Spence™
Designer's Guide
Edition IV

Steam Traps and Specialties

Thermostatic Steam Traps | Mechanical Steam Traps | Thermodynamic Steam Traps | Orifice Steam Traps | Clean Steam Products | Condensate Recovery Products | Pipe Couplings | Air Traps and Liquid Drainers

SPENCE™

SPENCE STEAM TRAP

Nicholson Steam Trap was founded in 1883 by W. H. Nicholson, Sr. He, along with his sons William, George and Samuel produced a variety of steam specialty products at their facility in Wilkes-Barre, Pennsylvania. In the 1930's, a wide range of bellows-activated thermostatic traps were developed, the descendants of which are still built today.

The Spence Steam Trap product line is focused on the industrial marketplace, and features traps ranging from highly polished stainless steel sanitary traps to innovative F&T traps. Spence thermostatic traps are known throughout the industry for their value and durability. Equally respected in naval yards are Spence orifice traps, offering long life and easy maintenance. A recent product introduction is the Condensate Commander Pump; a steam powered pump available in several sizes including prefabricated skid mounted systems. These continue the Spence tradition of providing high performance, value-oriented products to the industrial marketplace.

In 2019, Spence and Nicholson were acquire by Emerson from CIRCOR International.

For more information on Spence Steam Trap, visit our website at
www.SpenceValve.com

ISO 9001:2008

SPENCE STEAM TRAP is a member of the Fluid Controls Institute.

HOW TO USE THIS HANDBOOK

If you already know the product that you want information on, find the product page in the Table of Contents. Detailed product information on materials, ratings, dimensions, weights and applications are found in the Products Sections. General application and design information is in the Primer Section.

If you are not sure of what you need, collect all the following information. You will need it to select the right product for your needs.

Service (i.e.: Steam, Compressed Air, Water, etc.)
Inlet Pressure
Flow Rate (or Capacities)
Outlet or Condensate Return Pressure
Application (i.e.: Condensate Removal, Pump, Pipe Couplings, etc.)

Application data is listed on all Product Pages. If you identify the nature of the installation, it will assist you selecting the proper equipment.

WHAT KIND OF TRAP IS NEEDED?

Bucket? F&T? Disc? Steam Pump? First the objective must be defined - then a trap must be chosen. If pumping is required then a condensate commander must be selected. Once the requirements for condensate removal have been defined, the primer section may be consulted to best match product characteristics to the application at hand. Following the primer section the trap selection guide should help refine the search. For those who possess a basic understanding of traps and the Spence product line, starting with the trap selection guide may be appropriate.

Once the application parameters have been defined (e.g. condensate removal from a 70 psi steam system, drip leg application, continuous duty, 180 lb/hr condensate flow) and a design of trap decided upon (e.g. thermostatic, carbon or stainless steel construction, 200 psi minimum operating pressure, integral strainer) the product section should be consulted to determine the range of traps available. Often several traps may meet the need. General preferences such as repairable design versus sealed, maintenance free designs, size and piping configuration, and cost are a few considerations that will help select a specific type trap.

ECONOMICAL, LONG LIFE, OR BEST SUITED FOR THE APPLICATION

Unfortunately, the best trap for an application may not necessarily be the least expensive or have the longest life span. Typically, other considerations such as ease of maintenance, initial cost, piping considerations, etc. may influence trap selection. The product section will list all pertinent specifications including overall length and features that may influence trap selection.

HOW TO FIND SPENCE TRAPS

Spence goes to market through Manufacturers' Representatives and Stocking distributors across the country. To find the nearest stocking location, contact Spence at www.SpenceValve.com

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INTRODUCTION TO STEAM TRAPS

BASICS OF STEAM TRAPS

WHY DO WE NEED STEAM TRAPS?

In order to operate economically and efficiently, all steam systems must be protected against 3 factors:

*CONDENSATE

*AIR

*NON-CONDENSIBLES

Condensate is formed in a system whenever steam gives up its useable heat. And, since condensate interferes with the efficiency of the operation of a steam system, it must be removed.

Air, one of natures finest insulators, when mixed with steam, will lower its temperature and hinder the the overall effectiveness of an entire system. For example: A film of air 1/1000th of an inch thick offers as much resistance to heat transfer as 13" of copper or 3" of steel. For that reason, air MUST be continuously bled from a system by steam traps to have it operate efficiently and to conserve energy.

Non-condensibles, such as carbon dioxide promote corrosion and other deterioration of equipment and inhibit their function.

WHAT IS A STEAM TRAP?

A steam trap is basically an automatic valve which discharges condensate, undesirable air and non-condensibles from a system while trapping, or holding in, steam. They fall into 4 major categories;

Thermostatic, Mechanical, Thermodynamic and Drain Orifice.

Each type will be discussed in detail in this section.

In every steam system, there are four phases of operation in which traps play a vital role:

1) Start-up – During "start-up", when the system is initially activated, air and non-condensibles must be discharged.
2) Heat-up – During "heat-up", as the system works to achieve the desired temperature and pressure, condensate is discharged.
3) At Temperature – "At temperature", when the desired levels are reached, the valve must close to retain the steam.
4) Using Heat – At the "using heat" level, the valve's job is to stay closed unless and until condensate occurs; then the valve must open, discharge the condensate and close quickly and positively, without allowing valuable steam to escape.

WHAT ARE THE QUALITIES OF A GOOD STEAM TRAP?

A good steam trap should:

- Discharge condensate, air and non-condensibles.
- Be equal to the load over a wide range of pressures and temperatures.
- Be freeze-proof where necessary.
- Be simple and rugged.
- Have few moving parts.
- Require low maintenance and spare parts inventory.
- Have a long life.

A good steam trap should not:

- Discharge live steam.
- Fail or malfunction if pressure changes.
- Respond slowly or hesitantly.
- Open too often, too briefly or for too long.
- Require constant adjustment or frequent repair.
- Require a wide variety of models, spare parts or orifice sizes for different pressures.

STEAM TRAP SELECTION

Types of Steam Traps

Type	Thermostatic		Mechanical	Thermodynamic		Orifice
	Bellows	Bimetal	F & T	Bucket	Disc	Orifice
Condensate Discharge	Intermittent	Intermittent	Continuous	Intermittent	Intermittent	Continuous

- The optimum application of a trap is dependent upon the characteristics of the process and equipment with which it is used and its pattern of condensate discharge.
- The discharge capacity of a trap is determined by the pressure differential (trap inlet pressure minus outlet pressure) and the size of the orifice. Thermodynamic and Thermostatic traps (radiator and temperature modulating) have a fixed orifice size.
- Mechanical traps differ from the other types in that their orifice (discharge opening) must be selected to accommodate the maximum operating differential pressure.

Caution Failure to select the proper orifice may result in insufficient discharge capacity, waterlogging or locking of the trap.

Selecting a Steam Trap

It is important to select a product with the optimum capacity from the many types which are available. Use the following procedure to make sure the correct product is selected

1

Application

Define the application and the type of service in which it will be used. The conditions under which a trap must operate will differ according to where it is installed.

Steam Trap Application Guide

2

Confirmation of Operating Conditions

Check the maximum operating pressure, temperature, discharge rate and other conditions. Do not oversize the trap. Select the smallest capacity trap, yet avoid undersizing and ensure safe, accurate operation given the conditions of inlet pressure, temperature and pressure differential under which it will operate.

Check List for Confirming Operating Conditions

Discharge Rate Tables for Each Model

3

Maintenance Preference

Confirm whether inline repair feature or maintenance free technology is desirable.

Steam Trap Application Guide

CHECK LIST FOR CONFIRMING OPERATING CONDITIONS

(A) Confirmation of Conditions

1. What is the application? _____
2. Which trap is appropriate for the application?*1 _____
3. What is the trap inlet pressure? _____ psig
4. What is the outlet pressure?*2 _____ psig
5. What is the condensate load? _____ lb/Hr

(B) Selection

1. The required discharge capacity of the trap is ___ times*3 the amount of condensate generated.
2. Inlet pressure – Outlet pressure = Pressure differential. _____ psig
3. Select a trap with a maximum operating pressure equal to or slightly above the inlet pressure to the trap.
4. Select a discharge rate for the pressure differential from the discharge capacity chart.

Discharge	Product name	Pressure differential	Required discharge capacity
☐ _____	_____	_____ psig	_____ lb/Hr
☐ _____	_____		
☐ _____	_____		

5. The trap with the smallest discharge capacity greater than that required is the optimum trap.
6. Connection size _____ in
7. Connection Type

☐ NPT Threaded ☐ Flanged (flange standard_____) ☐ Socketweld

*1. See tables for selection of a steam trap by application.

*2. If unknown, is condensate recovered?..... ☐ Yes ☐ No...(back pressure = 0 psig)

If condensate is recovered

① How many feet does the trap outlet rise? _____ ft. x 0.5 = _____ psig

② What is the total pipe length from the trap to the recovery tank? _____ ft. x 0.01 = _____ psig

③ What is the pressure of the condensate recovery tank? ..... _____ psig

④ Add ①, ② and ③ .....{This is the outlet pressure (back pressure).} ① + ② + ③ = _____ psig

*3. Safety Factor

The margin of safety which is determined by the operating characteristics of each piece of equipment is referred to as the "safety factor." The safety factor required will differ according to the type of trap (type of condensate discharge). The discharge rate table for each model shows the values for condensate discharge when the trap is fully open, and the maximum rated condensate load on the equipment should correspond to the value obtained by dividing this discharge rate by the safety factor (see Steam Trap Application Guide on opposite page).

STEAM TRAP APPLICATION GUIDE

This guide is designed to direct the user to a General Steam Trap Technology section. Once a technology is selected, additional details, regarding specific steam traps, can be found in the catalog under the Technology Selection tab.

These choices, in the Guide, are based on many years of steam trap manufacturing experience. The choices, however are not limited to these alone. Variations in individual systems (superheat, water hammer, insulation, etc.), as well as personal preference, should be taken into consideration.

Application		Thermo-static	Thermo-dynamic	Float	Inverted Bucket	Float & Thermostatic	Orifice	Minimum Safety Factor
Drip & Tracing								
Main Drip	to 30 PSIG	1		2	3	2	4	1.51
	to 300 PSIG	1	2	3	2	3	3	1.51
	to 650 PSIG	1	2			3	2	1.51
	to 2500 PSIG							1.51
Steam Tracing		1	2	2	2	2	3	1.51
Process								
Heat Exchanger	to 20 PSIG	2		1	2	1		2.1
	to 150 PSIG	1		1	2	1		2.1
	to 300 PSIG	1		1	2	1		2.1
	to 600 PSIG			1				2.1
Cooker/Reactor	to 15 PSIG	2		1	3	1		3.1
	to 60 PSIG	1		1	3	1		3.1
	to 150 PSIG	1		1	3	1		3.1
	to 600 PSIG	2		1				3.1
Pressing	to 100 PSIG	1		1	2	1		3.1
	to 300 PSIG	1	2	2	2			3.1
Reboiler		2		1	3	1		2.1
Rotating Cylinders		2*		1*	3		3	3.1
Sterilizer		1		2		2		2.1
Tank Heating	Storage	1		2		2		1.51
	Line Heater	1		2		2		3.1
Evaporator				1	2	2		2.1
HVAC								
Air Heating Coils	to 15 PSIG	2		1	3	1		2.1
	to 60 PSIG	2		1	2	1		2.1
	to 250 PSIG	2		1				3.1
Radiator		1					4	2.1
Unit Heater		1		1	2	1		2.1
Absorption Chiller		2		1	2	1		2.1

*Requires Steam Lock Release

KEY	Blank = not recommended
1 = First Choice	3 = Third Choice
2 = Second Choice	4 = Fourth Choice

STEAM TRAP SELECTION CRITERIA MATRIX

Function	Thermostatic	Thermodynamic	Mechanical		Orifice	Float
			F & T	IB		
Response to Load Changes	Moderate	Slow	Fast	Moderate	Very Slow	Fast
Air Venting	Low	Med/High	Low	Low	High	High
Thermal Efficiency	High	Medium	Med/High	Medium	High†	Med/High
Applications	Drip Legs Tracing Process Eqpt.	Drip Legs Tracing	Drip Legs Process Eqpt.	Drip Legs Process Eqpt.	Drip Legs	Drip Legs Process Eqpt.
Affected By Ambient Temperatures	No	Yes	No		No	No
	(unless insulated)		(susceptible to freezing)			(may freeze)
Relative Cost	Low	Low	Medium	Med/Low	Low	Medium
Capacity	Medium	Low	High		Low	High
Pressure Range	to 650 psi	10 to 600 psi	to 650 psi	to 250 psi	to 2500 psi	to 650 psi
Size vs. Capacity	Small	Medium	Large		Small	Large
Life Expectancy	Moderate	Moderate	Moderate	Moderate	Long	Long
Ease of Maintenance	Very Easy	Very Easy	Moderate		Very Easy	Moderate
Orientation Limits	No	No	Yes		No	Yes

SPENCE STEAM TRAP OPTIONS

Steam Lock Release (SLR) Orifice

Specify where immediate elimination of condensate and improved sensitivity is desired. This option may also improve performance in applications where condensate must be lifted upstream to the trap. Allows continuous discharge of condensate. Trap will nominally pass 50 lb/hr of condensate at 50 psi within 2°F of saturated temperature.

Skirted Seat Trim

Recommended for higher pressure service, often over 300 psi. Minimizes erosion by dispersing trap discharge.

Sterilizer Trim

Specify where immediate elimination of condensate and improved sensitivity is desired. Shorter seat opens more quickly in presence of condensate. Hotter discharge temperature.

Internal Strainer

Recommended where steam may be contaminated with pipe scale or other particulate matter. Screen reduces deposits on valve and seat.

Blowdown Valve

Specify to clean strainer area and remove debris trapped before strainer. Also used to determine whether steam or water is present before the steam trap.

ISO Filled Actuator

Specify to reduce flash steam, provide highest thermal efficiency and/or air vent operation is desired. This option will subcool condensate by approximately 40°F. For use in applications above 500 psig and/or for superheated steam.

Continuous Bleed Air Vent

Replaces thermostatic air vent with a 1/32 inch orifice.

THERMOSTATIC STEAM TRAPS

N125 SERIES
THERMOSTATIC STEAM TRAPS

Pressures to 125 PSIG (8.75 barg)
Temperatures to 400°F (204°C)

Superior Performance - Hardened valve and seats are lapped in matched sets, providing tight shutoff and long service life.

Improved Energy Savings - Maximum elimination of air and non-condensibles - trap is closed at saturated steam temperature.

Temperature Sensitive Actuators - One moving part. Stainless Steel, fail open or fail closed, welded actuator for maximum corrosion, thermal and hydraulic shock resistance.

Freeze Proof - Threaded male union horizontal inlet and vertical outlet-self draining.

In-line Maintenance - Threaded cover for one step removal, inspection and service without breaking pipe connections.

Air Vent - Efficient steam service air vent when equipped with ISO Bellows and installed in air vent location.

MODELS*

- **N125** - Standard capacity
- **N125L** – Low capacity
- **N125HC** – High capacity
- **N125ST-FC** – Standard capacity w/sterilizer seat
- **N125STHC-FC** – High capacity w/sterilizer seat

*Add (-FC) for fail closed or (-FO) for fail open to end of model number

Options

- ST - Sterilizer Trim (1/4 "& 5/16" orifice sizes)
- SLR - SLR Orifice
- S - Internal Stainless Strainer
- ISO - ISO Filled Actuator
- HC - High Capacity

Applications

- Steam Tracing
- Drip Legs
- Automatic Air Vents
- Sterilizers
- Cooking Kettles
- Water Heaters
- Laundry Equipment
- Radiators
- Process Equipment
- Air Handlers

Canadian Registration # 0E0591.9

Operation

Thermal actuator is filled at its free length with a liquid having a lower boiling point than water. On start-up, valve is normally open. When steam enters trap, thermal actuator fill vaporizes to a pressure higher than line pressure. This forces valve into seat orifice to prevent any further flow. As condensate collects, it takes heat from thermal actuator, lowering internal pressure. Line pressure will then compress thermal actuator to open valve and discharge condensate. Valve opening automatically adjusts to load conditions from minimum on very light loads to full lift at maximum load. Restricted orifice in N125L (small opening at bottom of valve seat) prevents trap from discharging continuously on light loads.

N125 SERIES
THERMOSTATIC STEAM TRAPS

SPECIFICATION

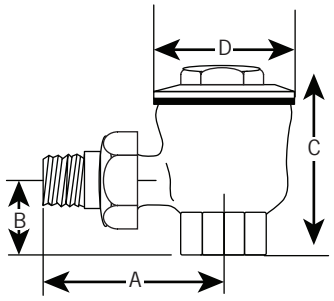
Steam trap shall be of balanced pressure design with stainless steel welded actuator capable of discharging condensate within10°F of saturated temperature. Where greater sensitivity is required, SLR orifice and Sterilizer trim will be available to allow condensate evacuation at or near saturated temperatures. Where subcooling of condensate is desired alternate thermostatic actuator will be available to allow condensate evacuation at or near 40°F below saturated temperatures. Thermostatic actuator shall employ a conical valve lapped in matched sets with the seat ring assuring tight shut off. A minimum of three orifice sizes shall be available allowing for custom capacity sizing. Trap shall be bronze bodied suitable for pressures through 125 psig and available in 3/8" through 3/4" NPT connections.

Maximum operating conditions

PMO: Max. Operating Pressure	125 psig	(8.75 barg)
TMO: Max. Operating Temperature	400°F	(204°C)
PMA: Max. Allowable Pressure	125 psig	(8.75 barg)
TMA: Max. Allowable Temperature	400°F	(204°F)

Materials of construction

Body & Cover .....Brass
Actuator.....Welded Stainless Steel
Cover Gasket .....Copper Jacketed
Valve & Seat.....Hardened 416 Stainless Steel



Connections: 3/8"–3/4" NPT

Dimensions					
Size	Inch (mm)				Weight Lb (kg)
	A	B	C	D	
3/8, 1/2	2 3/4 (70)	1 1/8 (29)	2 7/8 (73)	2 5/32 (54)	1.5 (.68)
3/4	3 3/16 (81)	1 9/16 (40)	3 (76)	2 5/32 (54)	1.8 (.82)

Maximum Capacity - lbs/hr 10°F Below Saturation (Kg/hr 5°C Below Saturation)							
Trap	Orifice Inch (mm)	Differential PSIG (barg)					
		5 (0.34)	10 (0.7)	20 (1.4)	50 (3.5)	100 (6.9)	125 (8.6)
N125L	1/8 (3)	216 (98)	265 (120)	375 (170)	592 (269)	778 (354)	838 (383)
N125 N125ST	1/4 (6)	550 (249)	825 (374)	1210 (549)	1975 (896)	2825 (1281)	3140 (1424)
N125HC N125STHC	5/16 (8)	860 (390)	1220 (554)	1725 (783)	2725 (1237)	3575 (1623)	3850 (1748)

Spence recommends ISO filled Actuator for superheated steam.

N450 SERIES
THERMOSTATIC STEAM TRAPS

Pressures to 450 PSIG (31 barg)
Temperatures to 600°F (316°C)

Compact - Easy to Install.

Inexpensive - Low initial cost.

Improved Energy Savings - High efficiency-maximum elimination of air and non-condensibles.

Temperature Sensitive Actuators - One moving part. Stainless Steel, fail open, welded actuator for maximum corrosion, thermal and hydraulic shock resistance.

Hardened Stainless Steel Valve and Seat - Long life. Lapped as a matched set for water tight seal.

Easily Maintained - Can be inspected and serviced without breaking pipe connections.

Freeze Proof - Self draining when installed vertically.

For Superheated Steam Applications - Because the trap closes at saturated steam temperature, superheated steam cannot reach trap.

Air Vent - Efficient steam service air vent when equipped with ISO filled Actuator and installed in air vent location.

MODELS*

- **N451-FO**–Low capacity, fail open only
- **N452**–Reduced capacity
- **N453**–Standard capacity
- **N454**–High capacity

*Add (-FC) for fail closed or (-FO) for fail open to end of model number

Options

- SK - Skirted Seat*
- SLR - SLR Orifice
- ISO - ISO Filled Actuator*
- ST - Sterilizer Trim
- SW - Socketweld

*Not available on N451

Applications

- Unit Heaters
- Air Vents
- Steam Tracing
- Drip Legs
- Platen Presses
- Plating Tanks
- Sterilizers
- Tire Presses
- Cooking Equipment
- Laundry Equipment
- Other Process Equipment

Canadian Registration # 0E0591.9

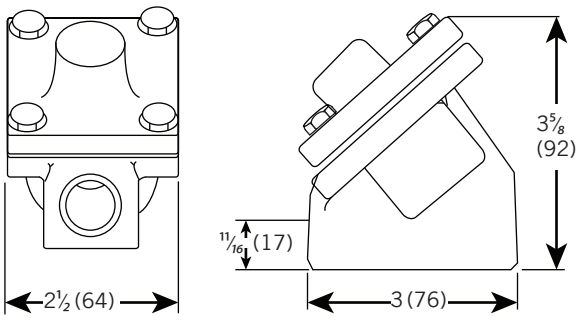
Operation

Thermal actuator is filled at its free length with a liquid having a lower boiling point than water. On start-up, valve is normally open. When steam enters trap, thermal actuator fill vaporizes to a pressure higher than line pressure. This forces valve into seat orifice to prevent any further flow. As condensate collects, it takes heat from thermal actuator, lowering internal pressure. Line pressure will then compress thermal actuator to open valve and discharge condensate. Valve opening automatically adjusts to load conditions from minimum on very light loads to full lift at maximum load. Restricted orifice in the N451 seat (small opening at bottom of valve seat) prevents trap from discharging continuously on light loads such as are encountered on tracer lines

N450 SERIES
THERMOSTATIC STEAM TRAPS

SPECIFICATION

Steam trap shall be of balanced pressure design with stainless steel welded actuator capable of discharging condensate within 10°F of saturated temperature. Where greater sensitivity is required, SLR orifice and Sterilizer trim will be available to allow condensate evacuation at or near saturated temperatures. Where subcooling of condensate is desired alternate thermostatic actuator will be available to allow condensate evacuation at or near 40°F below saturated temperatures. Thermostatic actuator shall employ a conical valve lapped in matched sets with the seat ring assuring tight shut off. A minimum of three orifice sizes shall be available allowing for custom capacity sizing. Trap shall be forged carbon steel bodied suitable for pressures through 450 psig and available in 1⁄2" and 3⁄4" NPT or socket weld.



