | 19 | 30 | 38 | 41 | 50 | 56 | 62 | 70 | 80 | 87 | 94 | 108 | 123 | 140 | 150 | 164 | 184 | 196 |
| | ** | 28 | 30 | 32.5 | 38 | 41 | 45 | 54 | 59 | 64 | 69 | 73 | 78 | 84 | 89 | 95 | 104 | 114 | 126 | 132 | 142 | 154 | 155 |
| | *** | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 35 | 35 | 34 | 34 | 33 | 33 | 33 | 32 | 31 |
| 120 | * | 2 | 6 | 10 | 13 | 17 | 28 | 30 | 39 | 45 | 52 | 59 | 65 | 72 | 79 | 88 | 98 | 115 | 128 | 145 | 155 | 168 | 189 |
| | ** | 30 | 37 | 40 | 45 | 49 | 58 | 61 | 66 | 71 | 78 | 80 | 88 | 91 | 96 | 100 | 112 | 123 | 132 | 145 | 150 | 161 | 174 |
| | *** | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 39 | 39 | 39 | 39 | 39 | 38 | 37 | 37 | 36 | 36 | 35 | 35 |
| 140 | * | 2 | 5 | 10 | 12 | 15 | 27 | 30 | 36 | 44 | 49 | 55 | 61 | 66 | 71 | 77 | 90 | 103 | 116 | 125 | 144 | 158 | 170 |
| | ** | 38 | 47 | 50 | 53 | 58 | 64 | 67 | 72 | 82 | 83 | 88 | 96 | 97 | 102 | 108 | 120 | 130 | 139 | 148 | 162 | 172 | 184 |
| | *** | 43 | 43 | 43 | 43 | 43 | 43 | 43 | 42 | 42 | 42 | 42 | 42 | 42 | 42 | 42 | 42 | 40 | 40 | 40 | 40 | 39 | 39 |

* Temp rise - °F (ΔT)
** Disch press - psig ($h_d$)
*** Liquid flow - gpm ($Q_m$)

**NOTE**
All data based on 32°-100°F operating liquid temperatures. For other temperatures, consult factory.

**CAUTION**
*Attempted operation within the areas to the right of the figures will cause uncondensed steam to discharge from the heater.*

### TABLE 5 - ELL, HLM CAPACITY FACTOR

| ½A | ½B | ½ | ¾ | 1 | 1¼ | 1½ | 2 | 2½ | 3 | 4 | 6 | 8 | 10 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.03 | 0.047 | 0.121 | 0.208 | 0.344 | 0.613 | 1 | 1.82 | 3.17 | 5.92 | 11.8 | 24 | 49 | 71 | 123 |

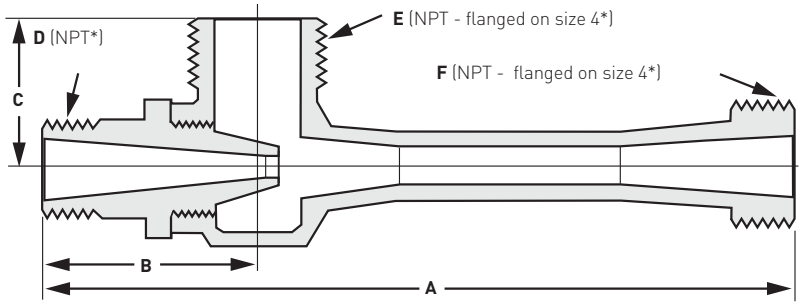



**TABLE 6 - CAST ELL, HLM DIMENSIONS (in inches)**

| Size | A | B | C | D | E* | F* |
|---|---|---|---|---|---|---|
| ½ A | 4⅜ | 1½ | 1¼ | ¼ | ½ | ½ |
| ½ B | 4⅜ | 1½ | 1¼ | ¼ | ½ | ½ |
| ½ | 4½ | 1⅝ | 1¼ | ⅜ | ½ | ½ |
| ¾ | 5⅞ | 2 | 1½ | ½ | ¾ | ¾ |
| 1 | 7⅛ | 2¼ | 1¾ | ¾ | 1 | 1 |
| 1¼ | 9 | 2½ | 2¼ | 1 | 1¼ | 1¼ |
| 1½ | 11 | 2¾ | 2½ | 1 | 1½ | 1½ |
| 2 | 14⅜ | 3⅛ | 3 | 1¼ | 2 | 2 |
| 2½ | 18⅛ | 3½ | 4⅛ | 1½ | 2½ | 2½ |
| 3 | 23⅞ | 4 | 5 | 2 | 3 | 3 |
| 4 | 32⅞ | 5 | 6 | 3 | 4❖ | 4❖ |

* All cast units have NPT connections except: 4" size has NPT inlet, flanged suction and discharge
❖ flange

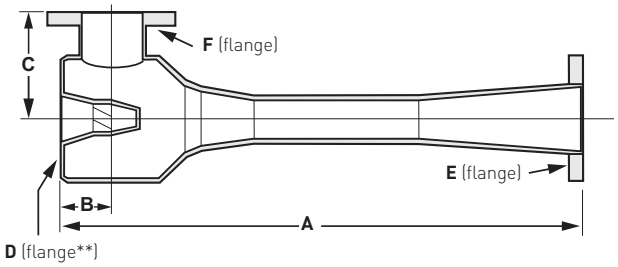



**TABLE 7 - FABRICATED ELL DIMENSIONS (in inches)**

| Size | A | B | C | D** | E | F |
|---|---|---|---|---|---|---|
| 4 | 38¼ | 5¼ | 8 | 3 | 4 | 4 |
| 6 | 52⅞ | 5⅞ | 9½ | 4 | 6 | 6 |
| 8 | 74 7/16 | 8 7/16 | 13 | 6 | 8 | 8 |
| 10 | 87⅜ | 10⅜ | 14 | 8 | 10 | 10 |
| 12 | 110¾ | 11¾ | 18 | 10 | 12 | 12 |

** Inlet flanges on fabricated units have blind tapped holes.

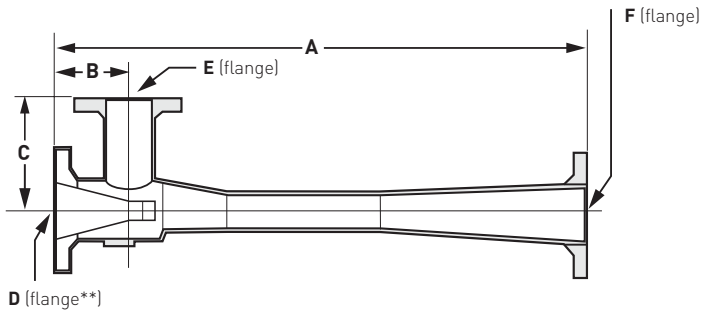



**TABLE 8 - FABRICATED HLM DIMENSIONS (in inches)**

| Size | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| 4 | 38¼ | 5¼ | 8 | 4 | 3 | 4 |
| 6 | 52⅞ | 5⅞ | 9½ | 6 | 4 | 6 |
| 8 | 74 7/16 | 8 7/16 | 13 | 8 | 6 | 8 |
| 10 | 87⅜ | 10⅜ | 14 | 10 | 8 | 10 |
| 12 | 110¾ | 11¾ | 18 | 12 | 10 | 12 |

## MODEL SRH

SRH (Steam Ring Heaters) are compact, inline units with low pressure drop. SRH units inject steam through a ring-shaped opening within an enlargement in the pipeline. Liquid passes through and around the ring. Heat is introduced by the direct condensation of steam. They provide fast temperature correction noiselessly and without vibration if applied correctly. Because the liquid flow area is unrestricted, pressure drops across the heater are minimized. This will reduce the horsepower requirements for the operating liquid pump.

Model SRH is available in inlet and outlet sizes of 1½", 2" and 3" threaded and 6" flanged.

**NOTE**
Always specify material, model and unit size when ordering.

**TABLE 9 - MODEL CONSTRUCTION DATA**

| Model | SRH | Standard materials |
|---|---|---|
| Sizes available | 1½", 2", 3", 6" | Low lead bronze, carbon steel, 316 STS |

The following information is required to select the correct model:
Operating liquid (for liquids other than water, consult the factory)
- Operating liquid inlet pressure, psig ($h_m$)
- Desired operating liquid capacity, gpm ($Q_m$)
- Operating liquid inlet temperature, °F (contact the factory when operating liquid inlet temperature exceeds 100°F)
- Desired temperature rise, °F (ΔT)
- Available steam pressure, psig ($h_s$)
- Minimum discharge pressure required, psig ($h_d$)
- Quality of steam available (i.e. saturated or superheated)
- Maximum pressure drop (ΔP). Refer to Tables 11, 12 and 13

## DIMENSIONS

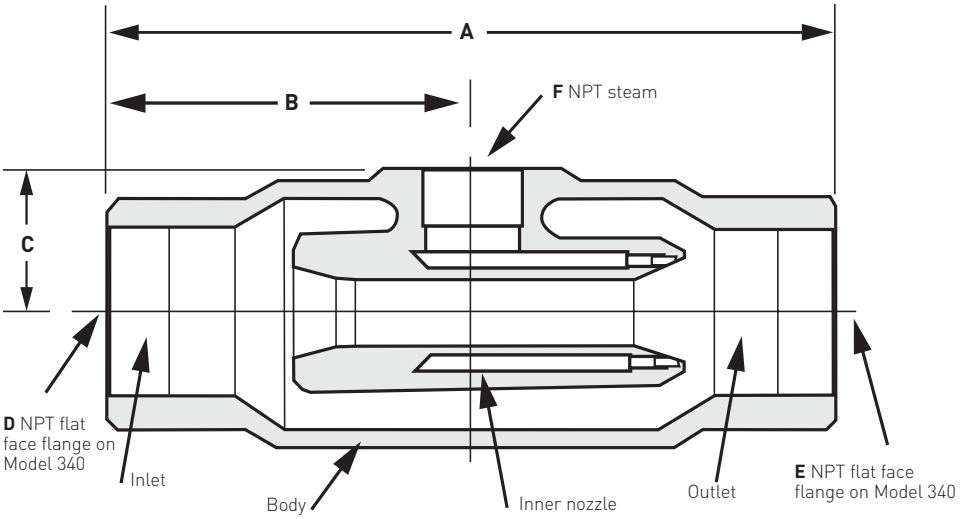



**TABLE 10 - SRH DIMENSIONS (in inches)**

| Unit | Inlet | Outlet | Steam | A | B | C |
|---|---|---|---|---|---|---|
| 310 | 1½ | 1½ | 1 | 6⅝ | 3⅜ | 1¾ |
| 320 | 2 | 2 | 1¼ | 9¾ | 4⅞ | 1⅞ |
| 330 | 3 | 3 | 1⅞ | 10¾ | 5⅜ | 2½ |
| 340 | 6(*) | 6(*) | 2 | 10 | 5 | 3¾ |

* Flanged.

**MODEL SRH**

The following steps are provided for selecting the correct size SRH:
Step 1 - In the steam consumption chart (Table 13) locate the point where the desired water flow gpm and temperature rise in °F (ΔT) intersect. Read off the steam consumption in lbs/min.
Step 2 - In the SRH performance chart (Table 12), locate the point where the operating water press. psig ($h_m$) and steam pressures ($h_s$) intersect. These represent the various steam consumptions for individual SRH units. Those with consumptions from the chart in Step 1 indicate the SRH model to choose.
Step 3 - If the steam flow shown for the model selected is greater than required, throttle the steam to a pressure that will provide the required steam flow.

To determine the pressure drop for the selected unit use the formula as shown.

The rational flow formula is:

$$dp = \left(\frac{GPM}{C_v}\right)^2 G$$

or

$$GPM = C_v \sqrt{dp/G}$$

GPM = U.S. gallons per minute
$C_v$ = Unit flow coefficient
G = Specific gravity
dp = Pressure drop across the unit, psid
$C_v$ is defined as the number of U.S. gallons of water per minute that will flow through the unit at a 1 psi pressure drop.

Example:

To find the pressure drop for a 320 heater with a flow of 150 gpm:

$$dp = \left(\frac{GPM}{C_v}\right)^2 G$$

$$dp = \left(\frac{150}{75}\right)^2 (1)$$

dp = 4 psid

**Example**
To heat 150 gpm water from 70 to 85°F (ΔT 15°F)
Operating liquid inlet pressure, psig ($h_m$): 40
Available steam pressure, psig ($h_s$): 80
Maximum pressure drop, psig (ΔP): 5
From Step 1 of the procedure, the steam consumption is 18.7 lb/min.

From Step 2 note the steam consumption closest to 18.7. Model 310 will handle 18 lb/min, just below our requirement and model 320 will handle 27 lb/min.

From Step 3, select the model with the higher available steam consumption and throttle the steam accordingly. The performance chart (Table 12) indicates that the model 320 should be throttled to slightly above 60 psig to achieve the desired consumption of 18.7 lbs/min.

Note that the maximum allowable pressure drop (ΔP) is 5 psig in this example. Using the rational flow formula example for the model 320 selected, we see the pressure drop is 4 psig below the stated maximum.

## MODEL SRH - PERFORMANCE

### TABLE 11 - SRH SIZING COEFFICIENT

| Unit | $C_V$ liquid sizing coefficient (gpm) | Heat input max. (BTU Min. at 150 psig wsp)* |
|---|---|---|
| 310 | 50 | 32000 |
| 320 | 75 | 48000 |
| 330 | 125 | 79000 |
| 340 | 350 | 128000 |

* Working steam pressure (at operating liquid pressure of 80 psig)