WEIGHT: 3 LBS. (1.4 KG)

Connections: 1/2" or 3/4" NPT or socketweld

Maximum operating conditions

PMO: Max. Operating Pressure	450 psig	(31 barg)
TMO: Max. Operating Temperature	600°F	(316°C)
PMA: Max. Allowable Pressure	450 psig	(31 barg)
TMA: Max. Allowable Temperature	750°F	(399°F)

† Consult factory for pressures greater than 300 psi.

Materials of construction

Body .....ASTM A105 Forged Steel
Cover .....ASTM A351 Grade CF8 (304)
Cover Gasket .....304 SS Spiral Wound w/Graphite Fill
Actuator.....Welded Stainless Steel
Valve & Seat .....Hardened 416 Stainless Steel

Maximum Capacity - lbs/hr 10°F Below Saturation (Kg/hr 5°C Below Saturation)

Trap	Orifice Inch (mm)	Differential PSIG (barg)												
		5 (0.34)	10 (0.7)	20 (1.4)	50 3.4)	100 (6.7)	125 (8.4)	150 (10.1)	200 (13.4)	250 (16.8)	300* (20.1)	350* (24.1)	400* (27.6)	450* (31.0)
N451	5/64 (2)	84 (38)	119 (54)	168 (76)	265 (120)	348 (158)	375 (170)	398 (181)	439 (199)	472 (214)	502 (228)	529 (240)	553 (251)	575 (261)
N452	1/8 (3)	216 (98)	265 (120)	375 (170)	592 (269)	778 (354)	838 (381)	890 (405)	980 (445)	1055 (480)	1121 (510)	1180 (536)	1235 (561)	1284 (584)
N453	1/4 (6)	550 (249)	825 (374)	1210 (549)	1975 (896)	2825 (1281)	3140 (1424)	3425 (1554)	3650 (1656)	3960 (1796)	4100 (1860)	4230 (1919)	4420 (2005)	4600 (2086)
N454	5/16 (8)	860 (390)	1220 (554)	1725 (783)	2725 (1237)	3575 (1623)	3850 (1748)	4090 (1857)	4505 (2045)	4850 (2202)	5155 (2340)	5425 (2463)	5675 (2576)	5900 (2679)

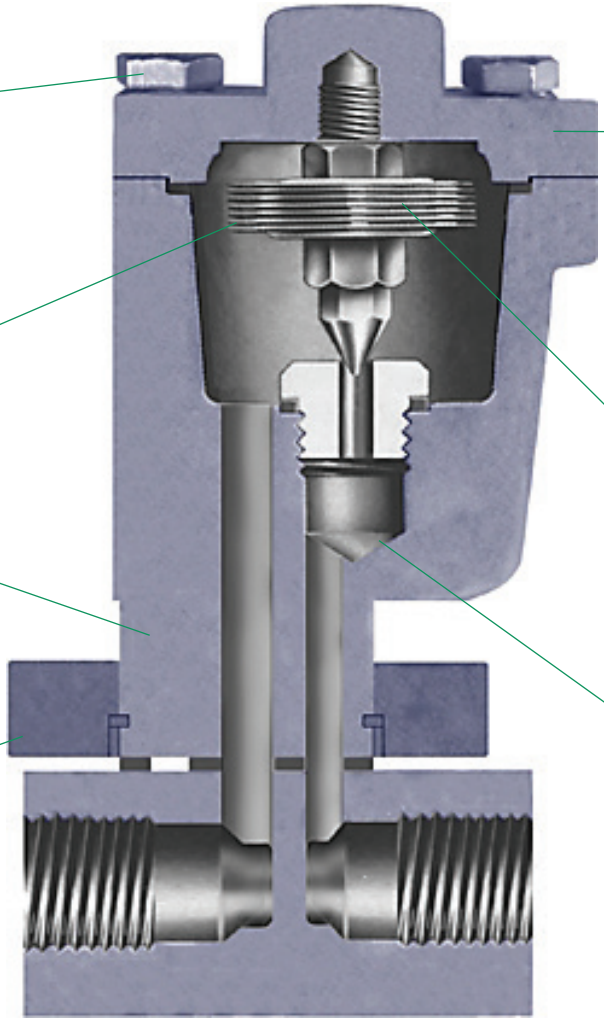
*Spence recommends skirted seat above 300 PSIG (20.7 bar). Spence recommends ISO filled Actuator for superheated steam.

LIQUIDATOR 450 SERIES
THERMOSTATIC STEAM TRAP

Pressures To 450 PSIG
Temperatures to 600°F

Applications

- Unit Heaters
- Laundry Equipment
- Steam Tracing
- Plating Tanks
- Drip Legs
- Platen Presses
- Tire Presses
- Cooking Equipment
- Air Vents



Easily Maintained

Four bolt cover permits easy in-line rebuilding for less than the cost of replacement.

Excellent Energy Savings

Positive shutoff and thermostatic action assure no loss of steam during normal operation.

Fits all Universal Connectors

Liquidator body will replace any manufacturers' universal mount trap body.

Easily Replaced

Two bolt design permits rapid removal without breaking pipe connections.

Freeze Proof

Self draining when installed vertically.

Optional Integral Strainer

Helps prevent dirt and scale build-up on valve seat.

Durability and Long Service Life

Stainless steel body and cover with stainless steel welded actuator for maximum corrosion, thermal and hydraulic shock resistance.

Rapid Startup with Outstanding Air Handling

Thermostatic action responds quickly to eliminate air and other non-condensibles. Large startup capacity.

Water Tight Seal

Hardened stainless steel valve and seat lapped as a matched set assure tight seal and long life.

LIQUIDATOR 450 SERIES
UNIVERSAL MOUNT THERMOSTATIC STEAM TRAPS

Pressures to 450 PSIG (31 barg)
Temperatures to 600°F (316°C)

Easily Maintained - Universal two bolt swivel mounting simplifies removal from system. Kits allow flexibility to replace or rebuild.

Simple Installation - Stainless mounting block mounts permanently into system. Trap installs via two bolt universal connection.

Improved Energy Savings - High efficiency-maximum elimination of air and non-condensibles.

Temperature Sensitive Actuators - One moving part. Stainless Steel, fail open, welded actuator for maximum corrosion, thermal and hydraulic shock resistance.

Hardened Stainless Steel Valve and Seat - Long life. Lapped as a matched set for water tight seal.

Freeze Proof - Self draining when installed vertically.

For Superheated Steam Applications - Because the trap closes at saturated steam temperature, superheated steam cannot reach trap.

Air Vent - Efficient steam service air vent when equipped with ISO filled Actuator and installed in air vent location.

Positive Shutoff and Long Life - Integral Stainless Steel Strainer helps prevent debris depositing on valve and seat.

Applications

- Unit Heaters
- Steam Tracing
- Drip Legs
- Tire Presses
- Cooking Equipment
- Laundry Equipment
- Plating Tanks
- Platen Presses
- Air Vents

Options

- SLR - SLR Orifice*
- ISO - ISO Filled Actuator*
- SW - Socketweld
- B - Blowdown Valve

*Not available on UMT451T

MODELS

- **UMT451**–Very Low Capacity Trap
- **UMT452**–Low Capacity Trap
- **UMT453**–Standard Capacity Trap
- **UMTC**–Standard connector (1/2" & 3/4" only)
- **UMTCY-RH**–Right Hand Connector w/Y strainer*
- **UMTCY-LH**–Left Hand Connector w/Y strainer*
- **UMTVS-BB**–Connector with Isolation Valves, Strainer, Blowdown Valve and Test Port

For complete unit, order trap and connector as separate items.

*Add (-B) for Blowdown Valve.

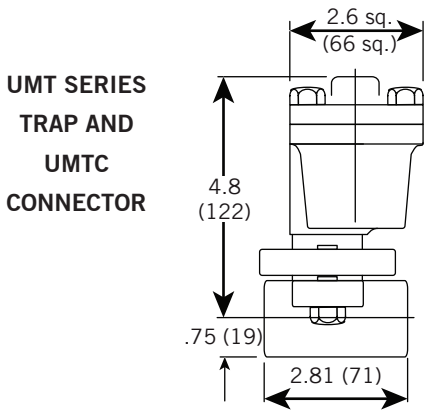
Canadian Registration # 0E20210.52

For information on Big Block UMTVS-BB Connector
SEE PAGE 116

Operation

Thermal actuator is filled at its free length with a liquid having a lower boiling point than water. On start-up, valve is normally open. When steam enters trap, thermal actuator fill vaporizes to a pressure higher than line pressure. This forces valve into seat orifice to prevent any further flow. As condensate collects, it takes heat from thermal actuator, lowering internal pressure. Line pressure will then compress thermal actuator to open valve and discharge condensate. Valve opening automatically adjusts to load conditions from minimum on very light loads to full lift at maximum load. Restricted orifice in UMT451T (small opening at bottom of valve seat) prevents trap from discharging continuously on light loads such as are encountered on tracer lines.

LIQUIDATOR 450 SERIES
UNIVERSAL MOUNT THERMOSTATIC STEAM TRAPS



Connections: 1/2", 3/4" or 1" NPT or socketweld

SPECIFICATION

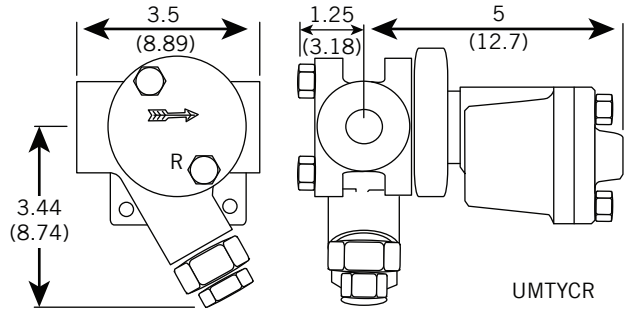
Steam trap shall be of balanced pressure design with stainless steel welded actuator capable of discharging condensate within 10°F of saturated temperature. Where greater sensitivity is required, SLR orifice and Sterilizer trim will be available to allow condensate evacuation at or near saturated temperatures. Where sub cooling of condensate is desired alternate thermostatic actuator will be available to allow condensate evacuation at or near 40°F below saturated temperatures. Thermostatic actuator shall employ a conical valve lapped in matched sets with the seat ring assuring tight shut off. A minimum of two orifice sizes shall be available allowing for custom capacity sizing. Trap shall be stainless steel bodied suitable for pressures through 450 psig. Trap connection shall be two bolt universal swivel mount. Mounting block shall be stainless steel and available in 1⁄2" through 1" NPT or socket weld.

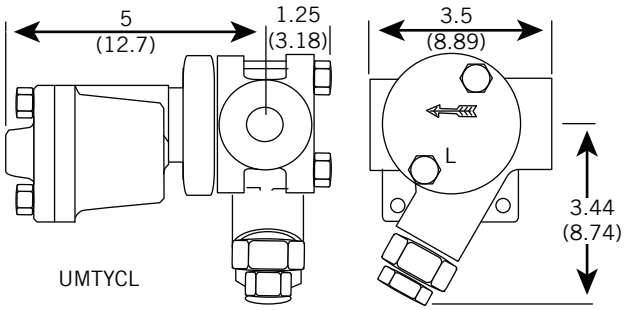
Maximum operating conditions

Traps with Welded Stainless Actuator		
PMO: Max. Operating Pressure	450 psig	(31 barg)
TMO: Max. Operating Temperature	600°F	(316°C)
Traps with Welded Stainless Actuator, ISO		
PMO: Max. Operating Pressure	450 psig	(31 barg)
TMO: Max. Operating Temperature	600°F	(316°C)
All Traps		
PMA: Max. Allowable Pressure	450 psig	(31 barg)
TMA: Max. Allowable Temperature	750°F	(399°C)

Materials of construction

Body & Cover .....ASTM A351 Grade CF8 (304)
Cover Gasket .....304 stainless spiral wound w/graphite fill
Actuator .....Welded SS
Strainer .....033 perf. 304 Stainless Steel
Valve & Seat .....Hardened 416 Stainless Steel
Mounting Block .....ASTM A351 Grade CF8 (304)





DIMENSIONS - INCHES (CM)
WEIGHT
TRAP - 3.2 LBS. (1.4 KG)
STD. MOUNTING BLOCK - 1.1 LBS. (0.5 KG)
Y STRAINER MOUNTING BLOCK - 2.3 LBS. (1.0 KG)

Maximum Capacity - lbs/hr 10°F Below Saturation (Kg/hr 5°C Below Saturation)

Trap	Orifice Inch (mm)	Differential PSIG (barg)												
		5 (0.34)	10 (0.7)	20 (1.4)	50 (3.4)	100 (6.7)	125 (8.4)	150 (10.1)	200 (13.4)	250 (16.8)	300† (20.1)	350 (24.1)	400 (27.6)	450 (31.0)
UMT451T	5/64 (2)	84 (38)	119 (54)	168 (76)	265 (120)	348 (158)	375 (170)	398 (181)	439 (199)	472 (214)	502 (228)	529 (240)	553 (251)	575 (261)
UMT452T	1/8 (3)	216 (98)	265 (120)	375 (170)	592 (269)	778 (354)	838 (381)	890 (405)	980 (445)	1055 (480)	1121 (510)	1180 (536)	1235 (561)	1284 (584)
UMT453T	1/4 (6)	550 (249)	825 (374)	1210 (549)	1975 (896)	2825 (1281)	3140 (1424)	3425 (1554)	3650 (1656)	3960 (1796)	4100 (1860)	4230 (1919)	4420 (2005)	4600 (2086)

ISO filled Actuator recommended for superheated steam.

TA SERIES
THERMOSTATIC STEAM TRAPS

Pressures To 650 PSIG (44.8 barg)
Temperatures to 750°F (400°C)

Sealed Stainless Steel Body - Lightweight, compact and corrosion resistant. No bolts or gaskets. Eliminates body leaks.

Self Centering Valve - Leak tight shutoff. Improved energy savings. Assembly of actuator and valve to impingement plate allows valve to self-align with center of valve seat orifice. Provides long lasting valve and seat.

Temperature Sensitive Actuators - One moving part. Stainless Steel, fail open or fail closed, welded actuator for maximum corrosion, thermal and hydraulic shock resistance.

For Superheated Steam Applications - Because the trap closes at saturated steam temperature, superheated steam cannot reach trap.

Thermal and Hydraulic Shock Resistant - Impingement plate plus welded construction prevent damage to actuator.

Hardened Stainless Steel Valve and Seat - Long life. Lapped as a matched set for water tight seal.

Inexpensive - Low initial cost.

Maintenance Free - Sealed unit. Replacement traps cost less than repair of more expensive in-line repairable traps.

Freeze Proof - Self draining when installed vertically.

Directional Discharge - Pipe thread erosion prevented by directing discharge to center of pipe.

Air Vent - Efficient steam service air vent when equipped with ISO Bellows and installed in air vent location.

MODELS*

- **TA502**–Reduced capacity
- **TA503**–Standard capacity
- **TA504**–High capacity

*Add (-FC) for fail closed or (-FO) for fail open to end of model number

Applications

- Unit Heaters
- Air Vents
- Steam Tracing
- Drip Legs
- Platen Presses
- Plating Tanks
- Sterilizers
- Tire Presses
- Cooking Equipment
- Laundry Equipment
- Other Process Equipment

Options

- ISO - ISO Filled Actuator
- SLR - SLR Orifice
- SW - Socketweld

Canadian Registration # 0E0591.9

Operation

Thermal actuator is filled at it's free length with a liquid having a lower boiling point than water. As assembled, valve is normally open. When very hot condensate enters trap, thermal actuator fill vaporizes to a pressure higher than line pressure. This forces valve into seat orifice to prevent any further flow. As condensate collects, it takes heat from the actuator, lowering internal pressure. Line pressure will then compress thermal actuator to open valve and discharge condensate. Valve opening automatically adjusts to load conditions from minimum on very light loads to full lift at maximum load. Restricted orifice in TA502 (small opening at bottom of valve seat) prevents trap from discharging continuously on light loads such as are encountered on tracer lines.

TA SERIES
THERMOSTATIC STEAM TRAPS

SPECIFICATION

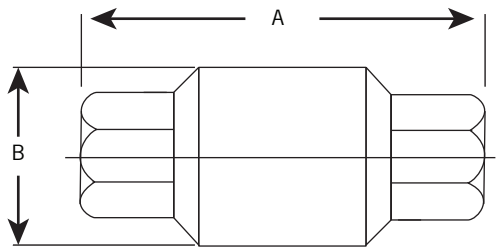
Steam trap shall be of balanced pressure design with stainless steel welded actuator capable of discharging condensate within 10°F of saturated temperature. Where greater sensitivity is required or protection from flash steam locking, a SLR orifice shall be available to allow condensate and flash steam evacuation at or near saturated temperatures. Where subcooling of condensate is desired alternate thermostatic actuator will be available to allow condensate evacuation at or near 40°F below saturated temperatures. Thermostatic actuator shall employ a conical valve lapped in matched sets with the seat ring assuring tight shut off. A minimum of three orifice sizes shall be available allowing for custom capacity sizing. Trap shall be stainless steel bodied suitable for pressures to 650 psig and available in 3/8" through 1" NPT or socketweld.

Maximum operating conditions

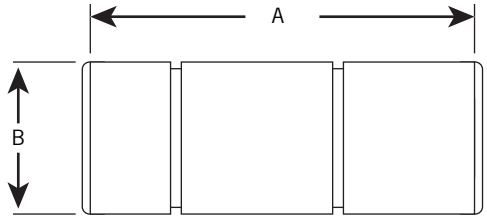
Standard Traps		
PMO: Max. Operating Pressure	500 psig	(34.5 barg)
TMO: Max. Operating Temperature	600°F	(316°C)
ISO Option Traps		
PMO: Max. Operating Pressure	650 psig	(44.8 barg)
TMO: Max. Operating Temperature	650°F	(343°C)
All Traps		
PMA: Max. Allowable Pressure	650 psig	(44.8 barg)
TMA: Max. Allowable Temperature	750°F	(400°C)

Materials of construction

Body & Cover ..... ASTM A276
For 1" - 316SS, ASME SA479
Actuator ..... Welded Stainless Steel
Valve & Seat ..... Hardened 416 Stainless Steel



3/8" - 3/4" BODY



1" BODY

Connections: 3/8" - 1" NPT or socketweld

Dimensions			
NPT or Socket weld	Inches (mm)		Weight Lbs. (kg)
	A	B	
3/8", 1/2"	3 3/4 (95)	1 3/4 (44)	1.1 (0.5)
3/4"	3 15/16 (100)	1 3/4 (44)	1.2 (0.54)
1"	4 3/8 (111)	1 3/4 (44)	1.6 (0.73)

Maximum Capacity - lbs/hr 10°F Below Saturation (Kg/hr 5°C Below Saturation)																		
Trap	Orifice Inch (mm)	Differential PSIG (barg)																
		5 (0.34)	10 (0.7)	20 (1.4)	50 (3.5)	100 (6.9)	125 (8.62)	150 (10.3)	200 (13.8)	250 (17.2)	300 (20.7)	350 (24.1)	400 (27.6)	450 (31.0)	500 (34.5)	550* (37.9)	600* (41.4)	650* (44.8)
TA502	1/8 (3)	216 (98)	265 (120)	375 (170)	592 (269)	778 (354)	838 (381)	890 (405)	980 (445)	1055 (480)	1121 (510)	1180 (536)	1235 (561)	1284 (584)	1331 (604)	1377 (625)	1425 (646)	1471 (667)
TA503	1/4 (6)	550 (249)	825 (374)	1210 (549)	1975 (896)	2825 (1281)	3140 (1424)	3425 (1554)	3650 (1656)	3960 (1796)	4100 (1860)	4230 (1919)	4420 (2005)	4600 (2086)	4760 (2161)	4910 (2232)	5060 (2297)	5190 (2359)
TA504	5/16 (8)	860 (390)	1220 (554)	1725 (783)	2725 (1237)	3575 (1623)	3850 (1748)	4090 (1857)	4505 (2045)	4850 (2202)	5155 (2340)	5425 (2463)	5675 (2576)	5900 (2679)	6110 (2774)	6310 (2868)	6480 (2945)	6625 (3011)

*Spence recommends ISO filled Actuator above 500 psi (34.5 bar) and for superheated steam.