### TABLE 12 - SRH PERFORMANCE - STEAM CONSUMPTION IN lbs/min ($Q_S$)

| Op. water press.**, | | Steam pressure, psig ($h_S$) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| psig ($h_m$) | Model | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 120 | 140 | 150 |
| 10 | 310 | 6 | **9** | 11 | 13 | 15 | 17 | 19 | 21 | 23 | 26 | 30 | 32 |
| | 320 | 9 | **14** | 17 | 20 | 22 | 25 | 28 | 31 | 34 | 40 | 45 | 48 |
| | 330 | 16 | **23** | 28 | 33 | 37 | 42 | 47 | 52 | 56 | 66 | 75 | 79 |
| | 340 | 25 | **36** | 45 | 52 | 60 | 68 | 75 | 83 | 90 | 106 | 121 | 128 |
| 20 | 310 | - | 7 | **10** | **13** | 15 | 17 | 18 | 21 | 23 | 26 | 30 | 32 |
| | 320 | - | 10 | **15** | **19** | 22 | 25 | 28 | 31 | 34 | 40 | 45 | 47 |
| | 330 | - | 17 | **25** | **31** | 37 | 42 | 47 | 52 | 56 | 66 | 75 | 79 |
| | 340 | - | 28 | **40** | **50** | 59 | 68 | 75 | 83 | 90 | 106 | 121 | 127 |
| 40 | 310 | - | - | - | 9 | **12** | **15** | **18** | 20 | 23 | 26 | 30 | 32 |
| | 320 | - | - | - | 13 | **18** | **23** | **27** | 31 | 34 | 40 | 45 | 47 |
| | 330 | - | - | - | 22 | **31** | **38** | **45** | 51 | 56 | 66 | 75 | 79 |
| | 340 | - | - | - | 35 | **49** | **61** | **72** | 82 | 90 | 106 | 121 | 127 |
| 60 | 310 | - | - | - | - | - | 11 | 15 | **19** | **21** | 26 | 30 | 32 |
| | 320 | - | - | - | - | - | 16 | 22 | **28** | **32** | 39 | 45 | 47 |
| | 330 | - | - | - | - | - | 26 | 37 | **46** | **53** | 65 | 75 | 79 |
| | 340 | - | - | - | - | - | 42 | 60 | **74** | **86** | 104 | 120 | 126 |
| 80 | 310 | - | - | - | - | - | - | - | 13 | 18 | **25** | 30 | 32 |
| | 320 | - | - | - | - | - | - | - | 20 | 27 | **37** | 44 | 47 |
| | 330 | - | - | - | - | - | - | - | 32 | 44 | **61** | 74 | 78 |
| | 340 | - | - | - | - | - | - | - | 52 | 71 | **98** | 119 | 126 |

All data based on 32° to 100°F inlet water temperature (Tm). For other inlet water temperatures consult the factory.

**(with water flowing)

**NOTE**
Operation shown in bold is susceptible to high frequency noise.

## MODEL SRH - PERFORMANCE

**TABLE 13 - SRH STEAM CONSUMPTION (lbs per minute) RELATED TO TEMPERATURE RISE AND WATER FLOW***

| | Temperature rise in °F (ΔT) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Water flow, gpm ($Q_m$)** | **5** | **10** | **15** | **20** | **25** | **30** | **35** | **40** | **45** | **50** | **55** | **60** | **65** | **70** | **75** |
| 10 | 0.4 | 0.8 | 1.2 | 1.7 | 2.1 | 2.5 | 2.9 | 3.3 | 3.7 | 4.2 | 4.6 | 5.0 | 5.4 | 5.8 | 6.2 |
| 15 | 0.6 | 1.2 | 1.9 | 2.5 | 3.1 | 3.7 | 4.4 | 5.0 | 5.6 | 6.2 | 6.9 | 7.5 | 8.1 | 8.7 | 9.4 |
| 20 | 0.8 | 1.7 | 2.5 | 3.3 | 4.2 | 5.0 | 5.8 | 6.7 | 7.5 | 8.3 | 9.2 | 10.0 | 10.8 | 11.7 | 12.5 |
| 25 | 1.0 | 2.1 | 3.1 | 4.2 | 5.2 | 6.2 | 7.3 | 8.3 | 9.4 | 10.4 | 11.4 | 12.5 | 13.5 | 14.5 | 15.7 |
| 35 | 1.6 | 2.9 | 4.4 | 5.8 | 7.3 | 8.7 | 10.2 | 11.7 | 13.1 | 14.6 | 16.0 | 17.6 | 18.8 | 20.0 | 22.0 |
| 45 | 1.9 | 3.7 | 5.2 | 7.5 | 9.4 | 11.2 | 13.1 | 15.0 | 16.9 | 18.7 | 21.0 | 22.0 | 24.0 | 28.0 | 28.0 |
| 50 | 2.5 | 5.0 | 7.5 | 10.3 | 12.5 | 15.0 | 17.5 | 20.0 | 22.0 | 25.0 | 27.0 | 30.0 | 32.0 | 35.0 | 37.0 |
| 60 | 3.3 | 6.7 | 10.0 | 13.3 | 16.7 | 20.0 | 23.0 | 27.0 | 30.0 | 33.0 | 37.0 | 40.0 | 43.0 | 47.0 | 50.0 |
| 100 | 4.2 | 8.3 | 12.5 | 16.7 | 21.0 | 25.0 | 29.0 | 33.0 | 37.0 | 42.0 | 46.0 | 50.0 | 54.0 | 58.0 | 62.0 |
| 125 | 5.2 | 10.4 | 15.8 | 21.0 | 27.0 | 31.0 | 38.0 | 42.0 | 47.0 | 52.0 | 57.0 | 62.0 | 68.0 | 73.0 | 78.0 |
| 150 | 6.2 | 12.5 | 18.7 | 25.0 | 31.0 | 37.0 | 44.0 | 50.0 | 55.0 | 62.0 | 69.0 | 75.0 | 81.0 | 87.0 | 94.0 |
| 175 | 7.3 | 14.6 | 22.0 | 29.0 | 36.0 | 44.0 | 51.0 | 58.0 | 66.0 | 73.0 | 80.0 | 87.0 | 95.0 | 102.0 | 109.0 |
| 200 | 8.3 | 16.7 | 25.0 | 33.0 | 42.0 | 50.0 | 58.0 | 67.0 | 75.0 | 83.0 | 92.0 | 100.0 | 108.0 | 117.0 | 125.0 |
| 250 | 10.4 | 21.0 | 31.0 | 42.0 | 52.0 | 62.0 | 73.0 | 83.0 | 94.0 | 100.0 | 114.0 | 125.0 | 135.0 | 148.0 | 158.0 |
| 300 | 12.5 | 25.0 | 39.4 | 50.0 | 62.0 | 74.0 | 85.0 | 100.0 | 112.0 | 124.0 | 136.0 | 150.0 | 162.0 | 175.0 | 187.0 |
| 400 | 17.0 | 33.0 | 50.0 | 67.0 | 83.0 | 100.0 | 117.0 | 133.0 | 150.0 | 167.0 | 183.0 | 200.0 | 217.0 | 233.0 | 250.0 |
| 500 | 21.0 | 42.0 | 62.0 | 83.0 | 104.0 | 125.0 | 146.0 | 166.0 | 187.0 | 200.0 | 229.0 | 250.0 | 271.0 | 291.0 | 312.0 |

**TABLE 13 - SRH STEAM CONSUMPTION (lbs per minute) RELATED TO TEMPERATURE RISE AND WATER FLOW* (continued)**

| | Temperature rise in °F (ΔT) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Water flow, gpm ($Q_m$)** | **80** | **85** | **90** | **95** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** | **180** | **190** | **200** |
| 10 | 6.7 | 7.1 | 7.5 | 7.9 | 8.3 | 9.2 | 10 | 10.8 | 11.7 | 12.5 | 13.3 | 14.2 | 15 | 15.8 | 16.7 |
| 15 | 10.0 | 10.6 | 11.2 | 11.9 | 12.5 | 13.7 | 15 | 16.2 | 17.5 | 18.7 | 20.0 | 21.0 | 22 | 24.0 | 25.0 |
| 20 | 13.3 | 14.2 | 15.0 | 15.8 | 16.7 | 18.3 | 20 | 22.0 | 23.0 | 25.0 | 27.0 | 28.0 | 30 | 32.0 | 33.0 |
| 25 | 15.7 | 17.7 | 18.7 | 19.8 | 21.0 | 23.0 | 25 | 27.0 | 29.0 | 31.0 | 33.0 | 35.0 | 37 | 40.0 | 42.0 |
| 35 | 23.0 | 25.0 | 26.0 | 28.0 | 29.0 | 32.0 | 36 | 38.0 | 41.0 | 44.0 | 47.0 | 50.0 | 52 | 55.0 | 58.0 |
| 45 | 30.0 | 32.0 | 34.0 | 36.0 | 37.0 | 41.0 | 45 | 49.0 | 52.0 | 58.0 | 60.0 | 64.0 | 67 | 71.0 | 75.0 |
| 50 | 40.0 | 42.0 | 45.0 | 47.0 | 50.0 | 55.0 | 60 | 65.0 | 70.0 | 75.0 | 80.0 | 85.0 | 90 | 95.0 | 100.0 |
| 60 | 53.0 | 57.0 | 60.0 | 63.0 | 67.0 | 73.0 | 80 | 87.0 | 93.0 | 100.0 | 107.0 | 113.0 | 120 | 127.0 | 133.0 |
| 100 | 67.0 | 71.0 | 75.0 | 79.0 | 83.0 | 92.0 | 100 | 108.0 | 117.0 | 125.0 | 133.0 | 142.0 | 150 | 158.0 | 167.0 |
| 125 | 83.0 | 88.0 | 94.0 | 99.0 | 104.0 | 115.0 | 125 | 135.0 | 148.0 | 158.0 | 167.0 | 177.0 | 187 | 198.0 | 208.0 |
| 150 | 100.0 | 105.0 | 112.0 | 119.0 | 125.0 | 137.0 | 150 | 162.0 | 175.0 | 187.0 | 200.0 | 212.0 | 225 | 237.0 | 250.0 |
| 175 | 117.0 | 124.0 | 131.0 | 136.0 | 146.0 | 160.0 | 175 | 189.0 | 204.0 | 219.0 | 233.0 | 243.0 | 262 | 277.0 | 291.0 |
| 200 | 133.0 | 142.0 | 150.0 | 158.0 | 167.0 | 183.0 | 200 | 217.0 | 233.0 | 250.0 | 267.0 | 283.0 | 300 | 317.0 | 333.0 |
| 250 | 167.0 | 177.0 | 187.0 | 198.0 | 208.0 | 229.0 | 250 | 271.0 | 291.0 | 312.0 | 333.0 | 354.0 | 375 | 396.0 | 416.0 |
| 300 | 200.0 | 212.0 | 225.0 | 237.0 | 250.0 | 275.0 | 300 | 325.0 | 350.0 | 375.0 | 400.0 | 425.0 | 450 | 475.0 | 500.0 |
| 400 | 267.0 | 283.0 | 300.0 | 317.0 | 333.0 | 367.0 | 400 | 433.0 | 466.0 | 500.0 | 533.0 | 566.0 | 600 | 633.0 | 666.0 |
| 500 | 333.0 | 354.0 | 375.0 | 396.0 | 416.0 | 458.0 | 500 | 541.0 | 583.0 | 625.0 | 666.0 | 708.0 | 750 | 791.0 | 833.0 |

* Based on 60°F inlet water

NWH water heaters, CTE circulating tank eductors and XL-32 heaters are open tank heaters that combine steam and liquid in vessels where contents may be recirculated.

Open tank heaters provide circulation and efficient steam-liquid contact superior to coil heating without the noise of direct application. They are installed submerged in the tank.

Using up to 140 psig steam, Penberthy open tank heaters produce maximum temperature rises up to 120°F, depending on the size of the unit.

**NOTE**

Because of the nature of open tank installations, do not attempt to heat beyond the maximum stated temperature.

There are four basic submerged open tank heaters that combine steam and liquid or slurry to recirculate the contents of a tank. They are especially suited for cooking, heating and circulating liquids.

Model NWH is an inexpensive, basic heater.

Model CTE is a versatile heater that can also produce a strong mixing action throughout the tank contents.

The XL-32 provides the highest steam flow for a given size of pipe. There is a provision for admitting controlled amounts of free air to allow near noiseless operation on as little as 3 psig steam pressure (the NWH and CTE require a minimum of 10 psig steam pressure).

**TABLE 14 - MODEL SPECIFICATIONS**

| Model | NWH water heater | CTE - Circulating Tank Eductor | XL-32 heater |
|---|---|---|---|
| Motive steam pressure | up to 120 psig (830 kPag) | up to 140 psig (966 kPag) | up to 140 psig (966 kPag) |
| Max. water temp. rise (ΔT) | 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) |

## MODELS NWH, CTE, XL-32

### Model NWH

NWH heaters offer an economical method for introducing steam into a tank. Recommended for installation with 10 to 12 inch length pipe nipple, mounted away from the tank wall and aimed toward the most remote part of the tank. Inlet and steam supply sizes range from ¼" to 2".

### Model CTE

The CTE (Circulating Tank Eductor) is an ejector-type jet, requiring no nipple, recommended for tanks in multiple installations near and parallel to the tank bottom. Steam inlet sizes range from ⅜" to 3".

### Model XL-32

The XL-32 heater produces the highest steam flow for the pipe size, and is the quietest when a controlled amount of free air can be admitted at the nozzle. When there is a choice, the preferred operating range is 60 to 80 psig. The heater should be installed clear of the tank sides pointing toward the remote part of the tank and equipped with a 12" to 18" discharge nipple. For each psig of steam, the unit should be submerged no more than 3". For pressures over 30 psig, submergence should not exceed 8'. The XL-32 steam inlet sizes range from ½" to 2".

**TABLE 15 - MODEL CONSTRUCTION DATA**

| Model | NWH | Standard materials | CTE | Standard materials | XL-32 | Standard materials |
|---|---|---|---|---|---|---|
| Sizes | ¼"-2" | Cast: Low lead bronze, carbon steel, 316 STS | ⅜"-4" | Cast: Low lead bronze, iron, carbon steel, 316 STS | ½"-2" | Cast: Low lead bronze |
| available | | | 4" and up | Fabricated: Carbon steel, 316 STS | | |

### Unit selection using performance charts

The following information is required to select and size tank heaters:

- Tank liquid (if other than water, consult the factory)
- Available steam pressure, psig ($h_m$)
- Desired temperature rise, °F (ΔT)
- Tank capacity, gallons
- Heating time, minutes
- Initial temperature of liquid °F ($T_s$)

**NOTE**

Always specify material, model and unit size when ordering.

**MODELS NWH, CTE, XL-32**

There are two methods provided here for selecting the correct unit.

Method 1 uses the steam consumption table (lb/min of steam).
Method 2 uses the performance table (heating capacity in ghpm-gallons heated per minute).