N650 SERIES
THERMOSTATIC STEAM TRAPS

Pressures To 650 PSIG (44.8 barg)
Temperatures to 750°F (400°C)

Positive Shutoff - Valve and seats are lapped in matched sets, providing tight shutoff for light and no- load conditions which results in improved energy savings.

Freeze Proof - Self draining when installed vertically.

Compact–Easy to Install - Ample extension for pipe wrench provided.

Easily Maintained - Actuator element and valve are attached to cover to facilitate inspection and servicing. Optional stainless blowdown valve permits easy strainer cleaning while in service.

Directional Discharge - Pipe and thread erosion prevented by directing condensate to center of discharge pipe.

Hardened Stainless Steel Valve and Seat - Long life. Lapped as a matched set for water tight seal.

Temperature Sensitive Actuators - One moving part. Stainless Steel, fail open or fail closed, welded actuator for maximum corrosion, thermal and hydraulic shock resistance.

Positive Shutoff and Long Life - Integral Stainless Steel Strainer helps prevent debris from depositing onto valve and seat.

Strainer - Integral Stainless Steel Strainer standard on all models.

MODELS

- **N651-FO**–Y pattern body w/strainer and blowdown port tapped & plugged; low capacity, fail open
- **N652***–Reduced capacity
- **N653***–Standard capacity
- **N654***–High capacity

*Add (-FC) for fail closed or (-FO) for fail open to end of model number

Applications

- Unit Heaters
- Air Vents
- Steam Tracing
- Drip Legs
- Platen Presses
- Plating Tanks
- Sterilizers
- Tire Presses
- Cooking Equipment
- Laundry Equipment
- Other Process Equipment

Options

- B - Blowdown Valve
- ISO - ISO Filled Actuator*
- SK - Skirted Seat*
- SLR - SLR Orifice
- SW - Socketweld

Canadian Registration # 0E0591.9

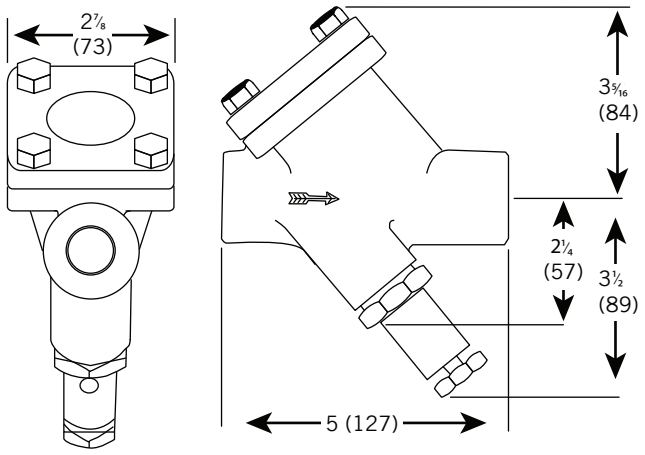
Operation

Thermal actuator is filled at its free length with a liquid having a lower boiling point than water. On start-up, valve is normally open. When steam enters trap, thermal actuator fill vaporizes to a pressure higher than line pressure. This forces valve into seat orifice to prevent any further flow. As condensate collects, it takes heat from thermal actuator, lowering internal pressure. Line pressure will then compress thermal actuator to open valve and discharge condensate. Valve opening automatically adjusts to load conditions from minimum on very light loads to full lift at maximum load. Optional blowdown valve allows fast and easy cleaning of internal strainer without removing trap from operation.

N650 SERIES
THERMOSTATIC STEAM TRAPS

SPECIFICATION

Steam trap shall be of balanced pressure design with stainless steel welded actuator capable of discharging condensate within 10°F of saturated temperature. Where greater sensitivity is required or protection from flash steam locking, a SLR orifice will be available to allow condensate and flash steam evacuation at or near saturated temperatures. Where subcooling of condensate is desired alternate thermostatic actuator will be available to allow condensate evacuation at or near 40°F below saturated temperatures. Thermostatic actuator shall employ a conical valve lapped in matched sets with the seat ring assuring tight shut off. A minimum of four orifice sizes shall be available allowing for custom capacity sizing. Trap shall be forged carbon steel Y pattern body with strainer and available blow down valve suitable for pressures to 650 psig and available in 1/2" and 3/4" NPT or socketweld.



SHOWN WITH OPTIONAL BLOWDOWN VALVE
WEIGHT: 5 LBS. (2.3 KG)

Connections: 1/2" or 3/4" NPT or socketweld

Maximum operating conditions

Standard Traps		
PMO: Max. Operating Pressure	500 psig	(34.5 barg)
TMO: Max. Operating Temperature	600°F	(316°C)
ISO Option Traps		
PMO: Max. Operating Pressure	650 psig	(44.8 barg)
TMO: Max. Operating Temperature	650°F	(343°C)
All Traps		
PMA: Max. Allowable Pressure	650 psig	(44.8 barg)
TMA: Max. Allowable Temperature	750°F	(400°C)

Materials of construction

Body & Cover ..... ASTM A105 Forged Steel
Actuator ..... Welded Stainless Steel
Cover Gasket ..... 304 SS Spiral Wound w/Graphite Fill
Strainer ..... .033 Perf. 304 Stainless Steel
Blowdown Valve ..... 416 Stainless Steel
Valve & Seat ..... Hardened 416 Stainless Steel

Maximum Capacity - lbs/hr 10°F Below Saturation (Kg/hr 5°C Below Saturation)

Trap	Orifice Inch (mm)	Differential PSIG (barg)																
		5 (0.34)	10 (0.7)	20 (1.4)	50 (3.5)	100 (6.9)	125 (8.62)	150 (10.3)	200 (13.8)	250 (17.2)	300 (20.7)	350 (24.1)	400 (27.6)	450 (31.0)	500 (34.5)	550 (37.9)	600 (41.4)	650 (44.8)
N651	5/64 (2)	84 (38)	119 (54)	168 (76)	265 (120)	348 (158)	375 (170)	398 (181)	439 (199)	472 (214)	502 (228)	529 (240)	553 (251)	575 (261)	595 (270)	615 (280)	635 (289)	650 (295)
N652	1/8 (3)	216 (98)	265 (120)	375 (170)	592 (269)	778 (354)	838 (381)	890 (405)	980 (445)	1055 (480)	1121 (510)	1180 (536)	1235 (561)	1284 (584)	1331 (604)	1377 (625)	1425 (646)	1471 (667)
N653	1/4 (6)	550 (249)	825 (374)	1210 (549)	1975 (896)	2825 (1281)	3140 (1424)	3425 (1554)	3650 (1656)	3960 (1796)	4100 (1860)	4230 (1919)	4420 (2005)	4600 (2086)	4760 (2161)	4910 (2232)	5060 (2297)	5190 (2359)
N654	5/16 (8)	860 (390)	1220 (554)	1725 (783)	2725 (1237)	3575 (1623)	3850 (1748)	4090 (1857)	4505 (2045)	4850 (2202)	5155 (2340)	5425 (2463)	5675 (2576)	5900 (2679)	6110 (2774)	6310 (2868)	6480 (2945)	6625 (3011)

*Spence recommends ISO filled Actuator above 500 psi (34.5 bar) and for superheated steam. Spence recommends skirted seat above 300 psi (20.7 bar).

“A” SERIES
THERMOSTATIC STEAM TRAPS

Pressures To 200 PSIG (13.8 barg)
Temperatures to 400°F (204°C)

Temperature Sensitive Actuator - One moving part stainless steel welded actuator for maximum corrosion, thermal and hydraulic shock resistance.

Improved Energy Savings - Maximum elimination of air and non-condensibles–trap is closed at saturated steam temperature.

Compact - Requires minimum space and provides condensate capacities equal to larger mechanical traps.

Freeze Proof - Type A with horizontal inlet and vertical outlet. Type AHV when installed vertically (outlet down) or horizontally on side (cover perpendicular to ground).

Renewable In-line - With factory packaged, precision matched internal parts kits.

Superior Performance - Fast response to changing pressure and condensate loads. Maximum air handling capability.

Shown in AHV Configuration

MODELS*

- **A33**–1/2" right angle trap
- **A43**–3/4" right angle trap
- **A53**–1" right angle trap
- **AHV33**–1/2" straight thru trap
- **AHV43**–3/4" straight thru trap
- **AHV53**–1" straight thru trap

*Add (-HC) to end of model number for high capacity.

Applications

- Unit Heaters
- Sterilizers
- Air Vents
- Autoclaves
- Dry Kilns
- Dryers
- Flash Tanks
- Small Heat Exchangers
- Plating Tanks
- Cookers
- Kettles
- Other Process Equipment

Options

- ST - Sterilizer Trim
- SLR - SLR Orifice
- HC - High capacity orifice

Canadian Registration # 0E0591.9

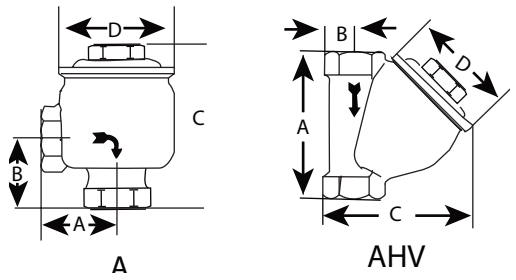
Operation

Thermal actuator is filled at its free length with a liquid having a lower boiling point than water. On start-up, valve is normally open. When steam enters trap, thermal actuator fill vaporizes to a pressure higher than line pressure. This forces valve into seat orifice to prevent any further flow. As condensate collects, it takes heat from thermal actuator, lowering internal pressure. Line pressure will then compress thermal actuator to open valve and discharge condensate. Valve opening automatically adjusts to load conditions from minimum on very light loads to full lift at maximum load.

"A" SERIES
THERMOSTATIC STEAM TRAPS

SPECIFICATION

Steam trap shall be of balanced pressure design with stainless steel welded actuator capable of discharging condensate within 10°F of saturated temperature. Where greater sensitivity is required, SLR orifice and Sterilizer trim shall be available to allow condensate evacuation at or near saturated temperatures. Thermostatic actuator shall employ a conical valve lapped in matched sets with the seat ring assuring tight shut off. A minimum of two orifice sizes shall be available allowing for custom capacity sizing. Trap shall be bronze bodied suitable for pressures through 200 psig and available in 1/2" through 1" NPT connections.



Connections: 1/2"–1" NPT

Dimensions						
Trap	Pipe Size inches	Inch (mm)				Weight Lb (kg)
		A	B	C	D	
A33	1/2	2 (41)	1 5/8 (106)	4 3/16 (76)	3 (1.5)	3.3 (1.5)
A43	3/4	2 (47)	1 7/8 (113)	4 7/16 (76)	3 (1.5)	3.3 (1.5)
A53	1	2 13/16 (56)	2 3/16 (125)	4 15/16 (76)	3 (2.2)	4.8 (2.1)
AHV33	1/2	4 (19)	3/4 (41)	3 7/8 (76)	3 (1.4)	3.1 (1.4)
AHV43	3/4	4 1/4 (22)	7/8 (108)	4 1/4 (76)	3 (1.6)	3.6 (1.6)
AHV53	1	5 5/8 (25)	1 (116)	4 9/16 (76)	3 (2.4)	5.3 (2.4)

Maximum operating conditions

PMO: Max. Operating Pressure	200 psig	(13.8 barg)
TMO: Max. Operating Temperature	400°F	(204°C)
PMA: Max. Allowable Pressure	200 psig	(13.8 barg)
TMA: Max. Allowable Temperature	400°F	(204°C)

Maximum operating conditions

Materials of construction

Body & Cover .....Brass
Actuator .....Welded Stainless Steel
Cover Gasket .....Copper Jacketed
Valve & Seat .....Hardened 416 Stainless Steel

Maximum Capacity - lbs/hr 10°F Below Saturation (Kg/hr 5°C Below Saturation)																
Trap	Orifice inch (mm)	1 (0.07)	2 (0.14)	5 (0.34)	10 (0.69)	15 (1.03)	20 (1.4)	40 (2.8)	50 (3.4)	60 (4.1)	80 (5.5)	100 (6.9)	125 (8.6)	150 (10.3)	175 (12.1)	200 (13.8)
1/2" A33, AHV33 3/4" A43, AHV43	5/16 (8)	785 (357)	1050 (477)	1650 (750)	2325 (1057)	2575 (1170)	2825 (1284)	3295 (1498)	3815 (1734)	4200 (1909)	4675 (2125)	5035 (2289)	5535 (2516)	5720 (2600)	6085 (2766)	6210 (2823)
1" A53, AHV53	3/8 (10)	985 (448)	1390 (632)	2180 (991)	3070 (1395)	3255 (1480)	3735 (1698)	4225 (1920)	5040 (2291)	5480 (2491)	5990 (2723)	6645 (3020)	7315 (3325)	7560 (3436)	8045 (3657)	8200 (3727)
1/2"- 1" All High Capacity "HC"	1/2 (13)	1140 (518)	1610 (732)	2545 (1157)	3600 (1636)	4405 (2002)	5090 (2314)	7195 (3270)	8045 (3657)	8810 (4005)	9800 (4455)	10560 (4800)	11375 (5170)	12090 (5495)	12725 (5784)	13305 (6048)

“B” SERIES
THERMOSTATIC STEAM TRAPS

Pressures To 250 PSIG (17.2 barg)
Temperatures to 450°F (232°C)

Renewable In-line - Renew trap in-line with factory packaged precision matched internal parts, replacement kits.

Compact - Requires minimum space while providing condensate capacities equal to larger mechanical traps.

Superior Performance - Maximum air handling capability. Immediate response to changing pressure and condensate loads. No adjustment necessary.

Sensitivity - Increased when installed on side with cover perpendicular to ground.

Temperature Sensitive Actuators - One moving part, stainless steel, fail open or closed, welded actuator provides maximum corrosion, thermal and hydraulic shock resistance and sensitivity.

Applications

- Unit Heaters
- Pipe Coils
- Blast Coils
- Steam Mains
- Dry Kilns
- Jacketed Kettles
- Hot Water Heaters
- Dryers (all types)
- Large Heat Exchangers

Options

- SLR - SLR Orifice
- HC - High capacity orifice

Canadian Registration # 0E0591.9

MODELS*

- **B33**–1/2" straight thru trap
- **B43**–3/4" straight thru trap
- **B53**–1" straight thru trap
- **B63**–1-1/4" straight thru trap
- **B73***–1-1/2" straight thru trap
- **B83***–2" straight thru trap

*Add (-HC) to end of model number for high capacity.

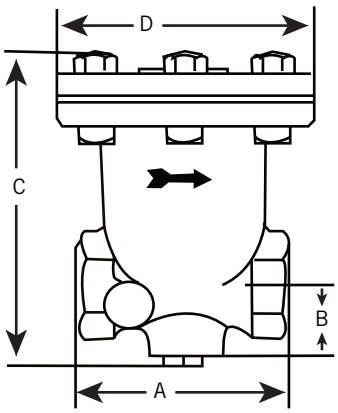
Operation

Thermal actuator is filled at its free length with a liquid having a lower boiling point than water. On start-up, valve is normally open. When steam enters trap, thermal actuator fill vaporizes to a pressure higher than line pressure. This forces valve into seat orifice to prevent any further flow. As condensate collects, it takes heat from thermal actuator, lowering internal pressure. Line pressure will then compress thermal actuator to open valve and discharge condensate. Valve opening automatically adjusts to load conditions from minimum on very light loads to full lift at maximum load.

"B" SERIES
THERMOSTATIC STEAM TRAPS

SPECIFICATION

Steam trap shall be of balanced pressure design with stainless steel welded actuator capable of discharging condensate within 10°F of saturated temperature. Where greater sensitivity is required or protection from flash steam locking, a SLR orifice will be available to allow condensate and flash steam evacuation at or near saturated temperatures. Thermostatic actuator shall employ a conical valve lapped in matched sets with the seat ring assuring tight shut off. Trap shall be cast iron or cast steel bodied suitable for pressures to 250 psig and available in 1/2" through 2" NPT



TYPE B

Connections: 1/2"–2" NPT

Dimensions						
Trap	Pipe Size inches	Inch (mm)				Weight Lb (kg)
		A	B	C	D	
B33	1/2	3 7/8 (98)	1 1/8 (29)	5 7/8 (149)	4 1/2 (114)	7 (3.2)
B43	3/4	4 1/4 (108)	1 3/8 (35)	6 3/4 (171)	5 1/16 (129)	10.3 (4.7)
B53	1	5 1/2 (140)	1 7/8 (48)	7 11/16 (195)	5 13/16 (148)	15.6 (7.1)
B63	1 1/4	5 1/2 (140)	1 7/8 (48)	7 11/8 (195)	5 13/16 (148)	15.3 (7.0)
B73	1 1/2	7 1/4 (184)	1 3/4 (44)	9 1/16 (230)	7 3/4 (197)	33.6 (15.3)
B83	2	7 1/4 (184)	1 3/4 (44)	9 1/16 (230)	7 3/4 (197)	32.4 (14.7)

Maximum operating conditions

PMO: Max. Operating Pressure	250 psig	(13.8 barg)
TMO: Max. Operating Temperature	400°F	(204°C)
PMA: Max. Allowable Pressure	250 psig	(13.8 barg)
TMA: Max. Allowable Temperature	400°F	(204°C)

Materials of construction

Body & Cover .....Cast Iron ASTM A278 Class 30
Actuator .....Welded Stainless Steel
Cover Gasket .....Graphite
Valve & Seat .....Hardened 416 Stainless Steel

Maximum Capacity - lbs/hr 10°F Below Saturation (Kg/hr 5°C Below Saturation)															
Trap	Pipe Size Inch	Orifice inch (mm)	Differential PSIG (barg)												
			1 (.07)	2 (.14)	5 (0.34)	10 (0.7)	20 (1.4)	50 (3.5)	100 (6.9)	125 (8.6)	150 (10.3)	175 (12.1)	200 (13.8)	225 (15.5)	250 (17.2)
B33	1/2	3/8 (10)	985 (448)	1390 (632)	2180 (991)	3070 (1395)	3735 (1698)	5040 (2291)	6645 (3070)	7315 (3325)	7560 (3436)	8045 (3657)	8200 (3727)	8615 (3916)	8915 (4052)
B43	3/4	7/16 (11)	1460 (664)	2055 (934)	3240 (1473)	4560 (2073)	5550 (2523)	7480 (3400)	9865 (4484)	10850 (4932)	11225 (5102)	11935 (5425)	12165 (5530)	12770 (5805)	13225 (6011)
B53, B63	1, 1 1/4	1/2 (12)	1825 (830)	2575 (1170)	4050 (1841)	5700 (2591)	6925 (3148)	9350 (4750)	12340 (5609)	13565 (6166)	14030 (6377)	14920 (6782)	15230 (6923)	15960 (7255)	16540 (7518)
B73, B83	1 1/2, 2	3/4 (19)	2760 (1255)	3890 (1768)	6120 (2782)	8610 (3914)	10470 (4759)	14125 (6420)	18660 (8482)	20520 (9327)	21235 (9652)	22580 (10264)	23015 (10461)	24190 (10995)	25055 (11389)
B73HC, B83HC	1 1/2, 2	1-1/4 (32)	3555 (1616)	5030 (2286)	7950 (3614)	11240 (5109)	15900 (7227)	25140 (11427)	33000 (15000)	— —	— —	— —	— —	— —	— —

"C" SERIES
THERMOSTATIC STEAM TRAPS

Pressures To 300 PSIG (21 barg)
Temperatures to 500°F (260°C)

Freeze Proof - When installed with horizontal inlet and vertical outlet.

Renewable In-line - Renew trap in-line with factory packaged precision matched internal parts, replacement kits.

Compact - Requires minimum space while providing condensate capacities equal to larger mechanical traps.

Superior Performance - Maximum air handling capability. Immediate response to changing pressure and condensate loads. No adjustment necessary.

Sensitivity - Increased when installed on side with cover perpendicular to ground.

Temperature Sensitive Actuators - One moving part, stainless steel, fail open or closed, welded actuator provides maximum sensitivity, corrosion and thermal & hydraulic shock resistance.

MODELS*

- **C33**–1/2" angle pattern trap
- **C43**–3/4" angle pattern trap
- **C53**–1" angle pattern trap
- **C63**–1-1/4" angle pattern trap
- **C73***–1-1/2" angle pattern trap
- **C83***–2" angle pattern trap

CS models are the same as above in cast steel.

*Add (-HC) to end of model number for high capacity.

Applications

- Unit Heaters
- Pipe Coils
- Blast Coils
- Steam Mains
- Dry Kilns
- Jacketed Kettles
- Hot Water Heaters
- Dryers (all types)
- Large Heat Exchangers

Options

- SLR - SLR Orifice
- SW - Socketweld
- HC - High capacity orifice

Canadian Registration # 0E0591.9

Operation

Thermal actuator is filled at its free length with a liquid having a lower boiling point than water. On start-up, valve is normally open. When steam enters trap, thermal actuator fill vaporizes to a pressure higher than line pressure. This forces valve into seat orifice to prevent any further flow. As condensate collects, it takes heat from thermal actuator, lowering internal pressure. Line pressure will then compress thermal actuator to open valve and discharge condensate. Valve opening automatically adjusts to load conditions from minimum on very light loads to full lift at maximum load.

"C" SERIES
THERMOSTATIC STEAM TRAPS

SPECIFICATION

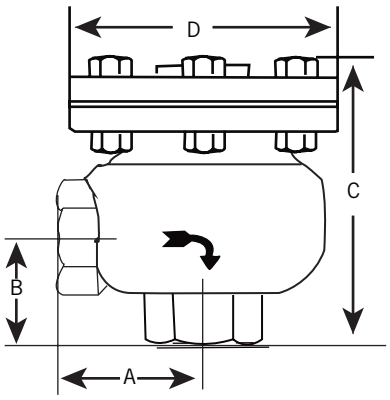
Steam trap shall be of balanced pressure design with stainless steel, welded actuator capable of discharging condensate within10°F of saturated temperature. Where greater sensitivity is required or protection from flash steam locking, a SLR orifice shall be available to allow condensate and flash steam evacuation at or near saturated temperatures. Thermostatic actuator shall employ a conical valve lapped in matched sets with the seat ring assuring tight shut off. Trap shall be cast iron or cast steel bodied suitable for pressures to 250 psig and available in 1/2" through 2" NPT.

Maximum operating conditions

Type C		
PMO: Max. Operating Pressure	250 psig	(17.2 barg)
TMO: Max. Operating Temperature	450°F	(232°C)
PMA: Max. Allowable Pressure	250 psig	(17.2 barg)
TMA: Max. Allowable Temperature	450°F	(232°C)
Type CS		
PMO: Max. Operating Pressure	300 psig	(20.7 barg)
TMO: Max. Operating Temperature	500°F	(260°C)
PMA: Max. Allowable Pressure	300 psig	(20.7 barg)
TMA: Max. Allowable Temperature	500°F	(260°C)

Materials of construction

Body & Cover: Type C ....Cast Iron ASTM A278 Class 30
Type CS ..Cast Steel ASTM A216 Grade WCB
Actuator.....Welded Stainless Steel
Cover Gasket .....Graphite
Valve & Seat.....Hardened 416 Stainless Steel



TYPE C & CS

*Connections: 1/2"–2" NPT or Socketweld**

Dimensions							
Trap	Pipe Size inches	Inch (mm)				Weight Lb (kg)	
		A	B	C	D	Type C	Type CS
C33	1/2	$2\frac{5}{8}$ (67)	$1\frac{13}{16}$ (46)	$4\frac{15}{16}$ (125)	$4\frac{1}{2}$ (114)	8.3 (3.8)	8.6 (3.9)
C43	3/4	$2\frac{3}{4}$ (70)	$2\frac{1}{16}$ (52)	$5\frac{7}{16}$ (138)	$5\frac{1}{16}$ (129)	11.1 (5.0)	13 (5.9)
C53	1	$3\frac{1}{2}$ (89)	$2\frac{13}{16}$ (71)	$6\frac{1}{16}$ (154)	$5\frac{13}{16}$ (148)	17.8 (8.1)	19.6 (8.9)
C63	1 1/4	$3\frac{1}{2}$ (89)	$2\frac{13}{16}$ (71)	$6\frac{1}{16}$ (154)	$5\frac{13}{16}$ (148)	17.5 (8.0)	19.3 (8.8)
C73	1 1/2	5 (127)	$3\frac{3}{4}$ (95)	$8\frac{3}{8}$ (213)	$7\frac{3}{4}$ (197)	39.1 (17.8)	39.2 (17.8)
C83	2	5 (127)	$3\frac{3}{4}$ (95)	$8\frac{3}{8}$ (213)	$7\frac{3}{4}$ (197)	39 (17.7)	31.1 (14.1)

Maximum Capacity - lbs/hr 10°F Below Saturation (Kg/hr 5°C Below Saturation)																
Trap	Pipe Size Inch	Orifice inch (mm)	Differential PSIG (barg)													
			1 (.07)	2 (.14)	5 (0.34)	10 (0.7)	20 (1.4)	50 (3.5)	100 (6.9)	125 (8.6)	150 (10.3)	175 (12.1)	200 (13.8)	225 (15.5)	250 (17.2)	300* (20.7)
C33, CS33	½	3/8 (10)	985 (448)	1390 (632)	2180 (991)	3070 (1395)	3735 (1698)	5040 (2291)	6645 (3070)	7315 (3325)	7560 (3436)	8045 (3657)	8200 (3727)	8615 (3916)	8915 (4052)	9220 (4191)
C43, CS43	¾	7/16 (11)	1460 (664)	2055 (934)	3240 (1473)	4560 (2073)	5550 (2523)	7480 (3400)	9865 (4484)	10850 (4932)	11225 (5102)	11935 (5425)	12165 (5530)	12770 (5805)	13225 (6011)	13685 (6220)
C53, CS53 C63, CS63	1, 1¼	1/2 (12)	1825 (830)	2575 (1170)	4050 (1841)	5700 (2591)	6925 (3148)	9350 (4750)	12340 (5609)	13565 (6166)	14030 (6377)	14920 (6782)	15230 (6923)	15960 (7255)	16540 (7518)	17120 (7782)
C73, CS73 C83, CS83	1½, 2	3/4 (19)	2760 (1255)	3890 (1768)	6120 (2782)	8610 (3914)	10470 (4759)	14125 (6420)	18660 (8482)	20520 (9327)	21235 (9652)	22580 (10264)	23015 (10461)	24190 (10995)	25055 (11389)	25915 (11780)
C73HC, C83HC	1½, 2	1-1/4 (32)	3555 (1616)	5030 (2286)	7950 (3614)	11240 (5109)	15900 (7227)	25140 (11427)	33000 (15000)	— —	— —	— —	— —	— —	— —	— —

*CS Series Only. C available with screwed connections only. CS available with screwed or socketweld connections.

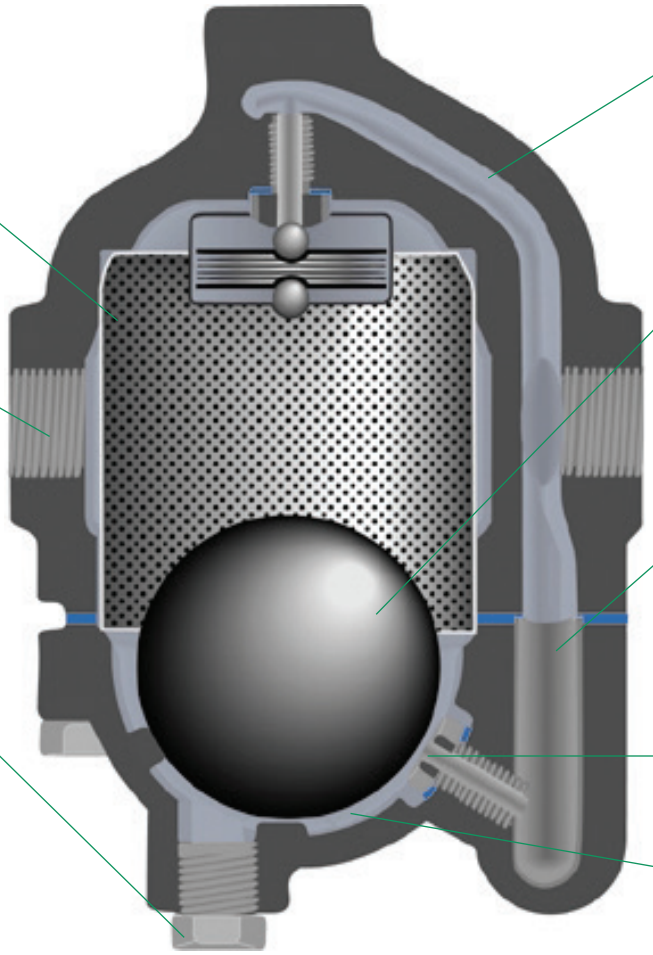
MECHANICAL STEAM TRAPS

NFT250 SERIES
VARIABLE ORIFICE STEAM TRAPS

Pressures To 250 PSIG
Temperatures to 450°F

Applications

- Steam Lines
- Unit Heaters
- Process Equipment
- Oil Preheaters
- Steam Cookers
- Converters
- Steam Heated Vats
- Coils
- Pressing Machinery
- Rotating Drum



Stainless Steel Strainer
with large screen area prevents dirt problems

Connections
Sizes 1/2" – 2" screwed NPT (BSPT optional)
Sizes 1 1/2" & 2" flanged optional ANSI 250

Bottom & Side
Blowdown Connections for preventative maintenance

Proven Caged Stainless Steel Balanced Pressure Thermostatic Air Vent
automatically discharges air and non-condensables

Weighted Stainless Steel Ball
multi-contact surface area modulates orifice discharge to provide smooth, continuous discharge and immediate response to load variations

Stainless Steel Sleeve
eliminates body erosion

Stainless Steel Seat
full bore prevents choking and permits ample capacities

Liquid Level
maintains seal over orifice to prevent live steam loss

NFT250 SERIES
VARIABLE ORIFICE STEAM TRAPS

Pressures To 250 PSIG (17.2 barg)
Temperatures to 450°F (232°C)

All Stainless Steel Internal Components - Hardened valves and seats. Extra long life and dependable service. Resists water hammer. Protects against erosion and corrosion.

Erosion Proof - Discharge passage is protected with a stainless steel liner.

Integral Strainer - Stainless Steel screen prevents dirt problems. Blow-down connection provided.

Thermostatic Air Vent - Full balanced pressure element for immediate and complete air venting.

Variable Orifice - Condensate is discharged continuously through the seat ring which is modulated by the float. This provides a smooth, even flow without high velocity or steam entrainment.

SLR Orifice - Optional continuous bleed prevents flash steam lockup when it is impossible to install trap at low point in system.

MODELS

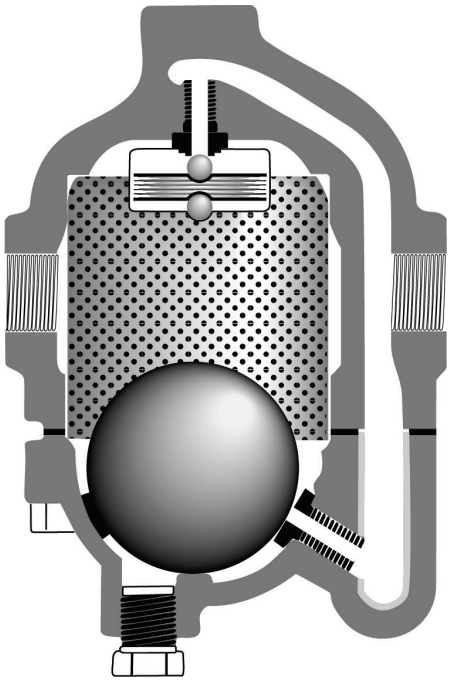
- **NFT250**–Low capacity
- **NFT251**–Medium capacity
- **NFT252**–High capacity
- **NFT253**–Super high capacity

Installation Tip: Always install STV Test & Block Valve as part of trap station

SEE PAGE 118

Installation Tip: Add Uniflex Pipe Coupling for ease of maintenance

SEE PAGE 98



Applications

- Steam Lines
- Process Equipment
- Steam Cookers
- Steam Heated Vats
- Pressing Machinery
- Unit Heaters
- Oil Preheaters
- Converters
- Coils
- Rotating Drum

Options

- SLR - SLR Orifice
- B - Blowdown Valve
- Orifice Continuous Bleed Air Vent
- 250# Flanged Connection*

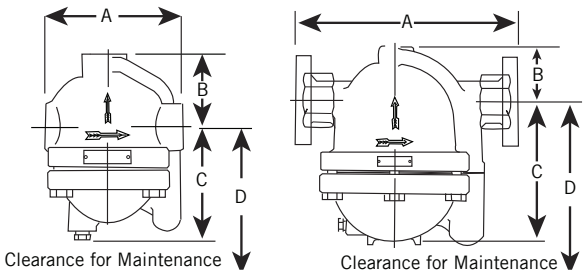
*Available on NFT 253 only.

Canadian Registration # OE0591.9C

Operation

On startup, the thermostatic air vent (caged stainless welded bellows) is open, allowing air to flow freely through the vent valve orifice. When condensate flows into the trap, the float rises, allowing condensate to be discharged. Once air and non-condensibles have been evacuated, hot condensate will cause the thermostatic vent to close. Condensate will continue to be discharged as long as condensation occurs. During normal operation, an increase in the load causes the liquid level in the trap to rise. The float then rises and rolls off the seat ring, allowing more condensate to flow out. The float sinks as the condensate load decreases, moving nearer to the seat ring, decreasing the effective size of the orifice and allowing less condensate to discharge. This provides smooth, continuous operation that reacts instantly to load variation while maintaining a water seal over the seat ring to prevent live steam loss.

NFT250 SERIES
VARIABLE ORIFICE STEAM TRAPS



Connections: ½"–2" NPT or 1½" - 2" Flanged

SPECIFICATION

Steam trap shall be of float and thermostatic design. Float shall be free of levers, linkages, or other mechanical connections. Float shall be weighted to maintain orientation and shall act as the valve being free to modulate condensate through the seat ring. Air vent shall be of balanced pressure design with stainless steel welded encapsulated bellows capable of discharging air and noncondensable gases continuously within 15°F of saturated temperature. Trap shall contain integral strainer and stainless steel exhaust port sleeve. Trap shall be cast iron bodied suitable for pressures to 250 psi and available in 1/2" through 2" NPT or flanged.

Dimensions

Model	Size	Connection	Inch (mm)				Weight Lb (kg)
			A	B	C	D	
NFT250	½ & ¾	NPT	4¼ (108)	2¾ (69)	3⅝ (92)	5½ (140)	6 (2.7)
NFT251	¾ & 1	NPT	5½ (140)	2 15/16 (74)	4 9/16 (116)	6¾ (171)	13 (5.9)
NFT252†	1 & 1½	NPT	11 (279)	2 15/16 (74)	7¾ (197)	10 (254)	41 (18.6)
NFT253	1½ & 2	NPT	13¾ (349)	2 15/16 (74)	11⅝ (295)	15⅜ (391)	120 (54.5)
		250# Flg.	15¾ (400)	2 15/16 (74)	11⅝ (295)	15⅜ (391)	130 (59.1)

Materials of construction

Body and Cover .....Cast Iron ASTM A126B
All Internal Parts .....Stainless Steel
Air Vent .....Balanced Pressure, Stainless Steel
Cover Gasket .....Graphite Fiber

Maximum operating conditions

PMO: Max. Operating Pressure

ORIFICE	PMO	
20	20 psig	(1.4 barg)
50	50 psig	(3.5 barg)
100	100 psig	(6.9 barg)
150	150 psig	(10.3 barg)
250	250 psig	(17.2 barg)

PMA: Max. Allowable Pressure:
250 psig (17.2 barg)

TMA: Max. Allowable Temperature:
450°F (232°C)

Maximum Capacity–lbs/hr (10°F Below Saturation)

Trap	Orifice inch (mm)	Differential PSIG (barg)															
		Max. ΔP	1 (.07)	5 (.34)	10 (.69)	15 (1.03)	20 (1.38)	30 (2.07)	50 (3.45)	75 (5.17)	100 (6.90)	125 (8.62)	150 (10.3)	175 (12.1)	200 (13.8)	225 (15.5)	250 (17.2)
NFT250	0.193	20	264	810	1050	1100	1200										
	0.141	50	190	430	610	750	870	1070	1400								
	0.102	100	88	160	250	300	350	425	530	670	710						
	0.091	150	70	140	219	260	295	345	410	470	520	555	590				
	0.067	250	37	90	140	170	200	240	300	340	390	405	415	440	460	480	500
NFT251	0.277	20	590	1600	2100	2400	2450										
	0.209	50	340	760	1080	1330	1540	1900	2460								
	0.157	100	200	500	650	740	830	950	1100	1300	1400						
	0.141	150	170	385	527	627	705	825	990	1130	1240	1330	1415				
	0.120	250	110	255	360	425	500	575	700	800	900	940	1000	1050	1100	1150	1200
NFT252	0.593	20	2720	6280	8600	10500	11700										
	0.469	50	1750	3920	5560	6830	7900	9700	12600								
	0.339	100	930	2170	3130	3840	4460	4990	6020	7030	7960						
	0.316	150	850	1935	2650	3150	3540	4140	4970	5685	6230	6690	7100				
	0.261	250	670	1400	1900	2400	2540	3000	3500	4100	4200	4900	5100	5300	5500	5750	6000
NFT253	1.102	20	8000	15000	18000	19900	22800										
	0.875	50	5460	12600	15600	16900	18400	21000	25400								
	0.593	100	2800	6350	8700	10900	12800	13700	16600	18700	21000						
	0.578	150	2690	6120	8385	9970	11200	13100	15700	17980	19700	21150	22450				
	0.484	250	1600	3770	5300	6470	7560	8610	10400	12100	13600	14600	15500	16300	17100	17800	18400

For Kg/Hr Multiply by .454

NFT650 SERIES
VARIABLE ORIFICE STEAM TRAPS

Pressures To 650 PSIG (44.8 barg)
Temperatures to 750°F (400°C)

All Stainless Steel Internal Components - Hardened valves and seats. Extra long life and dependable service. Resists water hammer. Protects against erosion and corrosion.

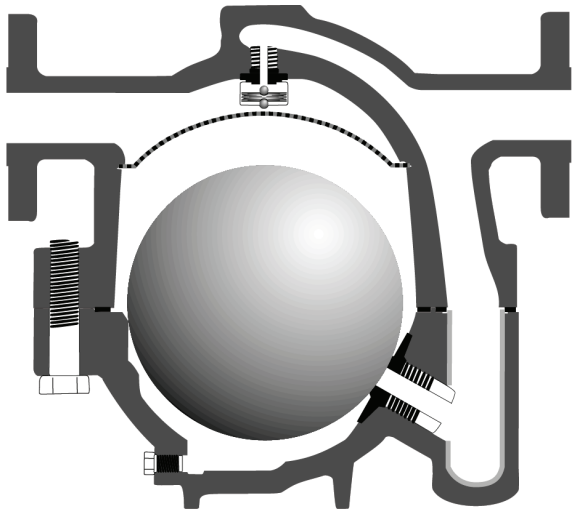
Erosion Proof - Discharge passage is protected with a stainless steel liner.

Integral Strainer - Stainless Steel screen prevents dirt problems. Blow-down connection provided.

Thermostatic Air Vent - Provided with balanced pressure element for immediate and complete air venting.

Variable Orifice - Condensate is discharged continuously through the seat ring which is modulated by the float. This provides a smooth, even flow without high velocity or steam entrainment.

SLR Orifice - Optional continuous bleed prevents flash steam lockup when it is impossible to install trap at low point in system.



MODELS

- **NFT651**–Low capacity
- **NFT652**–Medium capacity
- **NFT653**–High capacity

Installation Tip: Always install STV Test & Block Valve as part of trap station

SEE PAGE 118

Installation Tip: Add Uniflex Pipe Coupling for ease of maintenance

SEE PAGE 98

Applications

- Steam Lines
- Process Equipment
- Steam Cookers
- Steam Heated Vats
- Pressing Machinery
- Unit Heaters
- Oil Preheaters
- Converters
- Coils
- Rotating Drum

Options

- SLR - SLR Orifice
- B - Blowdown Valve
- Continuous Bleed Air Vent
- 300# or 600# Flanged Connection* (Raised Face)

*Available on NFT652 and NFT653 only.

Canadian Registration # OE0591.9C

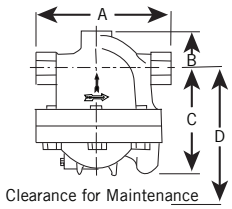
Operation

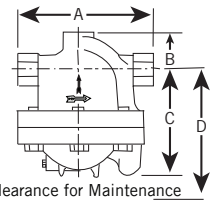
On startup, the thermostatic air vent (caged stainless welded bellows) is open, allowing air to flow freely through the vent valve orifice. When condensate flows into the trap, the float rises, allowing condensate to be discharged. Once air and non-condensibles have been evacuated, hot condensate will cause the thermostatic vent to close. Condensate will continue to be discharged as long as condensation occurs. During normal operation, an increase in the load causes the liquid level in the trap to rise. The float then rises and rolls off the seat ring, allowing more condensate to flow out. The float sinks as the condensate load decreases, moving nearer to the seat ring, decreasing the effective size of the orifice and allowing less condensate to discharge. This provides smooth, continuous operation that reacts instantly to load variation while maintaining a water seal over the seat ring to prevent live steam loss

NFT650 SERIES
VARIABLE ORIFICE STEAM TRAPS

SPECIFICATION

Steam trap shall be of float and thermostatic design. Float shall be free of levers, linkages, or other mechanical connections. Float shall be weighted to maintain orientation and shall act as the valve being free to modulate condensate through the seat ring. Air vent shall be of balanced pressure design with stainless steel welded encapsulated bellows capable of discharging air and noncondensable gases continuously within 15°F of saturated temperature. Trap shall contain integral strainer and stainless steel exhaust port sleeve. Trap shall be cast steel bodied suitable for pressures to 650 psi and available in 1/2" through 2" NPT, Socket Weld, or flanged.