**Method 1**

Step 1 - Multiply the total batch gallons by 8.33 lbs to find the weight (if water).
Step 2 - Multiply the result by the number of degrees temperature rise desired and divide this number by 1000 to determine the weight of steam (lbs) to do the job.
Step 3 - Divide this figure by the heating time required (in min.). This figure represents the rate of steam flow in pounds per minute.
Step 4 - Under available steam pressure, locate steam consumption equal to or greater than the requirement. At this point, move to the left and determine the unit size.

**Method 1 example**

This method can be used in selecting the NWH, the XL-32 or the CTE heaters for water.

Operating conditions

| | |
|---|---|
| Available steam pressure psig ($h_m$): | 40 |
| Desired temperature rise °F ($\Delta T$): | 40 |
| Tank capacity, gallons: | 800 |
| Heating time, minutes: | 60 |
| Initial temperature of liquid °F ($T_s$): | 40 |

Step 1 - 800 (gallons) x 8.33 (lbs) = 6670 lbs, the weight of water

Step 2 - $\frac{6670^* \, 40(\Delta T)}{1000}$ = 267 lbs, the weight of steam

Step 3 - $\frac{267\text{lbs}}{60\text{min}} = 4.45 \, \frac{\text{lb}}{\text{min}}$ required

Step 4 - From steam consumption chart - The NWH 1 unit will handle 5 lbs/min. The CTE ¾ unit will handle 6 lbs/min and the XL-32 will handle 7 lbs/min. In both cases, the steam may be throttled back to reduce the rate of steam consumption to the desired 4.45 lb/min.

**NOTE**

Multiple units can be used if desired. Select smaller units with total steam consumption equal to or greater than the desired flow rate obtained in Step 3.

**MODELS NWH, CTE, XL-32**

**Method 2**

This method can also be used in selecting the NWH, XL-32 and the CTE heaters.

Step 1 - Divide the total batch gallons to be heated by the time (in minutes) required. This result is the gallons heated per minute.

Step 2 - Refer to the performance chart. In the column under required available operating steam pressure select the figure equal to or greater than the desired capacity. Check to determine if adequate temperature rise is possible with this size. If not, move down to a larger size.

Step 3 - If multiple units are desired, select several smaller heaters with a total capacity of that required.

**Method 2 example**

Though the following example illustrates the selection of a CTE heater, the same procedure can be used in selecting the NWH or XL-32.

Operating conditions

| | |
|---|---|
| Available steam pressure, psig ($h_m$): | 80 |
| Desired temperature rise, °F (ΔT): | 40 |
| Tank Capacity, gallons: | 10,000 |
| Heating time, minutes: | 35 |

Step 1 - $\frac{10{,}000}{35}$ = 286 gallons heater per minute (ghpm)

Step 2 - From performance chart - under 80 psig steam pressure, go down the column to the capacity that is equal to or greater than required, to a row where ΔT=40°F. In this case the required capacity is 286 ghpm and the closest (higher) one is 315 ghpm in a 3" CTE heater.

Step 3 - If multiple units are required, try several smaller heaters, for example five 1½" units with 67 ghpm capacity: 5 x 67=355 ghpm total.