Connections: ½"– 2" NPT or 1½" - 2" Flanged

Maximum operating conditions

PMO: Max. Operating Pressure

ORIFICE	PMO	
20	20 psig	(1.4 barg)
50	50 psig	(3.5 barg)
100	100 psig	(6.9 barg)
175	175 psig	(12.1 barg)
300	300 psig	(20.7 barg)
400	400 psig	(27.6 barg)
600	600 psig	(41.4 barg)

PMA: Max. Allowable Pressure: 650 psig (44.8 barg)

TMA: Max. Allowable Temperature:750°F (400°C)

Materials of construction

Body & Cover .....ASTM A216 Grade WCB
Cover Gasket .....Spiral Wound 304 Stainless
.....w/graphite filler
All Internal.....Stainless Steel
Air Vent .....Balanced Pressure, Stainless Steel

Dimensions

Model	Size	Inch (mm) A NPT	A 300	A 600	B	C	D	Weight lb (kg)
NFT651	½ , ¾ & 1	5½ (140)	-	-	3 1/16 (78)	5 7/16 (138)	7¼ (184)	21 (9.5)
NFT652	1	11 (279)	13¾ (349)	13¾ (349)	2 15/16 (75)	8¾ (222)	11⅜ (290)	84 (38.2)
	1½ & 2	11 (279)	13¾ (349)	14 9/16 (349)	2 15/16 (75)	8¾ (222)	11⅜ (290)	87 (39.5)
NFT653	1½	13¾ (349)	16¾ (426)	17⅜ (392)	3 5/16 (84)	11⅞ (392)	16 (406)	192 (87.3)
	2	13¾ (349)	16 11/16 (424)	17 7/16 (443)	3 5/16 (84)	11⅞ (302)	16 (406)	195 (88.6)

Maximum Capacity - lbs/hr (10 degrees Below Saturation)

Trap	Orifice inch (mm)	Differential PSIG (barg) Max. ΔP	1 (.07)	5 (.34)	10 (.69)	20 (1.38)	50 (3.45)	75 (5.17)	100 (6.90)	150 (10.3)	175 (12.1)	200 (13.8)	250 (17.2)	300 (20.7)	400 (27.6)	500 (34.5)	600 (41.4)
NFT651	0.277	20	590	1600	2100	2450											
	0.209	50	340	760	1080	1540	2460										
	0.157	100	200	500	650	830	1100	1300	1400								
	0.141	150	170	385	527	705	990	1130	1240	1415							
	0.130	175	180	350	500	675	900	1000	1100	1300	1400						
	0.120	250	110	255	360	500	700	800	900	1000	1050	1100	1200				
	0.106	300	105	240	330	435	575	675	750	875	955	1020	1140	1255			
	0.096	400	100	220	300	390	510	585	640	740	795	835	920	1000	1140		
	0.081	600	75	145	180	225	300	340	375	435	465	490	540	585	665	740	800
NFT652	0.593	20	2720	6280	8600	11700											
	0.469	50	1750	3920	5560	7900	12600										
	0.339	100	930	2170	3130	4460	6020	7030	7960								
	0.316	150	850	1935	2650	3540	4970	5685	6230	7100							
	0.297	175	800	1700	2300	3200	4400	5000	5500	6400	6900						
	0.261	250	670	1400	1900	2540	3500	4100	4200	5100	5300	5500	6000				
	0.238	300	645	1240	1565	1955	2575	2940	3220	3740	4000	4220	4640	5060			
	0.213	400	515	995	1250	1565	2060	2355	2575	2995	3200	3380	3720	4050	4600		
	0.180	600	370	710	895	1120	1470	1680	1840	2140	2290	2410	2655	2890	3300	3655	3955
NFT653	1.102	20	8000	15000	18000	22800											
	0.875	50	5460	12600	15600	18400	25400										
	0.593	100	2800	6350	8700	12800	16600	18700	21000								
	0.578	150	2690	6120	8385	11200	15700	17980	19700	22450							
	0.547	175	2400	5500	7600	10300	14400	16500	18200	20750	21900						
	0.484	250	1600	3770	5300	7560	10400	12100	13600	15500	16300	17100	18400				
	0.453	300	1500	3500	5200	7075	9325	10655	11655	13545	14485	15275	16815	18315			
	0.404	400	1400	2800	4200	5630	7420	8480	9270	10770	11520	12150	13380	14570	16555		
	0.339	600	800	1800	2800	3900	5220	5970	6530	7585	8110	8555	9420	10260	11655	12960	13990

For Kg/Hr Multiply by .454

FTN SERIES
FLOAT & THERMOSTATIC STEAM TRAPS

Pressures To 125 PSIG (8.6 barg)
Temperatures to 450°F (232°C)

Universal Four-port Design - Four possible hookup combinations of the "H" pattern body and piping dimensions similar to other major manufacturers allow maximum installation flexibility for easy replacement of other traps. Inlet and outlet taps on larger sized traps located in the cover to permit larger capacities.

All Stainless Steel Internal Components - Hardened valves and seats. Extra long life and dependable service. Resists water hammer. Protects against erosion and corrosion.

Balanced Pressure Thermostatic Element - allows venting of non-condensibles while operating at design pressure.

Rugged Welded Stainless Steel Element - Increases service life.

Wide Selection of Differential Pressures - Sizes 3/4" to 2" available with 15, 30, 75 and 125 psig differential pressures.

Air Line Water Removal - Special configuration FTNA optimized for compressed air service.

Repairable In-line - Can be serviced without disturbing system piping.

MODELS

- **FTN**-15–Steam pressures to 15 PSIG
- **FTN**-30–Steam pressures to 30 PSIG
- **FTN**-75–Steam pressures to 75 PSIG
- **FTN**-125–Steam pressures to 125 PSIG
- **FTNA**-75–Air pressures to 75 PSIG
- **FTNA**-125–Air pressures to 125 PSIG

Installation Tip: Always install STV Test & Block Valve as part of trap station

SEE PAGE 118

Installation Tip: Add Uniflex Pipe Coupling for ease of maintenance

SEE PAGE 98

Applications

- Unit Heaters & other Space Heating
- Equipment
- Heat Exchangers/Reboilers
- Steam Heating Coils
- Steam Main Drips
- Air Compressor Receivers
- Air Line Drips
- Air Powered Process Equipment

Options

- Repair Kits

Operation

Air entering trap is immediately discharged through the high capacity integral air vent. The thermostatic vent will close just prior to saturation temperature. The balanced design will allow venting of non-condensibles that collect in the float chamber when operating at design pressure. When steam enters the trap, the thermostatic air vent closes to prevent steam loss. When steam gives up it's latent heat, it becomes condensate. This "condensate" enters the trap and causes the stainless steel ball float to rise. Raising of the float opens the discharge valve, allowing condensate to be continuously discharged as it enters the trap. The condensate level in the trap body is maintained above the discharge seat, providing a positive seal against the loss of steam.

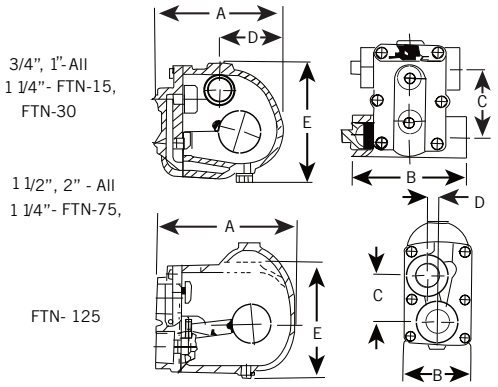
FTN SERIES
FLOAT & THERMOSTATIC STEAM TRAPS

SPECIFICATION

Steam trap shall be of float and thermostatic design. Float shall actuate the valve via a hinged lever and linkage. Air vent shall be of balanced pressure design with stainless steel welded encapsulated bellows capable of discharging air and noncondensable gases continuously within 15°F of saturated temperature. Traps through 1-1/4" shall employ "H" pattern connections to accommodate multiple piping configurations. Trap shall be cast iron bodied suitable for pressures to 125 psi and available in 3/4" through 2" NPT.

Dimensions

Model No.	Size	Inches (mm)					Weight Lb (kg)
		A	B	C	D	E	
FTN-15, FTN-30	¾	6.25 (159)	5.50 (140)	3.31 (84)	5.75 (146)	—	9 (4.1)
	1	6.25 (159)	5.50 (140)	3.31 (84)	5.75 (146)	—	9 (4.1)
	1¼	6.25 (159)	5.75 (146)	3.00 (76)	5.75 (146)	—	9½ (4.3)
	1½	8.50 (216)	4.25 (108)	3.00 (76)	—	8.40 (213)	18 (8.2)
	2	9.81 (249)	4.94 (123)	4.94 (123)	9.12 (232)	—	26 (11.8)
FTN-75, FTN-125 FTNA-75, FTNA-125	¾	6.25 (159)	5.50 (140)	3.31 (84)	5.75 (146)		9 (4.1)
	1	6.25 (159)	5.50 (140)	3.31 (84)	5.75 (146)	—	9 (4.1)
	1¼	8.50 (216)	4.25 (108)	3.00 (76)	—	8.40 (213)	18 (8.2)
	1½	8.50 (216)	4.25 (108)	3.00 (76)	—	8.40 (213)	18 (8.2)
	2	9.81 (249)	4.94 (123)	4.94 (123)	9.12 (232)	—	26 (11.8)



For Air Traps, 1/8" NPT tap at top boss for balancing line.

Connections: 3/4"–2" NPT

Materials of construction

Body & Cover .....Cast Iron ASTM A126B
All Internal.....Stainless Steel
Air Vent (FTN only) ...Balanced Pressure, Welded Stainless Steel

Maximum operating conditions

PMO: Max. Operating Pressure

ORIFICE	PMO	
15	15 psig	(1.03 barg)
30	30 psig	(2.07 barg)
75	75 psig	(5.17 barg)
125	125 psig	(8.62 barg)

PMA: Max Allowable Pressure
H Pattern Traps - 250 psig (17.2 barg)
Others - 125 psig (8.62 barg)
TMA: Max Allowable Temperature
H Pattern Traps - 450°F (232°C)
Others - 353°F (178°C)

Maximum Capacity—lbs/hr (10°F Below Saturation)

Trap	Size NPT	Orifice inch	Differential - PSIG (barg)														
			1/4 (.017)	1/2 (.034)	1 (.069)	2 (.138)	5 (.345)	10 (.690)	15 (1.03)	20 (1.38)	25 (1.72)	30 (2.07)	40 (2.76)	50 (3.45)	75 (5.17)	100 (6.90)	125 (8.62)
FTN-15	3/4"	.218	279	369	489	650	785	1000	1075								
FTN-15	1"	.218	279	369	489	650	785	1000	1075								
FTN-15	1 1/4"	.312	600	770	980	1240	1640	2000	2340								
FTN-15	1 1/2"	.500	1100	1700	2400	3300	5000	6600	7600								
FTN-15	2"	.625	2300	2800	3600	4650	6900	9000	10900								
FTN-30	3/4"	.218	279	369	489	650	785	1000	1075	1210	1300	1370					
FTN-30	1"	.218	279	369	489	650	785	1000	1075	1210	1300	1370					
FTN-30	1 1/4"	.228	375	500	690	910	1200	1500	1680	1800	1900	2000					
FTN-30	1 1/2"	.390	1000	1300	1700	2300	3400	4600	5500	6000	6600	7000					
FTN-30	2"	.500	1300	1800	2500	3400	5200	6800	7800	8600	9300	10000					
FTN-75†	3/4"	.166	160	213	280	365	520	700	795	875	930	970	1120	1230	1450		
FTN-75†	1"	.166	160	213	280	365	520	700	795	875	930	970	1120	1230	1450		
FTN-75†	1 1/4"	.312	550	725	960	1300	1900	2650	3050	3400	3700	4000	4400	4750	5400		
FTN-75†	1 1/2"	.312	550	725	960	1300	1900	2650	3050	3400	3700	4000	4400	4750	5400		
FTN-75†	2"	.421	850	1100	1500	2000	3100	4150	4750	5200	5500	5800	6400	6800	7700		
FTN-125†	3/4"	.125	100	135	175	230	330	415	500	585	620	685	750	830	970	1110	1190
FTN-125†	1"	.125	100	135	175	230	330	415	500	585	620	685	750	830	970	1110	1190
FTN-125†	1 1/4"	.246	400	520	680	890	1300	1700	2050	2300	2500	2700	3000	3200	3800	4200	4500
FTN-125†	1 1/2"	.246	400	520	680	890	1300	1700	2050	2300	2500	2700	3000	3200	3800	4200	4500
FTN-125†	2"	.332	550	675	880	1225	1950	2600	3000	3250	3500	3800	4200	4600	5500	6100	6600

For Kg/Hr Multiply by .454 †For FTNA capacities, multiply by 1.33.

FTE SERIES
FLOAT & THERMOSTATIC STEAM TRAPS

Pressures to 465 PSIG (32 barg)
Temperatures to 850ºF (454ºC)

- **High Capacities**
- **Rugged cast iron, ductile iron or cast steel body and cover**
- **Stainless steel thermostatic element eliminates air binding**
- **Stainless steel float and lever mechanism**
- **Below condensate level seat design prevents steam leakage**
- **Resistant to water hammer and corrosion**
- **In-Line repairable**

Applications

- Very High Condensate Loads
- Continuous Drainage With High Air Venting
- Capacity Requirements
- Industrial And Commercial Applications
- Absorption Systems
- Air Handling Coils
- Heat Exchangers
- Dryers Evaporators
- Hot water Generators
- Rendering Machines
- Steam Process Equipment
- Air Make-up Coils
- Unit Heaters And Cooking Kettles

MODELS*

CAST IRON BODY

- **FTE-10** – To 200 PSIG Threaded Connections
- **FTE-43** – To 200 PSIG Flanged Connections

DUCTILE IRON BODY

- **FTE-14** – To 200 PSIG Threaded Connections

CAST STEEL BODY

- **FTE-44** – To 465 PSIG Threaded/Socket Weld Connections
- **FTE-44F** – To 465 PSIG Flanged Connections

Note: * Add "S" to end of model for SLR

Installation Tip: Always install STV Test & Block Valve as part of trap station

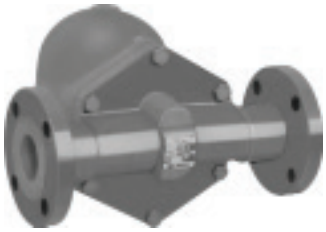
SEE PAGE 118

FTE 10

FTE 14

FTE 43

FTE 44



FTE 44F

Options

- BSPT Threaded connection
- S-SLR Orifice
- Socket Weld connection on FTE-44
- Flanged connections
  - ANSI 125/150, 300, 600
  - DIN 10, 16, 25 or 40
  - BS10 - F, H, J, K or R

Installation Tip:

Add Uniflex Pipe Coupling for ease of maintenance on NPT Traps

SEE PAGE 98

Operation

During startup, air and non-condensible gases enter the trap and are automatically vented through an accurate balanced pressure internal thermostatic air vent. As condensate enters the trap, the float and lever mechanism is raised, lifting the valve off the seat, discharging the condensate. Condensate will continue to be discharged at the same rate at which it is entering. Any air or non-condensible gas that may accumulate will be continually and efficiently passed by the thermostatic air vent.

FTE SERIES
FLOAT & THERMOSTATIC STEAM TRAPS

SPECIFICATION

Steam trap shall be of float and thermostatic design. Float shall actuate the valve via a hinged lever and linkage. Air vent shall be of balanced pressure design with stainless steel welded encapsulated bellows capable of discharging air and noncondensable gases continuously.

Maximum operating conditions

CAST IRON/DUCTILE IRON

PMO: Max. Operating Pressure	see orifice selection	
TMO: Max. Operating Temperature	saturated at pressure	
PMA: Max. Allowable Pressure	232 psig	(16 barg)
PMA: Max. Allowable Temperature	450ºF	(232ºC)

CAST STEEL

PMO: Max. Operating Pressure	see orifice selection	
TMO: Max. Operating Temperature	saturated at pressure	
PMA: Max. Allowable Temperature	465 psig	(32 barg)
TMA: Max. Allowable Pressure	850ºF	(454ºC)

Materials of construction

Body & Cover ..... Cast Iron (ASTM A48 Cl. 30)
..... Ductile Iron (DIN 1693 GGG 40)
..... Cast Steel (ASTM A216 Gr. WCB)
Valve ..... Stainless Steel 304 (up to 1")
..... Stainless Steel 410 (11⁄2", 2")
Valve Seat ..... Stainless Steel 410
Housing & Housing Cover
for Float Mechanism .. ..
..... ASTM A743 Gr. CA 40 (Investment Cast)
Float ..... Stainless Steel 304
Lever Assembly ..... Stainless Steel 304
Thermostatic Airvent . Stainless Steel 304
Cover Bolts ..... SAE Gr. 8

Connections: ½"– 2" NPT, Flanged, DIN or Socket Weld

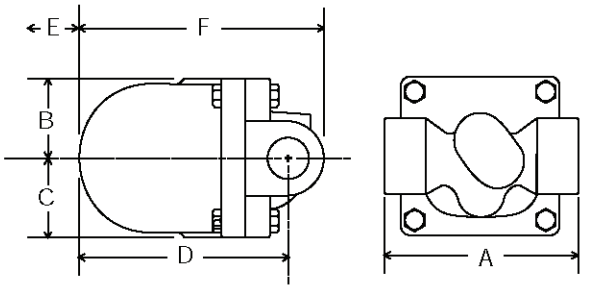
Maximum Capacity—lbs/hr (10ºF Below Saturation)

Trap	Size inlet	Orifice (in.)	Max ΔP		Differential Pressure-PSIG (barg)													
			BAR	PSI	5 (.345)	10 (.690)	20 (1.38)	40 (2.76)	50 (3.45)	65 (4.50)	80 (5.52)	100 (6.90)	125 (8.62)	145 (10.0)	180 (12.4)	200 (13.8)	300 20.7	400 27.6	465 32.1
FTE-10, 14, & 43	1/2 & 3/4	0.142	4.5	65	400	520	700	950	1000	1150									
		0.095	10.0	145	275	380	530	720	800	900	1000	1080	1250	1380					
		0.079	14.0	200	200	290	400	570	640	700	800	900	1020	1100	1240	1300			
FTE-10, 14, & 43	1	0.256	4.5	65	1650	2200	3050	4200	5000	5200									
		0.17	10.0	145	870	1250	1650	2350	2600	3000	3200	3500	3900	4100					
		0.142	14.0	200	640	800	1250	1600	1800	2000	2200	2550	2780	2900	3020	3100			
FTE-10 & 43	1½	0.689	4.5	65	4200	6000	8800	12500	13500	15000									
		0.571	10.0	145	2800	3900	5600	8000	9000	10000	11500	13000	14200	15000					
		0.531	14.0	200	1800	2600	3600	5000	5450	6000	6900	7800	8600	9000	9650	10000			
FTE-10 & 43	2	1.063	4.5	65	13500	19800	28000	40000	45000	50500									
		0.811	10.0	145	7300	10000	14500	20000	22500	26000	29000	32000	35000	40000					
		0.657	14.0	200	3500	5000	6800	9600	10500	12000	13500	15000	16500	17500	19000	20000			
FTE-44 & 44F	1/2 & 3/4	0.142	4.5	65	400	520	700	950	1000	1150									
		0.095	10.0	145	275	380	530	720	800	900	1000	1080	1250	1380					
		0.079	14.0	200	200	290	400	570	640	700	800	900	1020	1100	1240	1300			
		0.07	21.0	300	110	145	200	280	315	350	400	430	480	520	580	610	700		
		0.063	32.0	465	65	90	120	155	170	200	215	250	280	300	325	345	400	425	440
FTE-44 & 44F	1	0.256	4.5	65	1650	2200	3050	4200	5000	5200									
		0.17	10.0	145	870	1250	1650	2350	2600	3000	3200	3500	3900	4100					
		0.142	14.0	200	640	800	1250	1600	1800	2000	2200	2550	2780	2900	3020	3100			
		0.114	21.0	300	400	520	700	950	1000	1150	1600	1850	2020	2150	2350	2500	2800		
		0.095	32.0	465	275	380	530	720	800	900	1000	1080	1250	1380	1440	1500	1800	2000	2050
FTE-44 & 44F	1½	0.689	4.5	65	4200	6000	8800	12500	13500	15000									
		0.571	10.0	145	2800	3900	5600	8000	9000	10000	11500	13000	14200	15000					
		0.531	14.0	200	1800	2600	3600	5000	5450	6000	6900	7800	8600	9000	9650	10000			
		0.531	21.0	300	1800	2600	3600	5000	5450	6000	6900	7800	8600	9000	9650	10000	13000		
		0.531	32.0	465	1800	2600	3600	5000	5450	6000	6900	7800	8600	9000	9650	10000	13000	14300	15000
FTE-44 & 44F	2	1.063	4.5	65	13500	19800	28000	40000	45000	50500									
		0.811	10.0	145	7300	10000	14500	20000	22500	26000	29000	32000	35000	40000					
		0.657	14.0	200	3500	5000	6800	9600	10500	12000	13500	15000	16500	17500	19000	20000			
		0.657	21.0	300	3500	5000	6800	9600	10500	12000	13500	15000	16500	17500	19000	20000	27000		
		0.657	32.0	465	3500	5000	6800	9600	10500	12000	13500	15000	16500	17500	19000	20000	27000	29800	31000