**TABLE 16 - NWH, CTE, XL-32 PERFORMANCE (gallons heated per minute - ghpm)**

| | Temp. | Operating steam pressure ($h_m$) | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | rise °F | 20 psig | | | 40 psig | | | 60 psig | | | 80 psig | | | 100 psig | | | 120 psig | | | 140 psig | |
| Size | (ΔT) | NWH | CTE | XL-32 | NWH | CTE | XL-32 | NWH | CTE | XL-32 | NWH | CTE | XL-32 | NWH | CTE | XL-32 | NWH | CTE | XL-32 | CTE | XL-32 |
| ¼ | 10 | 11 | - | - | 17 | - | - | 22 | - | - | 29 | - | - | 34 | - | - | 40 | - | - | - | - |
| | 20 | 5 | - | - | 8 | - | - | 11 | - | - | 14 | - | - | 17 | - | - | 20 | - | - | - | - |
| | 40 | 3 | - | - | 4 | - | - | 5 | - | - | 7 | - | - | 8 | - | - | 10 | - | - | - | - |
| | 80 | 1 | - | - | 2 | - | - | 3 | - | - | 3 | - | - | 4 | - | - | 5 | - | - | - | - |
| | 120 | 1 | - | - | 1 | - | - | 2 | - | - | 2 | - | - | 3 | - | - | 3 | - | - | - | - |
| ⅜ | 10 | 14 | 24 | - | 20 | 37 | - | 28 | 51 | - | 35 | 64 | - | 41 | 77 | - | 48 | 90 | - | 103 | - |
| | 20 | 7 | 12 | - | 10 | 19 | - | 14 | 25 | - | 18 | 32 | - | 21 | 38 | - | 24 | 45 | - | 51 | - |
| | 40 | 3 | 6 | - | 5 | 9 | - | 7 | 13 | - | 9 | 16 | - | 10 | 19 | - | 12 | 22 | - | 26 | - |
| | 80 | 1 | 3 | - | 2 | 5 | - | 3 | 6 | - | 4 | 8 | - | 5 | 10 | - | 6 | 11 | - | 13 | - |
| | 120 | 1 | 2 | - | 2 | 3 | - | 2 | 4 | - | 3 | 5 | - | 3 | 6 | - | 4 | 8 | - | 9 | - |
| ½ | 10 | 22 | - | 25 | 35 | - | 39 | 47 | - | 53 | 60 | - | 67 | 71 | - | 80 | 83 | - | 94 | - | 108 |
| | 20 | 11 | - | 12 | 17 | - | 19 | 23 | - | 26 | 30 | - | 34 | 35 | - | 40 | 41 | - | 48 | - | 54 |
| | 40 | 5 | - | 6 | 9 | - | 10 | 12 | - | 13 | 15 | - | 17 | 16 | - | 20 | 21 | - | 23 | - | 27 |
| | 80 | 3 | - | 3 | 4 | - | 5 | 6 | - | 7 | 7 | - | 8 | 8 | - | 10 | 10 | - | 12 | - | 13 |
| | 120 | 2 | - | 2 | 3 | - | 3 | 4 | - | 4 | 5 | - | 6 | 6 | - | 7 | 7 | - | 8 | - | 9 |
| ¾ | 10 | 28 | 51 | 43 | 44 | 78 | 67 | 59 | 106 | 92 | 75 | 133 | 117 | 90 | 160 | 138 | 103 | 187 | 163 | 214 | 187 |
| | 20 | 14 | 25 | 21 | 22 | 39 | 34 | 29 | 53 | 46 | 37 | 67 | 59 | 45 | 80 | 69 | 52 | 94 | 82 | 107 | 93 |
| | 40 | 7 | 13 | 11 | 11 | 20 | 17 | 15 | 27 | 23 | 19 | 33 | 29 | 22 | 40 | 35 | 26 | 47 | 41 | 54 | 46 |
| | 80 | 3 | 6 | 5 | 5 | 10 | 8 | 7 | 13 | 11 | 9 | 17 | 15 | 11 | 20 | 17 | 13 | 23 | 20 | 27 | 23 |
| | 120 | 2 | 4 | 4 | 4 | 7 | 6 | 5 | 9 | 8 | 6 | 11 | 10 | 7 | 13 | 11 | 9 | 16 | 14 | 18 | 15 |
| 1 | 10 | 36 | - | 74 | 57 | - | 86 | 76 | - | 160 | 96 | - | 201 | 115 | - | 238 | 35 | - | 280 | - | 322 |
| | 20 | 18 | - | 37 | 28 | - | 58 | 38 | - | 80 | 48 | - | 100 | 58 | - | 119 | 67 | - | 140 | - | 161 |
| | 40 | 9 | - | 19 | 14 | - | 29 | 19 | - | 40 | 24 | - | 50 | 29 | - | 60 | 34 | - | 70 | - | 80 |
| | 80 | 4 | - | 9 | 7 | - | 14 | 9 | - | 20 | 12 | - | 25 | 15 | - | 30 | 17 | - | 35 | - | 40 |
| | 120 | 3 | - | 6 | 5 | - | 10 | 6 | - | 13 | 8 | - | 17 | 10 | - | 20 | 11 | - | 23 | - | 27 |
| 1¼ | 10 | 46 | - | 127 | 71 | - | 198 | 97 | - | 271 | 123 | - | 344 | 147 | - | 406 | 169 | - | 480 | - | 552 |
| | 20 | 23 | - | 64 | 36 | - | 99 | 49 | - | 135 | 61 | - | 172 | 74 | - | 204 | 84 | - | 240 | - | 276 |
| | 40 | 11 | - | 32 | 18 | - | 49 | 24 | - | 68 | 31 | - | 86 | 37 | - | 101 | 42 | - | 120 | - | 138 |
| | 80 | 6 | - | 16 | 9 | - | 25 | 12 | - | 34 | 15 | - | 43 | 18 | - | 51 | 21 | - | 60 | - | 69 |
| | 120 | 4 | - | 11 | 6 | - | 16 | 8 | - | 23 | 10 | - | 29 | 12 | - | 34 | 15 | - | 40 | - | 46 |
| 1½ | 10 | 57 | 103 | 171 | 89 | 158 | 268 | 120 | 215 | 364 | 151 | 270 | 463 | 182 | 324 | 550 | 210 | 380 | 648 | 434 | 742 |
| | 20 | 28 | 51 | 85 | 44 | 79 | 134 | 60 | 107 | 182 | 75 | 135 | 232 | 91 | 162 | 275 | 105 | 190 | 324 | 217 | 371 |
| | 40 | 14 | 26 | 43 | 22 | 40 | 67 | 30 | 54 | 91 | 38 | 67 | 116 | 45 | 81 | 137 | 52 | 95 | 162 | 108 | 186 |
| | 80 | 7 | 13 | 21 | 11 | 20 | 33 | 15 | 27 | 46 | 19 | 34 | 58 | 23 | 41 | 69 | 26 | 48 | 81 | 54 | 93 |
| | 120 | 5 | 9 | 14 | 7 | 13 | 22 | 10 | 18 | 30 | 13 | 23 | 39 | 15 | 27 | 46 | 18 | 32 | 54 | 36 | 62 |
| 2 | 10 | 91 | 203 | 257 | 142 | 214 | 401 | 192 | 425 | 545 | 242 | 534 | 696 | 292 | 642 | 825 | 320 | 752 | 972 | 859 | 1115 |
| | 20 | 45 | 102 | 128 | 71 | 157 | 201 | 96 | 212 | 272 | 121 | 267 | 348 | 145 | 321 | 412 | 160 | 376 | 486 | 429 | 557 |
| | 40 | 23 | 51 | 64 | 35 | 78 | 100 | 48 | 106 | 136 | 60 | 133 | 174 | 73 | 160 | 206 | 80 | 188 | 243 | 215 | 278 |
| | 80 | 12 | 25 | 32 | 18 | 39 | 50 | 24 | 53 | 68 | 30 | 67 | 87 | 36 | 80 | 103 | 40 | 94 | 121 | 107 | 139 |
| | 120 | 9 | 17 | 21 | 12 | 26 | 33 | 18 | 35 | 45 | 22 | 44 | 58 | 27 | 54 | 68 | 30 | 63 | 81 | 72 | 93 |
| 3 | 10 | - | 481 | - | - | 741 | - | - | 1004 | - | - | 1261 | - | - | 1517 | - | - | 1777 | - | 2029 | - |
| | 20 | - | 240 | - | - | 371 | - | - | 502 | - | - | 631 | - | - | 758 | - | - | 888 | - | 1015 | - |
| | 40 | - | 120 | - | - | 185 | - | - | 251 | - | - | 315 | - | - | 379 | - | - | 444 | - | 507 | - |
| | 80 | - | 60 | - | - | 93 | - | - | 125 | - | - | 158 | - | - | 190 | - | - | 222 | - | 254 | - |
| | 120 | - | 40 | - | - | 62 | - | - | 84 | - | - | 105 | - | - | 126 | - | - | 148 | - | 169 | - |

**TABLE 17 - NWH, CTE, XL-32 STEAM CONSUMPTION (lbs per minute using dry steam)**

| | Operating steam pressure ($h_m$) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 3psig | | | 5 psig | | | 10 psig | | | 20 psig | | | 40 psig | | | 60 psig | | | 80 psig | | | 100 psig | | | 120 psig | | | 140 psig | |
| Heater size | NWH | CTE | XL-32 | NWH | CTE | XL-32 | NWH | CTE | XL-32 | NWH | CTE | XL-32 | NWH | CTE | XL-32 | NWH | CTE | XL-32 | NWH | CTE | XL-32 | NWH | CTE | XL-32 | NWH | CTE | XL-32 | CTE | XL-32 |
| ¼ | - | - | - | - | - | - | 1 | - | - | 1 | - | - | 2 | - | - | 2 | - | - | 3 | - | - | 3 | - | - | 4 | - | - | - | - |
| ⅜ | - | - | - | - | - | - | 1 | 1 | - | 1 | 2 | - | 2 | 3 | - | 3 | 4 | - | 3 | 5 | - | 4 | 6 | - | 5 | 7 | - | 8 | - |
| ½ | - | - | 1 | - | - | 1 | 2 | - | 2 | 2 | - | 2 | 3 | - | 4 | 4 | - | - | 6 | - | 7 | 7 | - | 8 | 8 | - | 9 | - | 10 |
| ¾ | - | - | 2 | - | - | 3 | 2 | 2 | 3 | 3 | 4 | 4 | 4 | 6 | 7 | 6 | 9.5 | 9 | 7 | 11 | 11 | 8 | 13 | 13 | 10 | 16 | 16 | 18 | 18 |
| 1 | - | - | 4 | - | - | 4 | 2 | - | 5 | 3 | - | 7 | 5 | - | 11 | 7 | - | 16 | 9 | - | 20 | 11 | - | 23 | 13 | - | 27 | - | 31 |
| 1¼ | - | - | 7 | - | - | 7 | 3 | - | 9 | 4 | - | 13 | 7 | - | 19 | 9 | - | 26 | 12 | - | 33 | 14 | - | 39 | 16 | - | 45 | - | 53 |
| 1½ | - | - | 9 | - | - | 10 | 4 | 4 | 12 | 5 | 8 | 17 | 8 | 13 | 26 | 11 | 19 | 35 | 14 | 22 | 45 | 17 | 27 | 53 | 20 | 32 | 62 | 36 | 71 |
| 2 | - | - | 13 | - | - | 15 | 6 | 6 | 18 | 9 | 17 | 25 | 13 | 26 | 39 | 18 | 36 | 53 | 23 | 44 | 67 | 27 | 63 | 79 | 32 | 63 | 93 | 71 | 106 |
| 3 | - | - | - | - | - | - | - | 20 | - | - | 40 | - | - | 52 | - | - | 86 | - | - | 106 | - | - | 126 | - | - | 148 | - | 169 | - |

## MODELS NWH, CTE, XL-32 - DIMENSIONS

**TABLE 18 - NWH DIMENSIONS (in inches)**

| Heater size | A | C | D | F | M |
|---|---|---|---|---|---|
| ¼ | 1¾ | 1½ | ¼ | ⅜ | 10 |
| ⅜ | 2½ | 2 | ⅜ | ½ | 10 |
| ½ | 2⅝ | 2⅛ | ½ | 1 | 10 |
| ¾ | 2⅞ | 2¼ | ¾ | 1 | 10 |
| 1 | 2⅞ | 2⅜ | 1 | 1¼ | 12 |
| 1¼ | 3⅝ | 2¾ | 1¼ | 1¼ | 12 |
| 1½ | 4⅛ | 3⅜ | 1½ | 2 | 12 |
| 2 | 4⅞ | 3⅜ | 2 | 2½ | 12 |

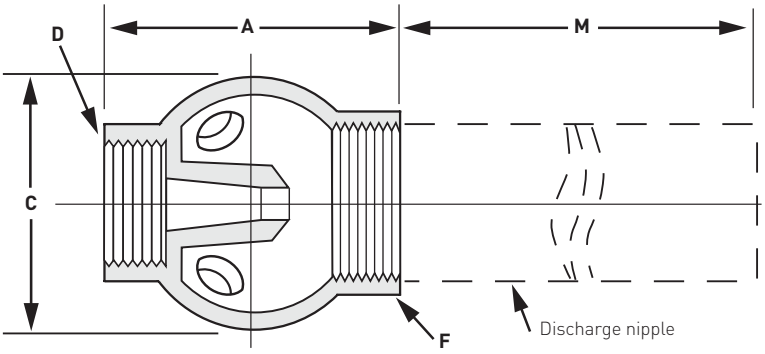



**TABLE 19 - CTE DIMENSIONS (in inches)**

| Heater size | A | C | D |
|---|---|---|---|
| ⅜* | 4½ | 1¾ | ⅜ |
| ¾* | 6 | 2¼ | ¾ |
| 1½ | 7¼ | 3 | 1½ |
| 2 | 11¼ | 4¼ | 2 |
| 3 | 19⅜ | 6½ | 3 |

*Male NPT

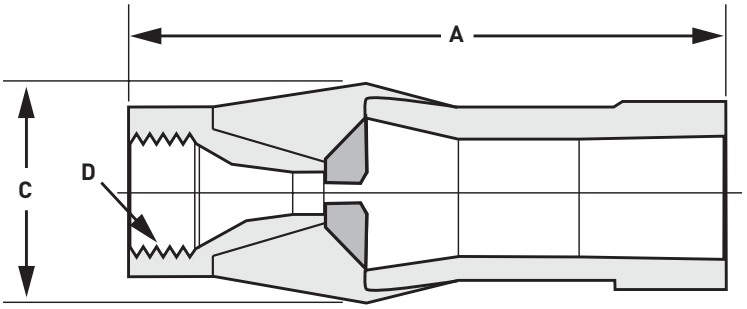
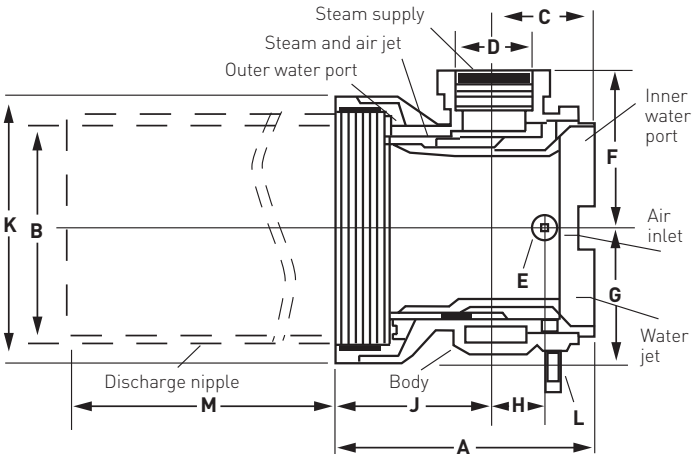



**TABLE 20 - XL-32 DIMENSIONS (in inches)**

| Heater size | A | B* | C | D* | E* | F | G | H | J | K | L* | M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ½ | 4¼ | 2 | 1½ | ½ | ¼ | 1⅞ | 1½ | ⅞ | 2¾ | 2¾ | ¼ | ** |
| ¾ | 4½ | 2½ | 1⅝ | ¾ | ¼ | 2⅛ | 1¾ | ⅞ | 2⅞ | 3¼ | ¼ | ** |
| 1 | 5 | 3 | 1¾ | 1 | ¼ | 2½ | 2 | 1 | 3¼ | 4 | ¼ | ** |
| 1¼ | 5½ | 4 | 2 | 1¼ | ¼ | 2⅞ | 2½ | 1⅛ | 3½ | 5 | ⅜ | ** |
| 1½ | 6 | 5 | 2⅜ | 1½ | ¼ | 3⅝ | 3¼ | 1¼ | 3¾ | 6 | ⅜ | *** |
| 2 | 6¾ | 7 | 2¾ | 2 | ⅜ | 4¾ | 4¼ | 1⅝ | 4⅛ | 8¼ | ⅜ | *** |