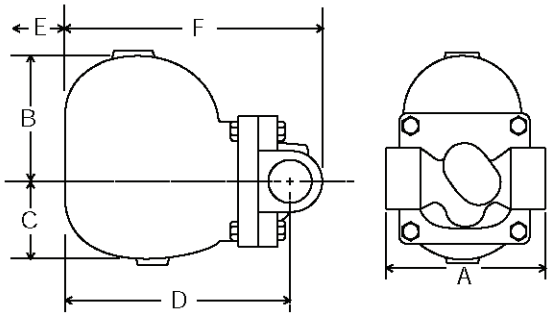
For Kg/Hr Multiply by .454

SERIES FTE DIMENSIONS

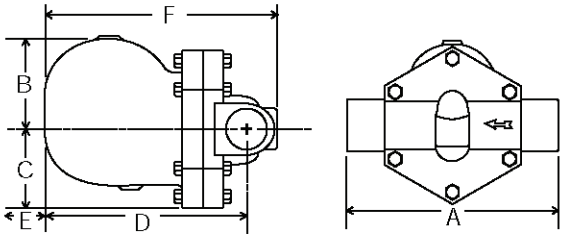
DIMENSIONS inches (mm) AND WEIGHTS pounds (kg) SERIES FTE-10 & FTE 44								
Size	Inches (mm)						Weight Lbs (kg)	
	A	B	C	D	E	F	FTE-10	FTE-44
1/2	5 1/16 (128)	2 1/8 (54)	2 1/8 (54)	5 11/16 (145)	4 5/16 (110)	6 11/16 (170)	10.5 (4.8)	11.4 (5.2)
3/4	5 1/16 (128)	2 1/8 (54)	2 1/8 (54)	5 11/16 (145)	4 5/16 (110)	6 11/16 (170)	10.5 (4.8)	11 (5.0)
1	5 1/16 (128)	4 5/16 (110)	2 15/16 (75)	7 1/2 (190)	6 5/16 (160)	8 1/2 (216)	18.7 (8.5)	17.6 (8.0)
1¼	11 1/8 (282)	5 (127)	4 5/16 (110)	10 (254)	7 7/8 (200)	11 3/8 (289)	49.5 (22.5)	48.4 (22.0)
2	12 1/8 (308)	5 1/2 (140)	5 (127)	10 1/4 (260)	7 1/8 (200)	11 13/16 (300)	61.6 (28.0)	59.4 (27.0)



FTE-10 CAST IRON & FTE-44 CAST STEEL 1/2" & 3/4"

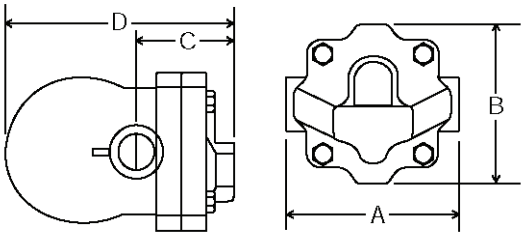


FTE-10 CAST IRON & FTE-44 CAST STEEL 1"



FTE-10 CAST IRON & FTE-44 CAST STEEL 1½" & 2"

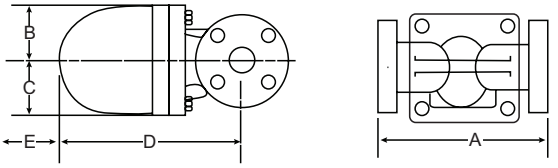
DIMENSIONS inches (mm) AND WEIGHTS pounds (kg) SERIES FTE-14					
Size	Inches (mm)				Weight Lbs (kg)
	A	B	C	D	
1/2	4 (121)	4 (108)	2 (67)	5 (148)	7.9 (3.6)
3/4	4 (121)	4 (108)	2 (67)	5 (148)	7.9 (3.6)
1	5 (145)	4 (108)	3 (76)	6 (167)	10.1 (4.6)



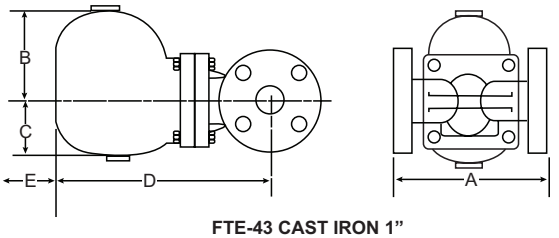
FTE-14-DUCTILE IRON 1/2", 3/4" & 1"

SERIES FTE DIMENSIONS

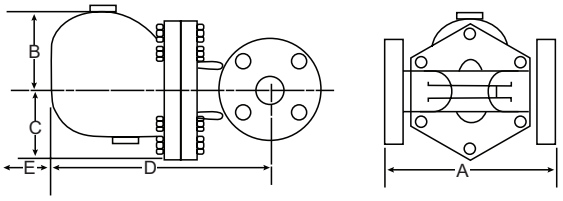
DIMENSIONS inches (mm) AND WEIGHTS pounds (kg) SERIES FTE-43/44/44F							
Size	Inches (mm)					Weight Lbs (kg)	
	A	B	C	D	E	FTE-43/44F	FTE-44
1/2 & 3/4 FTE 43	5⅛ (150)	2⅛ (54)	2⅛ (54)	7½ (190)	4⁵⁄₁₆ (110)	16 (7.3)	---
1/2 & 3/4 FTE 44/44F	4⁷⁄₁₆ (113)	5⅛ (135)	2¹³⁄₁₅* (71)*	6⅝ (169)	5¼ (134)	16 (7.3)	13 (5.8)
1	6⁵⁄₁₆ (160)	4⁵⁄₁₆ (110)	2⁵⁄₁₆ (75)	9¹⁵⁄₁₅ (245)	6⁵⁄₁₆ (160)	25.3 (11.5)	17.6 (8.0)
1½	9⅛ (230)	5 (127)	4⁵⁄₁₆ (110)	13⅛ (333)	7⅞ (200)	61.6 (28.0)	48.4 (22.0)
2	9⅛ (230)	5½ (140)	5 (127)	13½ (343)	7⅛ (200)	74.8 (34.0)	69.4 (27.0)
*FTEDDF is 4-7/16" (113mm)							



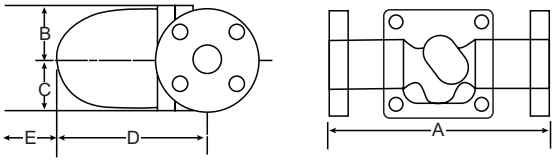
FTE-43 CAST IRON 1/2" & 3/4"



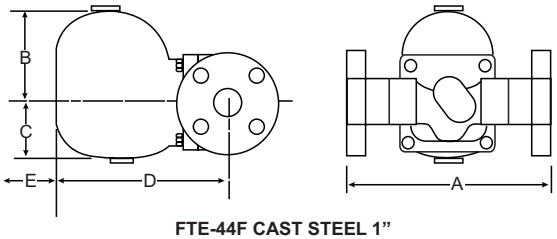
FTE-43 CAST IRON 1"



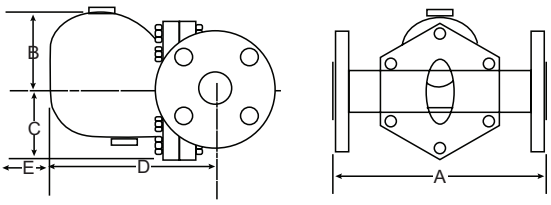
FTE-43 CAST IRON 1$^{1/2"}$ & 2"



FTE-44F CAST STEEL 1/2" & 3/4"



FTE-44F CAST STEEL 1"



FTE-44F CAST STEEL 1$^{1/2"}$ & 2"

DURA-FLO
INVERTED BUCKET STEAM TRAP

Pressures To 250 PSIG
Temperatures to 450°F

Applications

- Steam Lines
- Unit Heaters
- Process Equipment
- Oil Preheaters
- Steam Cookers
- Converters
- Steam Heated Vats
- Coils
- Pressing Machinery
- Rotating Drum

Withstands Severe Conditions

Heavy wall cast iron cover and body provide many years of trouble free service.

Easy to Maintain

Working parts lift out with top for quick inspection and maintenance.

Smooth Action and Tight Shutoff

Stainless steel linkage, valve and seats are precision manufactured to ensure optimal performance.

Resists Corrosion

Stainless steel bucket provides maximum service life with minimum deterioration.

Ideal for "Dirty" Systems

Valve and seat located at top of trap and stainless steel strainers available on most horizontal models ensure long service

Minimizes Effects of Water Hammer

Open bucket design avoids collapse typical of sealed floats.

Maximum Compatibility with Existing Installations

Pressure change assemblies are interchangeable with Armstrong which guarantees maximum flexibility when stocking repair parts.

Suitable for Wide Variety of Loads/Applications

Horizontal and vertical models in thirteen body sizes are one of the most comprehensive inverted bucket trap lines available.

DURA-FLO
INVERTED BUCKET STEAM TRAPS

Pressures To 250 PSIG (17.2 barg)
Temperatures to 450°F (232°C)

Hardened Stainless Steel Valve and Seat - Long life and maximum corrosion resistance.

Stainless Steel Bucket - Long lasting, rugged and naturally resistant to water hammer.

Inexpensive - Low maintenance and initial cost.

Repairable in-line - All working parts lift out of top of trap.

Cast Iron Body - Durable heavy wall construction provides years of reliable service.

Suitable for Wide Variety of Loads/Applications - Horizontal and vertical models in thirteen body sizes.

Resists Dirt and Scale - Valve and seats positioned at top of traps and internal stainless strainer available on most horizontal models ensure long service.

Applications

- Steam Lines
- Process Equipment
- Steam Cookers
- Steam Heated Vats
- Pressing Machinery
- Unit Heaters
- Oil Preheaters
- Converters
- Coils
- Rotating Drum

Options

- Repair Kits

MODELS*

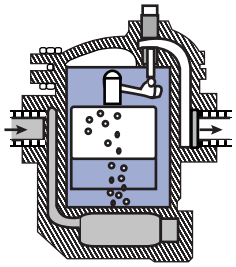
- **80S**–Low capacity horizontal w/integral strainer
- **81S**–Medium low capacity horizontal w/integral strainer
- **82S**–Medium capacity horizontal w/integral strainer
- **83S**–Medium high capacity horizontal w/integral strainer
- **84**–High capacity horizontal
- **85**–Super high capacity horizontal
- **86**–Ultra high capacity horizontal
- **21**–Medium low capacity vertical
- **22**–Medium capacity vertical
- **23**–Medium high capacity vertical
- **24**–High capacity vertical
- **25**–Super high capacity vertical
- **26**–Ultra high capacity vertical

Canadian Registration # OE 0591.1C

Installation Tip: Always install STV Test & Block Valve as part of trap station SEE PAGE 118

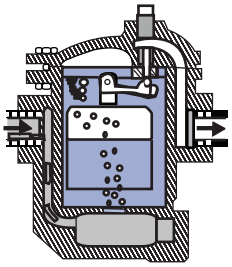
Installation Tip: Add Uniflex Pipe Coupling for ease of maintenance SEE PAGE 98

Operation



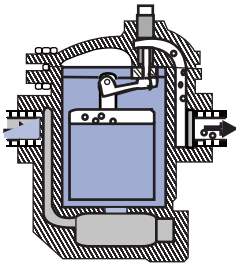
Trap Closed

After trap is installed and primed, steam entering the trap collects in the top of the bucket, floating the bucket and forcing the valve into its seat.



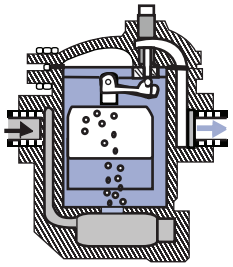
Trap Begins to Open

As condensate begins to flow into the trap, steam and air are forced from the bucket. This causes the bucket to begin losing buoyancy, tending to pull the valve from its seat.



Trap Discharges

When enough condensate has entered the trap, displacing the steam and air, the bucket drops, pulling the valve from the seat and allowing condensate and air to discharge.



Trap Closes

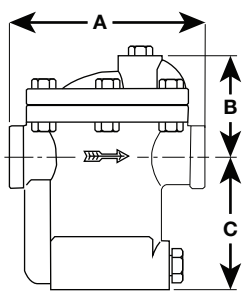
As the flow of condensate stops, steam enters the trap and refloats the bucket, forcing the valve into its seat. The cycle then repeats as more condensate reaches the trap.

DURA-FLO
INVERTED BUCKET STEAM TRAPS

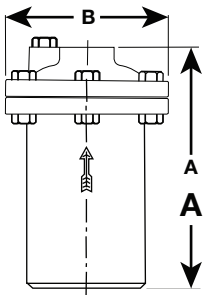
SPECIFICATION

Furnish and install as shown on the plans, inverted bucket traps capable of discharging condensate, air and other noncondensible gases without loss of steam. These traps shall have a heavy cast iron body, hardened stainless steel valve and seat, all stainless steel linkage and bucket, and a graphite fiber cover gasket.

Dimensions					
Trap	End Connections	Inches (mm)			Weight Lbs (kg)
		A	B	C	
80S	½, ¾	5 1/16 (129)	2 11/16 (69)	3½ (89)	7 (3.2)
81S	½, ¾, 1	5 1/16 (129)	2 11/16 (69)	4 7/16 (113)	8 (3.6)
82S	½, ¾	7 (178)	3⅞ (98)	5 7/16 (138)	22 (10.0)
83S	¾, 1	8⅛ (206)	5 (127)	7⅝ (194)	32 (14.5)
84	1, 1¼	9 (229)	5¾ (146)	7 13/16 (199)	47 (21.3)
85	1½, 2	10¼ (260)	8 (203)	8⅜ (213)	74 (33.6)
86	2, 2½	13 (330)	9¾ (248)	11 (279)	140 (63.5)
21	½	6⅜ (162)	4¼ (108)	—	6.5 (2.9)
22	½, ¾	8 (203)	5⅝ (143)	—	16 (7.3)
23	¾, 1	10½ (267)	6⅞ (175)	—	28 (12.7)
24	1, 1¼	12½ (318)	7½ (190)	—	35 (15.9)
25	1, 1½	14⅜ (365)	9 1/16 (230)	—	60 (27.2)
26	½, 2	16 11/16 (424)	10¼ (260)	—	90 (40.8)



80 SERIES, HORIZONTAL



20 SERIES, VERTICAL

Connections: ½"– 2" NPT

Maximum operating conditions

PMO: Max. Operating Pressure	see orifice selection
TMO: Max. Operating Temperature	saturated at pressure
PMA: Max. Allowable Pressure	250 psig (17.2 barg)
TMA: Max. Allowable Temperature	450°F (232°C)

Materials of construction

Body & Cover .....Cast Iron ASTM-A-126/A48
Bucket & Linkage .....Stainless Steel
Valve & Seat.....Hardened Chrome Steel
Standpipe .....Steel Pipe
Cover Gasket .....Graphite

DURA-FLO
CAPACITY TABLES

Trap	Orifice Size	Orifice Max ΔP	0.50 (.034)	1 (.069)	5 (.345)	10 (.690)	15 (1.03)	20 (1.38)	25 (1.72)	30 (2.07)	40 (2.76)	60 (4.14)	70 (4.83)	80 (5.52)	100 (6.90)	125 (8.62)	130 (8.97)	150 (10.3)	180 (12.4)	200 (13.8)	225 (15.5)	250 (17.2)
80S	3/16	20	200	270	450	560	640	690														
	1/8	80	80	110	200	300	360	420	460	500	540	620	660	690								
	7/64	125	-	55	90	145	195	260	305	345	400	485	525	565	640	680						
	3/32	150	-	-	70	110	150	200	240	270	310	380	410	440	480	540	545	570				
81S & 21	1/4	15	300	450	830	950	1060															
	3/16	30	190	300	540	670	770	880	950	1000												
	5/32	70	100	165	180	430	495	585	655	710	770	900	950									
	1/8	125	70	130	220	340	390	460	515	560	610	710	760	800	860	950						
	7/64	200	-	65	150	230	275	335	375	405	455	545	580	610	665	735	780	810	850	860		
	3/32	250	-	-	100	150	190	240	270	290	340	420	450	470	520	575	585	620	670	700	730	760
82S & 22	5/16	15	570	850	1600	1900	2100															
	1/4	30	350	500	950	1380	1630	1800	1900	2050												
	3/16	70	250	420	785	950	1120	1260	1395	1500	1700	2000	2200									
	5/32	125	180	300	560	680	800	900	995	1070	1220	1440	1550	1650	1800	2000						
	1/8	200	100	180	325	465	505	575	650	710	805	980	1050	1105	1225	1375	1410	1500	1560	1600		
	7/64	250	75	130	240	340	370	420	480	520	590	720	770	810	900	1010	1020	1100	1170	1230	1280	1300
83S & 23	1/2	15	1410	1880	2900	3500	3900															
	3/8	30	990	1400	2300	2700	3300	3500	3800	4000												
	5/16	60	600	940	1730	2045	2510	2825	2995	3135	3800	4400										
	9/32	80	510	735	1350	1595	1960	2205	2340	2450	2880	3490	3800	4000								
	1/4	125	385	600	1100	1300	1600	1800	1910	2000	2350	2850	3100	3300	3600	3900						
	7/32	180	300	490	860	1165	1350	1595	1865	2085	2205	2510	2695	2820	3065	3185	3300	3500	3700			
	3/16	250	255	400	700	950	1100	1300	1520	1700	1800	2050	2200	2300	2500	2600	2700	2800	3020	3200	3400	3500
84 & 24	5/8	15	2160	2900	4800	5800	6500															
	1/2	30	1450	2250	3700	4750	5200	6000	6500	6800												
	3/8	60	1050	1750	2950	3550	4000	4700	5000	5400	5800	6800										
	11/32	80	800	1560	2500	2900	3200	3500	4000	4400	4850	5750	6000	6400								
	5/16	125	660	1200	1950	2450	2750	3100	3250	3500	4000	4800	5250	5600	6200	6700						
	9/32	180	550	950	1500	1900	2200	2350	2700	2900	3250	3800	4250	4500	4800	5500	5600	5700	6000			
	1/4	250	350	580	1000	1250	1450	1800	2000	2200	2600	3150	3350	3500	3800	4300	4450	4700	5000	5300	5500	5700
85 & 25	3/4	15	3100	4160	7600	9000	10000															
	9/16	30	1800	2900	5200	6400	7700	8500	9200	9800												
	7/16	60	1400	2200	3800	5000	6000	6600	7100	7600	8300	9500										
	3/8	100	1100	1700	3000	3600	4500	5200	5800	6100	7000	8500	9200	9700	10400							
	11/32	130	900	1500	2600	3200	3900	4500	5000	5400	6200	7500	8050	8500	9600	10900	11000					
	5/16	180	750	1200	2100	2600	3200	3700	4100	4500	5400	6600	7000	7257	8118	8979	9040.5	9500	10000			
	9/32	225	600	970	1700	2100	2600	2950	3300	3600	4500	5400	5700	5900	6600	7300	7350	7850	8400	9200	9800	
	1/4	250	400	700	1200	1500	1900	2100	2400	2600	3200	3800	4000	4150	4600	5100	5150	5500	5950	6350	6650	7000
86 & 26	1-1/16	15	6240	8400	14500	17300	19200															
	7/8	25	4100	5490	10000	12930	15620	18500	20000													
	3/4	40	2900	4500	8200	10600	12800	15000	16700	18000	20000											
	5/8	60	2100	3500	6900	8700	10600	12100	13300	14250	16300	19800										
	9/16	80	1900	3095	6000	7600	9300	10600	11700	12500	14300	17300	18300	19000								
	1/2	125	1600	2600	5000	6400	7800	8900	9800	10500	12000	14500	15400	16300	18000	20000						
	7/16	180	1400	2210	4180	5530	6640	7500	8490	9230	10450	12420	13300	14150	15750	17400	17900	18500	20000			
	3/8	250	1000	1800	3400	4500	5400	6100	6900	7500	8500	10100	10800	11500	12800	14200	14300	15600	16900	17500	18500	19000

For Kg/Hr Multiply by .454

DURA-FLO
INVERTED BUCKET STEAM TRAPS PCA REPAIR KITS

Quick, easy and economical

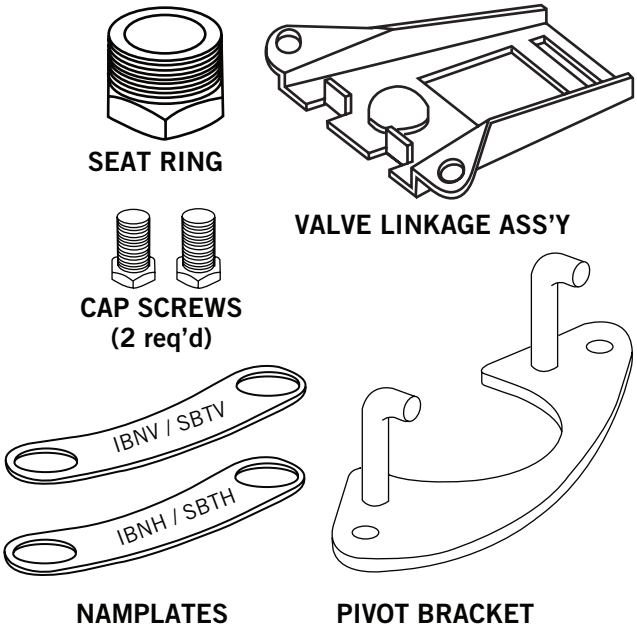
Simplifies and standardizes inventory

All stainless steel corrosion resistant internal parts

Hardened stainless steel condensate valves and seats for extra long life

MODELS

- **80S**–Orifice ratings 20, 80, 125, 150
- **81S & 21**–Orifice ratings 15, 30, 70, 125, 200, 250
- **82S & 22**–Orifice ratings 15, 30, 70, 125, 200, 250
- **83S & 23**–Orifice ratings 15, 30, 60, 80, 125, 180, 250
- **84 & 24**–Orifice ratings 15, 30, 60, 80, 125, 180, 250
- **85 & 25**–Orifice ratings 15, 30, 60, 100, 130, 180, 225, 250



SEAT RING **VALVE LINKAGE ASS'Y**

CAP SCREWS (2 req'd)

NAMPLATES **PIVOT BRACKET**

Supplied in a labeled, clear plastic bag.

FTN SERIES
FLOAT & THERMOSTATIC STEAM TRAPS REPAIR KITS

High quality replacement kits

Rebuild existing F & T Traps far more economically than replacement

Quick, easy and economical

Simplifies and standardizes inventory

All stainless steel corrosion resistant internal parts

Hardened stainless steel condensate valves and seats for extra long life

Repairs other leading manufacturers' F & T Traps

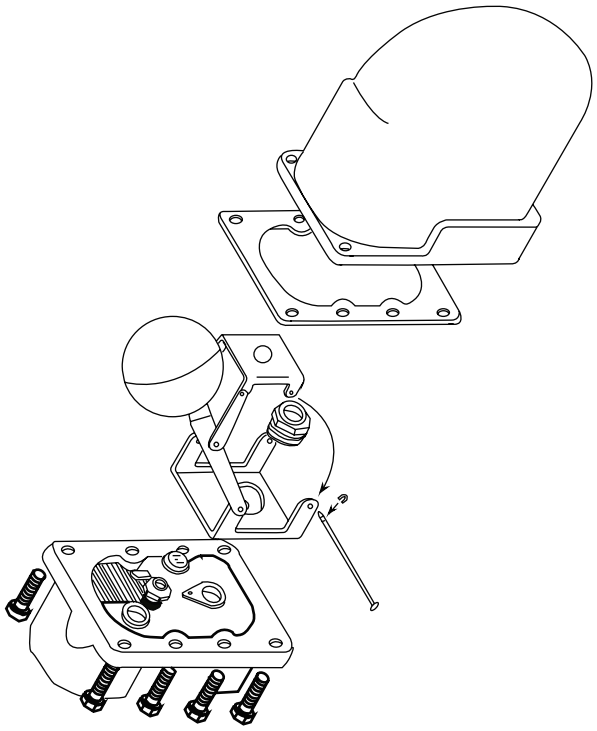
MODELS

- **FTN-15** available in ¾", 1",1¼",1½" and 2"
- **FTN-30** available in ¾", 1",1¼",1½" and 2"
- **FTN-75** available in ¾", 1",1¼",1½" and 2"
- **FTN-125** available in ¾", 1",1¼",1½" and 2"

All ¾" and 1" kits as well as 1¼" FTN-15 and FTN-30 kits supplied with cover assembly.

All 1¼" FTN-75 and FTN-125 kits as well as all 1½" and 2" kits supplied as mechanism complete.

See Capacity Charts on page 39



Consult factory for latest crossover fitments.

SEALED STAINLESS STEEL DURA-FLO
INVERTED BUCKET STEAM TRAPS

Pressures to 650 PSIG (45 barg)
Temperatures to 497ºF (258ºC)

Easy Trap Replacement - Universal two bolt swivel mounting option simplifies removal from system.

Simple Installation - Stainless mounting Block mounts permanently into system. Trap installs via two bolt universal mount connection.

Hardened Chrome Steel Valve and Seat - Long life and maximum corrosion resistance.

Stainless Steel Bucket - Long lasting, rugged and naturally resistant to water hammer.

Inexpensive - Low maintenance and initial cost.

Stainless Steel Body - Durable heavy wall construction provides years of reliable service and resists corrosion and freezing.

Suitable for Wide Variety of Loads/Applications - Horizontal models in three body sizes.

Resists Dirt and Scale - Valve and seats positioned at top of traps ensure long service.

Maintenance Free (TSBT-_S and USBT-_S) - Sealed design prevents unnecessary tampering. Trap can be replaced without breaking pipe.

Freeze Resistant - Extruded SS Body helps prevent problems associated with freezing conditions.

Applications

- Steam Lines
- Process Equipment
- Steam Cookers
- Steam Heated Vats
- Pressing Machinery
- Unit Heaters
- Oil Preheaters
- Converters
- Coils
- Rotating Drum

For information on Big Block UMTVS-BB Connector
SEE PAGE 116

MODELS

NPT CONNECTION

- **TSBT-LS** – Low Capacity, 200 PSIG
- **TSBT-MS** – Medium Capacity, 340 PSIG
- **TSBT-HS** – High Capacity, 650 PSIG

UMT CONNECTION

- **USBT-LS** – Low Capacity, 200 PSIG
- **USBT-MS** – Medium Capacity, 340 PSIG
- **USBT-HS** – High Capacity, 650 PSIG

UMT CONNECTOR BLOCKS

- **UMTC** – Standard connector (1/2" & 3/4" only)
- **UMTCY-RH** – Right Hand Connector with Y Strainer
- **UMTCY-LH** – Left Hand connector with Y Strainer
- **UMTVS-BB** – Connector with Isolation Valves, Strainer, Blowdown Valve and Test Port

Canadian Registration # 0E20210.52

Operation

During startup, air and non-condensible gases enter the trap and are automatically vented through an accurate balanced pressure internal thermostatic air vent. As condensate enters the trap, the float and lever mechanism is raised, lifting the valve off the seat, discharging the condensate. Condensate will continue to be discharged at the same rate at which it is entering. Any air or non-condensible gas that may accumulate will be continually and efficiently passed by the thermostatic air vent.

SEALED STAINLESS STEEL DURA-FLO
INVERTED BUCKET STEAM TRAPS

SPECIFICATION

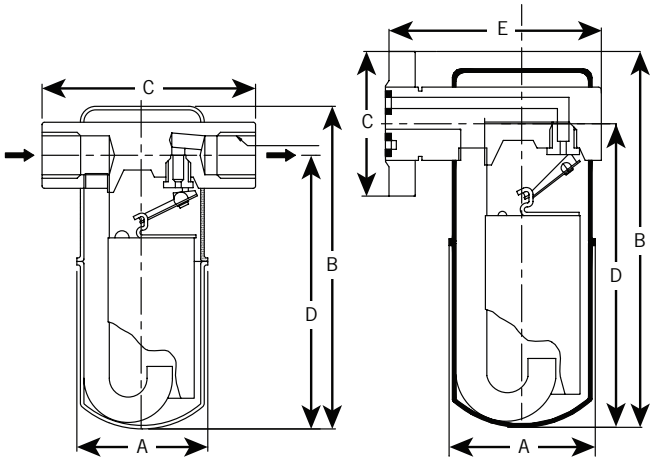
Furnish and install as shown on the plans, inverted bucket traps capable of discharging condensate, air and other non-condensable gases without loss of steam. These traps shall have a stainless steel sealed body, hardened chrome steel valve and seat and an all stainless steel linkage and bucket. It shall have a universal mount connector option.

Materials of construction

Body .....AISI 304 SS
Bucket .....AISI 304 SS
Bucket Clip.....AISI 304 SS
Lever .....AISI 304 SS
Inlet Tube .....AISI 304 SS
Valve .....Hardened Chrome Steel AISI D3
Valve Seat .....Hardened Chrome Steel AISI D3
Connector .....AISI 304 SS

Maximum operating conditions

PMO: Max. Operating Pressure		See Orifice Selection	
TMO: Max. Operating Temperature		Saturated at PMO	
PMA: Max. Allowable Pressure -			
LS 200 psig	(13 8 barg) at	450ºF	(232ºC)
MS 307 psig	(21.2 barg) at	450ºF	(232ºC)
HS 650 psig	(44.8 barg) at	497ºF	(258ºC)
TMA: Max. Allowable Temperature -			
MS, LS & HS -		800ºF	(425ºC)



TSBT SEALED SERIES **USBT REPAIRABLE SERIES**

Connections: 3/8"– 1" NPT

Dimensions inches (mm) and Weight pounds (kg)					
Model	Inches (mm)				Weight lbs (kg)
	A	B	C	D	
TSBT-LS	2¾ (70)	5⁹⁄₁₆ (142)	2⁵⁄₁₆ (110)	4⁹⁄₁₆ (116	2.25 (1)
TSBT-MS	2¾ (70)	6⁹⁄₁₆ (167)	4⁵⁄₁₆ (70)	5⁹⁄₁₆ (141)	2.5 (1.1)
TSBT-HS	3⅞ (99)	8¾ (218)	2¾ (127)	7⅜ (187)	7 (3.2)

Connections: Universal Mount Two Bolt Swivel Connection

Dimensions inches (mm) and Weight pounds (kg)						
Model	Inches (mm)					Weight lbs (kg)
	A	B	C	D	E	
USBT- LS	2¾ (70)	6 (152)	2¾ (70)	4⅝ (117)	4 (101.6)	4.25 (2)
USBT- MS	2¾ (70)	7³⁄₁₆ (183)	2¾ (70)	5¹³⁄₁₆ (148)	4 (101.6)	4.75 (2.2)
USBT- HS	3⅞ (99)	8¾ (222)	2¾ (70)	7⅜ (187)	5 (127)	7 (3.2)

Maximum Capacity—(lbs/hr)															
Trap	Orifice		Differential - PSIG (barg)												
			5	10	15	30	40	70	80	125	200	250	300	400	650
	Size	MOP	(0.34)	(0.69)	(1.03)	(2.07)	(2.76)	(4.83)	(5.52)	(8.62)	(13.79)	(17.24)	(20.69)	(27.59)	(44.83)
SBT-LS & TSBT-LS	3/32	200	85	120	145	200	230	300	325	400	500				
USBT-MS & TSBT-MS	1/4	15	800	920	1040										
	3/16	30	540	690	800	1000									
	5/32	70	390	490	560	700	790	940							
	1/8	125	260	325	400	530	600	750	800	970					
	7/64	200	200	265	315	410	470	580	610	720	900				
	3/32	250	155	200	240	315	360	440	480	560	690	750			
	5/64	400	100	130	155	210	235	280	310	360	440	460	510	580*	
USBT-HS & TSBT-HS	1/4	40	1040	1350	1580	2000	2350								
	3/16	80	680	930	1120	1550	1775	2400	2300						
	5/32	125	480	630	780	1050	1200	1600	1700	2000					
	1/8	250	320	42	510	700	790	1020	1090	1300	1650	1800			
	7/64	300	220	280	325	430	500	630	685	800	1000	1100	1200		
	3/32	650	175	225	270	370	400	510	540	650	800	870	930	1050	1300

For Kg/Hr Multiply by .454

* CRN not available

REPAIRABLE STAINLESS STEEL DURA-FLO
INVERTED BUCKET STEAM TRAPS

Pressures to 650 PSIG (45 barg)
Temperatures to 497ºF (258ºC)

Easy Trap Replacement - Universal two bolt swivel mounting option simplifies removal from system.

Simple Installation - Stainless mounting Block mounts permanently into system. Trap installs via two bolt universal mount connection.

Hardened Chrome Steel Valve and Seat - Long life and maximum corrosion resistance.

Stainless Steel Bucket - Long lasting, rugged and naturally resistant to water hammer.

Inexpensive - Low maintenance and initial cost.

Stainless Steel Body - Durable heavy wall construction provides years of reliable service and resists corrosion and freezing.

Suitable for Wide Variety of Loads/Applications - Horizontal models in three body sizes.

Resists Dirt and Scale - Valve and seats positioned at top of traps ensure long service.

Repairable Model (TSBT-_R & USBT-_R) - Removable cover allows pressure change or repair with existing Dura-Flo PCA kits.

Applications

- Steam Lines
- Process Equipment
- Steam Cookers
- Steam Heated Vats
- Pressing Machinery
- Unit Heaters
- Oil Preheaters
- Converters
- Coils
- Rotating Drum

For information on Big Block UMTVS-BB Connector
SEE PAGE 116

Canadian Registration # 0E20210.52

MODELS

NPT CONNECTION, REPAIRABLE

- **TSBT-LR**-Low Capacity, 200 PSIG
- **TSBT-MR**-Medium Capacity, 400 PSIG
- **TSBT-HR**-High Capacity, 650 PSIG

UMT CONNECTION, REPAIRABLE

- **USBT-LR**-Low Capacity, 200 PSIG
- **USBT-MR**-Medium Capacity, 400 PSIG
- **USBT-HR**-High Capacity, 650 PSIG

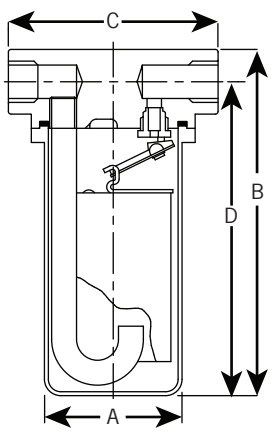
UMT CONNECTOR BLOCKS

- **UMTC**-Standard connector (1/2" & 3/4" only)
- **UMTCY-RH**-Right Hand Connector w/Y strainer*
- **UMTCY-LH**-Left Hand Connector w/Y strainer*
- **UMTVS-BB**-Connector with Isolation Valves, Strainer, Blowdown Valve and Test Port

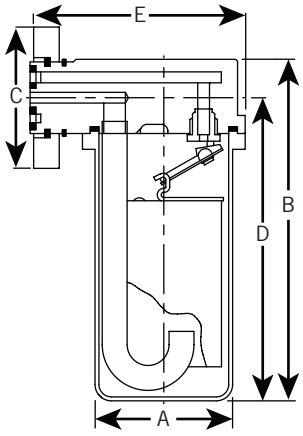
Operation

After trap is installed and primed, steam entering the trap collects in the top of the bucket, floating the bucket and forcing the valve into its seat. As condensate begins to flow into the trap, steam and air are forced from the bucket. This causes the bucket to begin losing buoyancy, tending to pull the valve from its seat. When enough condensate has entered the trap, displacing the steam and air, the bucket drops, pulling the valve from the seat and allowing condensate and air to discharge. As the flow of condensate stops, steam enters the trap and re-floats the bucket, forcing the valve into its seat. The cycle then repeats as more condensate reaches the trap.

REPAIRABLE STAINLESS STEEL DURA-FLO
INVERTED BUCKET STEAM TRAPS



TSBT REPAIRABLE SERIES



USBT REPAIRABLE SERIES

SPECIFICATION

Furnish and install as shown on the plans, inverted bucket traps capable of discharging condensate, air and other non-condensable gases without loss of steam. These traps shall have a stain- less steel sealed body, hardened chrome steel valve and seat and an all stainless steel linkage and bucket. It shall also have a universal mount connection option. The repairable traps shall have a removable cover to allow repair or orifice change.

Maximum operating conditions

PMO: Max. Operating Pressure — See Orifice Selection
TMO: Max. Operating Temperature — Saturated at PMO
PMA: Max. Allowable Pressure -
LR 200 psig (13.8 barg) at 450ºF (232ºC)
MR 420 psig (29.0 barg) at 450ºF (232ºC)
HR 650 psig (44.8 barg) at 497ºF (258ºC)
TMA: Max. Allowable Temperature 800ºF (425ºC)

Materials of construction

Body .....ASTM A351 CF8
Cover .....ASTM A351 CF8
Bucket .....AISI 304 SS
Bucket Clip .....AISI 304 SS
Lever .....AISI 304 SS
Inlet Tube .....AISI 304 SS
Valve .....Hardened Chrome Steel AISI D3
Valve Seat .....Hardened Chrome Steel AISI D3
Swivel Connector .....AISI 304 SS
Cover Gasket .....Spiral Wound 304 SS wIth Grafoil

Connections: 3/8"– 1" NPT

Dimensions inches (mm) and Weight pounds (kg)					
Model	Inches (mm)				Weight lbs (kg)
	A	B	C	D	
TSBT-LS	2⅞ (73)	6¼ (159)	4⅝ (110)	5⅝ (141)	6.6 (3.0)
TSBT-MS	2⅞ (73)	7¼ (184)	4⅝ (110)	6⅝ (166)	7.2 (3.2)
TSBT-HS	4⅛ (104.8)	9½ (241.3)	5 (127)	8½ (215.9)	22 (10)

Connections: 3/8"– 1" NPT

Dimensions inches (mm) and Weight pounds (kg)						
Model	Inches (mm)					Weight lbs (kg)
	A	B	C	D	E	
USBT- LS	2⅞ (73)	6⅜ (161)	2¾ (70)	5⅝ (143)	4¼ (108)	7.25 (3.3)
USBT- MS	2⅞ (73)	7⅜ (186)	2¾ (70)	5⅝ (148)	4¼ (101.6)	8 (3.6)
USBT- HS	4⅛ (104.8)	9¾ (247.7)	2¾ (70)	8¾ (222.2)	6¼ (158.8)	25 (11.33)

Maximum Capacity—(lbs/hr)															
Trap	Orifice		Differential Pressure												
			5	10	15	30	40	70	80	125	200	250	300	400	650
	Size	MOP	(0.34)	(0.69)	(1.03)	(2.07)	(2.76)	(4.83)	(5.52)	(8.62)	(13.79)	(17.24)	(20.69)	(27.59)	(44.83)
TSBT-LR, USBT-LR	3/32	200	85	120	145	200	230	300	325	400	500				
TSBT-MR, USBT-MR	1/4	15	800	920	1040										
	3/16	30	540	690	800	1000									
	5/32	70	390	490	560	700	790	940							
	1/8	125	260	325	400	530	600	750	800	970					
	7/64	200	200	265	315	410	470	580	610	720	900				
	3/32	250	155	200	240	315	360	440	480	560	690	750			
	5/64	400	100	130	155	210	235	280	310	360	440	460	510	580	
TSBT - HR USBT-HR	1/4	40	1040	1350	1580	2000	2350								
	3/16	80	680	930	1120	1550	1775	2400	2300						
	5/32	125	480	630	780	1050	1200	1600	1700	2000					
	1/8	250	320	42	510	700	790	1020	1090	1300	1650	1800			
	7/64	300	220	280	325	430	500	630	685	800	1000	1100	1200		
	3/32	650	175	225	270	370	400	510	540	650	800	870	930	1050	1300

For Kg/Hr Multiply by .454

NOTES

THERMODYNAMIC STEAM TRAPS

NTD600 SERIES
THERMODYNAMIC STEAM TRAPS

Pressures To 600 PSIG (41.3 barg)
Temperatures to 800°F (426°C)

Compact Design - Hardened stainless steel disc is the only moving part.

Inexpensive - Low initial cost is less expensive than repairable technologies.

Simplifies Installation - Works in vertical or horizontal position.

Rugged - Handles water hammer and superheat.

Reliable, Efficient Operation - Blast discharge helps to eliminate dirt buildup and provides tight shutoff

Freeze resistant - Self draining design prevents freezing.

All Stainless Steel Construction - Resists both internal and external corrosion.

Easy to Monitor - Audible discharge cycle makes checking operation simple.

Applications

- Steam Tracing
- Drips
- Heating

MODELS

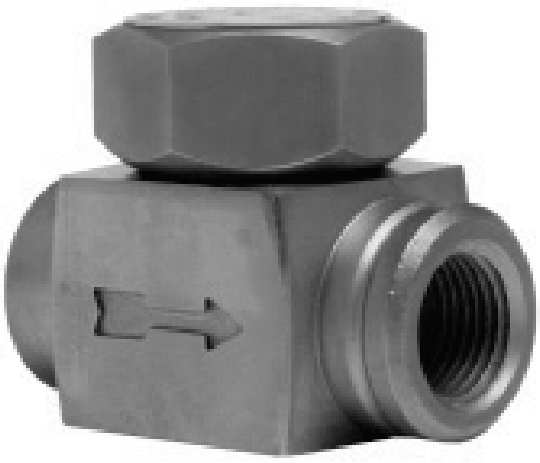
- **NTD600**–Thermodynamic Disc Trap
- **NTD600S**–NTD600 with integral strainer
- **NTD600B**–NTD600S with blowdown valve

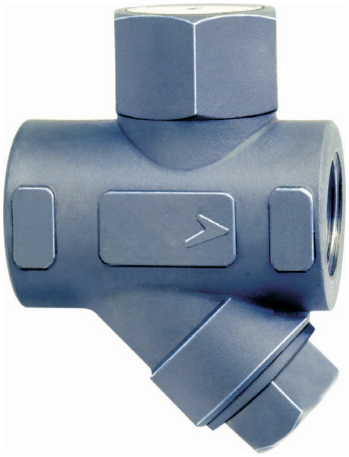
Installation Tip: Always install STV Test & Block Valve as part of trap station

SEE PAGE 118

Installation Tip: Add Uniflex Pipe Coupling for ease of maintenance

SEE PAGE 98





NTD600 Model Only:
Canadian Registration # OE0591.9C

Operation

Incoming air and condensate flow through the trap body and into the control chamber. Line pressure raises the disc off the seat allowing complete discharge. When flashing condensate enters the cartridge, flow velocity increases, creating low pressure underneath the disc. Flashing condensate at high velocity strikes the inside wall of the disc chamber and is deflected to the top of the disc causing a pressure buildup. The disc is forced down onto the seat by this pressure imbalance. The trap remains closed as flashed vapor in the control chamber keeps the disc seated. Pressure inside the cap is not lowered until the trapped flash vapor condenses due to body radiation. Condensing steam lowers the pressure above the disc. Disc is then lifted and the cycle repeated.