* NPT nominal pipe size
** App. 12
*** App. 18



## SELECTION GUIDE - MODELS ELL, HLM

| Example: | HLM | 04 | CS | C | NT | NT | NT | - 01 |
|---|---|---|---|---|---|---|---|---|
| **Model** | | | | | | | | |
| **ELL** Model ELL | | | | | | | | |
| **HLM** Model HLM | | | | | | | | |
| **Jet size** | | | | | | | | |
| **4A** ½A | | | | | | | | |
| **4B** ½B | | | | | | | | |
| **04** ½" | | | | | | | | |
| **06** ¾" | | | | | | | | |
| **08** 1" | | | | | | | | |
| **10** 1¼" | | | | | | | | |
| **12** 1½" | | | | | | | | |
| **16** 2" | | | | | | | | |
| **20** 2½" | | | | | | | | |
| **24** 3" | | | | | | | | |
| **32** 4" | | | | | | | | |
| **48** 6" | | | | | | | | |
| **64** 8" | | | | | | | | |
| **80** 10" | | | | | | | | |
| **96** 12" | | | | | | | | |
| **Material of construction** | | | | | | | | |
| **BZ** Bronze | | | | | | | | |
| **CS** Carbon steel | | | | | | | | |
| **IR** Cast iron | | | | | | | | |
| **SS** 316 SST | | | | | | | | |
| **HC** Hastelloy C | | | | | | | | |
| **MO** Monel | | | | | | | | |
| **20** A20 | | | | | | | | |
| **Style of construction** | | | | | | | | |
| **C** Cast metal 2-PC (standard for sizes ½A - 3") | | | | | | | | |
| **F** Metal fabricated (4" - 12") (flanged only) | | | | | | | | |
| **B** Metal barstock | | | | | | | | |
| **W** Metal weld construction | | | | | | | | |
| **Inlet (motive) connection style** | | | | | | | | |
| **NT** NPT (standard for sizes ½A - 3") | | | | | | | | |
| **RS** Raised face slip on #150 flange (20,CS,IR,SS,HC and MO material only) | | | | | | | | |
| **RT** Raised face threaded #150 flange (20,CS,IR,SS,HC and MO material only) | | | | | | | | |
| **FS** Flat face slip on #150 flange (BZ material) | | | | | | | | |
| **FT** Flat face threaded #150 flange (BZ material) | | | | | | | | |
| **FF** Flat face #150 on fabricated 4" - 12" jet | | | | | | | | |
| **Suction connection style** | | | | | | | | |
| **NT** NPT (standard for sizes ½A - 3") | | | | | | | | |
| **RS** Raised face slip on #150 flange (20,CS,IR,SS,HC and MO material only) | | | | | | | | |
| **RT** Raised face threaded #150 flange (20,CS,IR,SS,HC and MO material only) | | | | | | | | |
| **FS** Flat face slip on #150 flange (BZ material) | | | | | | | | |
| **FT** Flat face threaded #150 flange (BZ material) | | | | | | | | |
| **FF** Flat face #150 on fabricated 4" - 12" jet | | | | | | | | |
| **Discharge connection style** | | | | | | | | |
| **NT** NPT (standard for sizes ½A - 3") | | | | | | | | |
| **RS** Raised face slip on #150 flange (20,CS,IR,SS,HC and MO material only) | | | | | | | | |
| **RT** Raised face threaded #150 flange (20,CS,IR,SS,HC and MO material only) | | | | | | | | |
| **FS** Flat face slip on #150 flange (BZ material) | | | | | | | | |
| **FT** Flat face threaded #150 flange (BZ material) | | | | | | | | |
| **FF** Flat face #150 on fabricated 4" - 12" jet | | | | | | | | |
| **Variation** | | | | | | | | |
| **01** Catalog standard | | | | | | | | |

## SELECTION GUIDE - MODEL SRH

| Example: | SRH | 31 | CS | C | NT | NT | NT | - 01 |
|---|---|---|---|---|---|---|---|---|
| **Model** | | | | | | | | |
| **SRH** Model SRH | | | | | | | | |
| **Jet size** | | | | | | | | |
| **31** Unit 310 (inlet 1½", outlet 1½", steam 1") | | | | | | | | |
| **32** Unit 320 (inlet 2", outlet 2", steam 1¼") | | | | | | | | |
| **33** Unit 330 (inlet 3", outlet 3",steam 1½") | | | | | | | | |
| **34** Unit 340 (inlet 6" flgd., outlet 6" flgd., steam 2") | | | | | | | | |
| **Material of construction** | | | | | | | | |
| **BZ** Bronze | | | | | | | | |
| **CS** Carbon Steel | | | | | | | | |
| **SS** 316 SST | | | | | | | | |
| **Style of construction** | | | | | | | | |
| **C** Metal cast | | | | | | | | |
| **Inlet connection style** | | | | | | | | |
| **NT** NPT | | | | | | | | |
| **RS** Raised face slip on #150 flange | | | | | | | | |
| **FS** Flat face slip on #150 flange | | | | | | | | |
| **FF** Flat face cast #150 flange (330 and 340 only) | | | | | | | | |
| **RF** Raised face cast #150 flange (330 and 340 only) | | | | | | | | |
| **Outlet connection style** | | | | | | | | |
| **NT** NPT | | | | | | | | |
| **RS** Raised face slip on #150 flange | | | | | | | | |
| **FS** Flat face slip on #150 flange | | | | | | | | |
| **FF** Flat face cast #150 flange (340 only) | | | | | | | | |
| **RF** Raised face cast #150 flange (340 only) | | | | | | | | |
| **Steam connection style** | | | | | | | | |
| **NT** NPT | | | | | | | | |
| **RS** Raised face slip on #150 flange | | | | | | | | |
| **FS** Flat face slip on #150 flange | | | | | | | | |
| **Variation** | | | | | | | | |
| **01** Catalog standard | | | | | | | | |

## SELECTION GUIDE - MODEL NWH

| Example: | NWH | 04 | BZ | C | NT | - 01 |
|---|---|---|---|---|---|---|
| **Model** | | | | | | |
| **NWH** Model NWH | | | | | | |
| **Jet size** | | | | | | |
| **02** ¼" **10** 1¼" | | | | | | |
| **03** ⅜" **12** 1½" | | | | | | |
| **04** ½" **16** 2" | | | | | | |
| **06** ¾" | | | | | | |
| **08** 1" | | | | | | |
| **Material of construction** | | | | | | |
| **CS** Carbon steel | | | | | | |
| **SS** 316 SST | | | | | | |
| **BZ** Bronze | | | | | | |
| **Style of construction** | | | | | | |
| **C** Metal cast | | | | | | |
| **Steam supply connection style (D)** | | | | | | |
| **NT** NPT | | | | | | |
| **Variation** | | | | | | |
| **01** Catalog standard | | | | | | |

### SELECTION GUIDE - MODEL CTE

| Example: | CTE | 03 | CS | C | NT | - 01 |
|---|---|---|---|---|---|---|
| **Model** | | | | | | |
| **CTE** Model CTE | | | | | | |
| **Jet size** | | | | | | |
| **03** ⅜" | | | | | | |
| **06** ¾" | | | | | | |
| **12** 1½" | | | | | | |
| **16** 2" | | | | | | |
| **24** 3" | | | | | | |
| **Material of construction** | | | | | | |
| **CS** Carbon steel | | | | | | |
| **IR** Cast iron | | | | | | |
| **SS** 316 SST | | | | | | |
| **BZ** Bronze | | | | | | |
| **Style of construction** | | | | | | |
| **C** Metal cast | | | | | | |
| **B** Metal barstock | | | | | | |
| **Inlet connection style** | | | | | | |
| **NT** NPT | | | | | | |
| **RS** Raised face slip on #150 flange | | | | | | |
| **Variation** | | | | | | |
| **01** Catalog standard | | | | | | |

### SELECTION GUIDE - MODEL XL-32

| Example: | XL | 04 | BZ | NT | NT | NA | - 01 |
|---|---|---|---|---|---|---|---|
| **Model** | | | | | | | |
| **XL** Model XL-32 | | | | | | | |
| **Jet size** | | | | | | | |
| **04** ½" | | | | | | | |
| **06** ¾" | | | | | | | |
| **08** 1" | | | | | | | |
| **10** 1¼" | | | | | | | |
| **12** 1½" | | | | | | | |
| **16** 2" | | | | | | | |
| **Material of construction** | | | | | | | |
| **BZ** Bronze | | | | | | | |
| **Inlet connection style (E)** | | | | | | | |
| **NT** NPT | | | | | | | |
| **Steam supply connection style (D)** | | | | | | | |
| **NT** NPT | | | | | | | |
| **Discharge connection style (F)** | | | | | | | |
| **NA** None | | | | | | | |
| **DN** Discharge nipple (2" XL-32 only) | | | | | | | |
| **Variation** | | | | | | | |
| **01** Catalog standard | | | | | | | |