NTD600 SERIES
THERMODYNAMIC STEAM TRAPS

SPECIFICATION

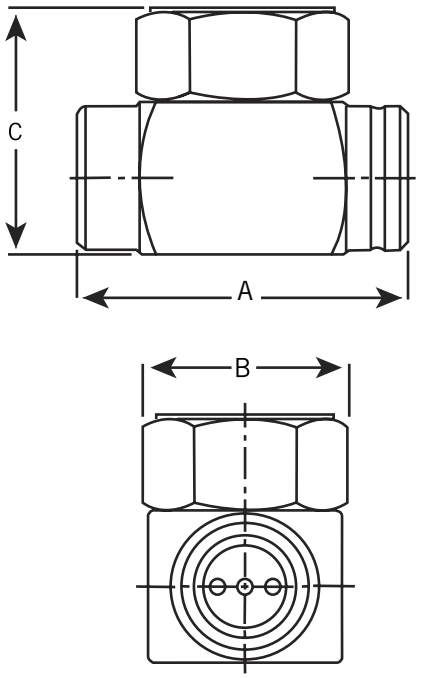
Steam trap shall be of thermodynamic design. Body shall be of all stainless construction and hardened throughout. Seat shall be integral to body. Cover shall seal to body without gaskets or seals. Trap shall be suitable for pressures through 600 psi and available in 3/8" through 1".

Maximum operating conditions

PMO: Max. Operating Pressure	600 psig	(41.3 barg)
TMO: Max. Operating Temperature	800°F	(426°C)
PMA: Max. Allowable Pressure	600 psig	(41.3 barg)
TMA: Max. Allowable Temperature	800°F	(426°F)

Materials of construction

Body ..... 420F SS ASTM A743 CA40F
Cap & Disc ..... 420F SS ASTM A743 CA40F
Blow Down Valve 304/316SS
Screen ..... Stainless Steel



Connections: 3/8"– 1" NPT

Dimensions				
	Inches (mm)			Weight Lbs (kg)
Size	A	B	C	
3/8"	2 (51)	1¾ (44)	1¾ (44)	.8 (.36)
½"	2 (68)	1¾ (44)	2 (51)	1.2 (.55)
¾"	2 13/16 (71)	2 5/16 (59)	2 7/16 (62)	1.85 (.86)
1"	3 5/16 (84)	2½ (64)	2⅞ (73)	3.1 (1.8)

Maximum Capacity—lbs/hr 10°F Below Saturation														
NPT Connection	Differential PSIG (barg)													
	3.5 (0.24)	5 (0.34)	10 (0.7)	20 (1.4)	30 (2.1)	50 (3.4)	75 (5.2)	100 (6.9)	150 (10.3)	200 (13.8)	300 (20.7)	400 (27.6)	500 (34.5)	600 (41.3)
3/8"	180	185	190	200	215	245	305	370	500	610	790	960	1100	1250
1/2"	300	310	345	410	465	575	700	810	1000	1140	1410	1630	1830	2000
3/4"	405	420	470	560	640	810	1000	1160	1450	1670	2100	2430	2750	3050
1"	640	670	725	865	980	1200	1470	1750	2200	2600	3250	3780	4250	4700

For Kg/Hr Multiply by .454

NOTE: The NTD600 Series works efficiently at all line pressures between 5 & 600 psi and back pressures up to 80% of line pressures.

LIQUIDATOR UMT-TD SERIES
THERMODYNAMIC STEAM TRAP

Pressures To 450 PSIG
Temperatures to 650°F

Applications

- Unit Heaters
- Laundry Equipment
- Steam Tracing
- Plating Tanks
- Drip Legs
- Platen Presses
- Tire Presses
- Cooking Equipment

Easily Maintained
Four bolt cover permits easy in-line rebuilding for less than the cost of replacement.

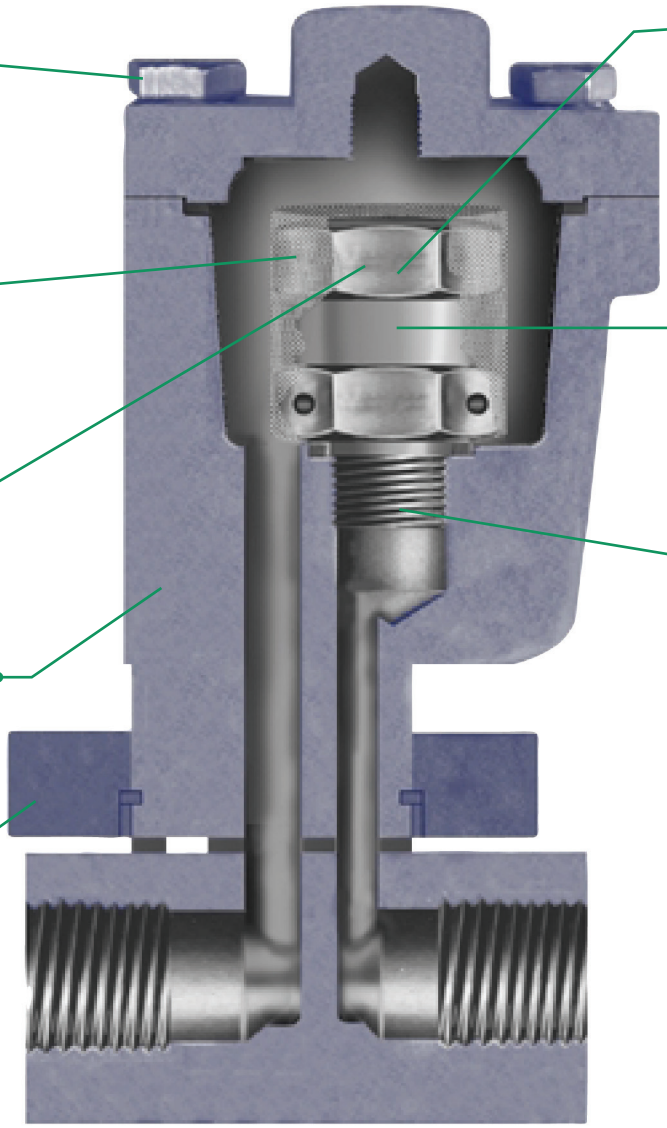
Optional Integral Strainer
Helps prevent dirt and scale build-up on valve seat.

Excellent Energy Savings
Positive shutoff assures no loss of steam during normal operation.

Fits all Universal Connectors
Liquidator body will replace any manufacturers' universal mount trap body.

Easily Replaced
Two bolt design permits rapid removal without breaking pipe connections.

Freeze Proof
Self draining when installed vertically



Durability and Long Service Life
Stainless steel body and cover with stainless steel Celtron® Cartridge for maximum corrosion, thermal and hydraulic shock resistance.

Unaffected by Ambient Conditions
Steam jacketing minimizes steam loss.

Blast Discharge
Clears away dirt and scale.

LIQUIDATOR UMT-TD UNIVERSAL MOUNT

THERMODYNAMIC STEAM TRAPS

Pressures To 450 PSIG (31 barg)
Temperatures to 650°F (343°C)

Simple Installation - Stainless mounting block mounts permanently into system. Trap installs via two bolt universal connection.

Improved Energy Savings - Lowers steam waste due to steam jacketing. Trap cycle is unaffected by ambient temperatures or precipitation.

Extended Trap Life - Integral strainer keeps disc and seat clean. Non-violent discharge reduces wear. Heavy disc improves performance.

Freeze Proof - When mounted vertically or on its side horizontally.

Economical - First cost and maintenance cost are low.

UMT-TD SERIES TRAP AND UMTC CONNECTOR

Applications

- Steam Tracing
- Drips
- Light Process

Options

- SW - Socketweld Connections
- B - Blowdown Valve

Celtron

plastic-packed replaceable cartridge for fast and simple replacement

MODELS

- **UMT-TD10L** - Low Capacity Trap
- **UMT-TD10** - Standard Capacity Trap
- **UMTC** - Standard connector (1/2" & 3/4" only)
- **UMTCY** - Connector w/Y strainer
- **UMTCYR** - Right Hand Connector w/Y strainer
- **UMTCYL** - Left Hand Connector w/Y strainer
- **UMTVS-BB** - Connector with Isolation Valves, Strainer, Blowdown Valve and Test Port

For complete unit, order trap and connector as separate items.

For information on Big Block UMTVS-BB Connector
SEE PAGE 116

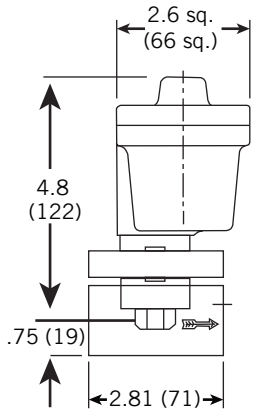
Canadian Registration # 0E20210.52

Operation

Incoming air and condensate flow through the trap body and into the Celtron® cartridge. Line pressure raises the disc off the seat allowing complete discharge. When flashing condensate enters the cartridge, flow velocity increases, creating low pressure underneath the disc. Flashing condensate at high velocity strikes the inside wall of the disc chamber and is deflected to the top of the disc causing a pressure buildup. The disc is forced down onto the seat by this pressure imbalance. The trap remains closed as steam in the jacket prevents exposure of the Celtron® cartridge to ambient temperatures. Pressure inside the cap is not lowered until the trapped flash vapor condenses. Condensing steam lowers the pressure above the disc. Disc is then lifted and the cycle repeated.

LIQUIDATOR UMT-TD UNIVERSAL MOUNT
THERMODYNAMIC STEAM TRAPS

UMT-TD SERIES TRAP AND UMTC CONNECTOR



SPECIFICATION

Steam trap shall be of a thermodynamic capsule design. The body shall be of a 304 stainless steel 2 bolt universal swivel construction with a stainless steel in line renewable Celtron capsule. Celtron capsule shall contain all working components. Capsule shall be hardened throughout. Seat shall be stress relieved to eliminate warping. Trap shall seal to body with spiral wound graphite gaskets. Trap shall be suitable for pressures through 450 psi and available in 1/2" through 1" NPT or socketweld connections.

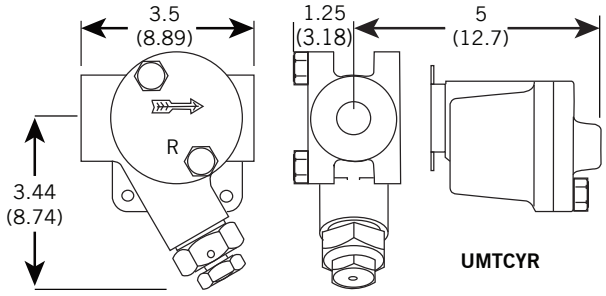
Maximum operating conditions

PMO: Max. Operating Pressure	(41.3 barg)	(31 barg)
TMO: Max. Operating Temperature	650°F	(343°C)
PMA: Max. Allowable Pressure	450 psig	(31 barg)
TMA: Max. Allowable Temperature	650°F	(343°C)

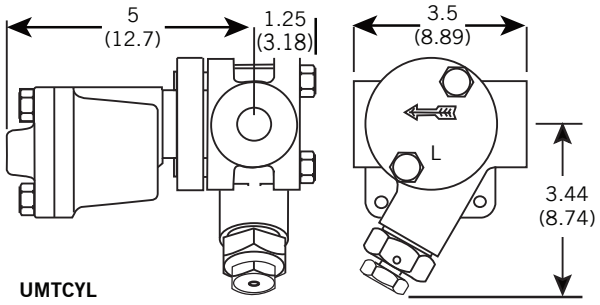
Materials of construction

Body & Cover: ..... ASTM A351 Grade CF8 (304)
Cover Gasket: ..... 304 stainless spiral wound w/graphite fill
Celtron® Cartridge: ...416 Stainless Steel w/hardened disc & seat
Strainer: .....(.033 perf.) 304 Stainless Steel
Mounting Block: .....ASTM A351 Grade CF8 (304)

Connections: 1/2", 3/4" or 1" NPT or socketweld



UMTCYR



UMTCYL

DIMENSIONS - INCHES (MM)

WEIGHT

TRAP - 3.2 LBS. (1.4 KG)

STD. MOUNTING BLOCK - 1.1 LBS. (0.5 KG)

Y STRAINER MOUNTING BLOCK - 2.3 LBS. (1.0 KG)

Maximum Capacity—lbs/hr 10°F Below Saturation										
Trap	Differential PSIG (barg)									
	5 (0.34)	10 (0.7)	25 (1.7)	50 (3.4)	75 (5.2)	100 (6.9)	200 (13.8)	300 (20.7)	400 (27.6)	450 (31)
UMT-TD10L	105	150	235	330	395	435	550	630	690	715
UMT-TD10	240	265	420	590	700	770	980	1120	1240	1280

For Kg/Hr Multiply by .454

The UMT-TD Series trap works efficiently at all line pressures between 5 and 450 psi and back pressures to 80% of line pressure.

NOTES

NOTES

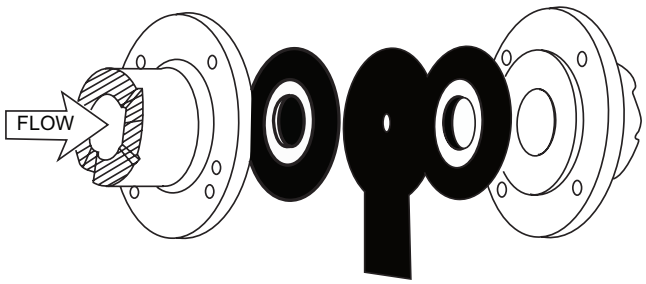
ORIFICE
STEAM TRAPS

TYPE DFA DRAIN
ORIFICE STEAM TRAP

Pressures To 2500 PSIG (172 barg)
Temperatures to 750°F (400°C)

Applications

- Pressure Reduction
- Ratio of Flow-mixing two or more fluids at fixed ratio
- Fixed Flow-i.e. gland seal recirculation of cooling water on pumps, compressors, process analyzers, etc.
- Intermittent Drainage-i.e. air tools, air storage tanks, cleaning fixtures, air vents, etc.
- Cryogenic Storage Venting
- Low Pressure Blanking
- Sampling of process fluids at a fixed flow rate for use with Instrument Analyzers



Energy Saving Benefits

- Design factor results in reduced initial steam loss.
- Fuel savings up to 50% achieved in applications during past 10 years.
- Maintains low rate of steam loss.
- Cannot fail open, eliminating large steam losses.

Operating Benefits

- Accommodates varying condensate loads created by modulating pressures.
- Freeze proof when mounted in vertical piping.
- Resists thermal and hydraulic shock.
- Reduces make-up water to boiler and water chemical treatment costs.
- Maintains constant pressure to condensate return systems.
- Meets dimensional requirements of MS 18301.
- Specifications.

Canadian Registration # 0E0591.9

MODELS

- **DFA**–Drain Orifice Trap with gaskets and inlet screen.
- **DFR**–Replacement gasket kit including inlet screen.

Operation

The Spence Drain Orifice Trap is an engineered, continuous flow device. The controlling element in the Drain Orifice Assembly is a flat S.S. plate, 1/4" thick. Drain Orifices discharge air, condensate and all other non-condensible gases with minimal live steam loss. The fixed orifice size is calculated, for a given application, to discharge the condensate load at a maximum thermal efficiency. Approximately 10-25% of discharging hot condensate flashes to steam at the downstream side of the orifice, at a constant pressure drop. This flashing effect further restricts the flow of saturated steam. In actual conditions, a minimum percentage of steam, by weight, is discharged with condensate, since the specific volume of steam is large compared to that of the condensate. The velocity through the orifice is highly turbulent. The major factor for energy efficient performance is based on initial orifice sizing for the application. Properly sized, thermal efficiencies of 98%+ can be attained. The Drain Orifice Trap is ideally suited for use on high pressure steam (saturated or superheated) from 600 PSIG to 2500 PSIG with minimum steam loss, zero maintenance and long service life.

TYPE DFA DRAIN
ORIFICE STEAM TRAP

SPECIFICATION

Orifice Drain shall comply with dimensional requirements of MIL SPEC MS 18301 and consist of 1/4" 304 stainless orifice plate fixed between user supplied flanges. It shall be sealed by spiral wound gaskets. Inlet gasket shall be modified with a stainless steel mesh strainer affixed across the inside diameter. Orifice shall be sized for the application to a minimum of 0.020".

Maximum operating conditions

PMO: Max. Operating Pressure	2500 psig	(172 barg)
TMO: Max. Operating Temperature	750°F	(400°C)
PMA: Max. Allowable Pressure	2500 psig	(172 barg)
TMA: Max. Allowable Temperature	750°F	(400°C)

Materials of construction

Inlet Gasket* .....Spiral-wound 347 S.S./Graphite
w/S.S. 60 mesh dome strainer insert
Orifice Plate .....304 S.S., 1/4" thick
Outlet Gasket* .....Spiral-wound 347 S.S./Graphite
Customer to supply ANSI B16.5 flanges.

*Note: Other materials available

Sizing*

Consult Factory–required information:

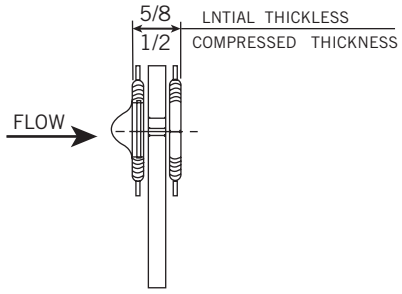
Condensate Load _____

Inlet Pressure _____

Outlet Pressure _____

Elevation of return line over trap (if any) _____

* Specify orifice size when ordering



Connections: 1/2" – 2" Wafer Style
ANSI 150#, 600#, 1500# & 2500#

Dimensions		
Pipe Size NPT	**Min. Pipe Bore (in.)***	**Min. Orifice**
1/2"	9/16	.020
3/4"	3/4	.020
1"	7/8	.020
1¼"	N/A	.020
1½"	N/A	.020
2"	N/A	.020
*Dome strainer used for sizes up to 1". Flat strainer used for larger sizes.		

TYPE DUA
ORIFICE UNION ASSEMBLY

Pressures To 3000 PSIG (207 barg)
Temperatures to 850°F (454°C)

Reliable Operation - High reliability labyrinth-type seal: leak tight seal is maintained when subjected to expansion or contraction due to temperature or pressure changes in the line. Positive, leak-tight seal eliminates loss of product.

Ease of Installation - No danger of damaging seats or losing seal by overtorquing during installation. Requires normal torque to obtain a leak-tight seal. Welding repairs reduced; no need to replace union components welded to pipe.

Low Cost Maintenance - Downtime, labor and material costs drastically reduced. Service is required only when the union is disassembled, then only a change of gaskets is required to put it back in service. Eliminates the need to replace the union housing.

Flexibility - Orifice easily replaced where a different orifice size is required for a specific application. Orifice can be redrilled to a larger size, if necessary, eliminating need to replace the entire assembly. Large range of orifice sizes available from a minimum 0.020" diameter.

MODELS

- **DUA**–Orifice Union
- **RUA**–Orifice Kit includes 2 gaskets, orifice plate and inlet screen.
- **DUR**–Gasket Kit includes 2 gaskets and inlet screen.

Applications

- Condensate Removal
- Pressure Reduction
- Ratio of Flow-mixing two or more fluids at fixed ratio
- Fixed Flow-i.e. gland seal recirculation of cooling water on pumps, compressors, process analyzers, etc.
- Intermittent Drainage-i.e. air tools, air storage tanks, cleaning fixtures, air vents, etc.
- Cryogenic Storage Venting
- Low Pressure Blanking
- Sampling of process fluids at a fixed flow rate for use with Instrument Analyzers

Options

- SW - Socketweld

Canadian Registration # 0E0591.9

Operation

The Spence Drain Orifice Trap is an engineered, continuous flow device. The controlling element in the Drain Orifice Assembly is a flat S.S. plate, 1/4" thick. Drain Orifices discharge air, condensate and all other non-condensible gases with minimal live steam loss. The fixed orifice size is calculated, for a given application, to discharge the condensate load at a maximum thermal efficiency. Approximately 10-25% of discharging hot condensate flashes to steam at the downstream side of the orifice, at a constant pressure drop. This flashing effect further restricts the flow of saturated steam, In actual conditions, a minimum percentage of steam, by weight, is discharged with condensate, since the specific volume of steam is large compared to that of the condensate. The velocity through the orifice is highly turbulent. The major factor for energy efficient performance is based on initial orifice sizing for the application. Properly sized, thermal efficiencies of 98%+ can be attained. The Drain Orifice Trap is ideally suited for use on high pressure steam (saturated or superheated) from 300 PSIG to 3000 PSIG with minimum steam loss, zero maintenance and long service life.

TYPE DUA
ORIFICE UNION ASSEMBLY

SPECIFICATION

Orifice Union shall consist of 1/4" 304 stainless steel plate fixed inside a gasketed union housing. Seal shall be provided by spiral wound gaskets whose inlet shall be modified with a stainless steel dome mesh strainer fixed across the inside diameter. Orifice shall be sized for the application to a minimum of 0.020 inches.

Maximum operating conditions

PMO: Max. Operating Pressure — see chart
TMO: Max. Operating Temperature — see chart

Materials of construction

Body: .....Forged Carbon Steel
Inlet Gasket*: .....Spiral-wound S.S./Graphite w/S.S. 60 mesh dome strainer insert
Orifice Plate: .....304 S.S., 1/4" thick
Outlet Gasket*: .....Spiral-wound S.S./Graphite

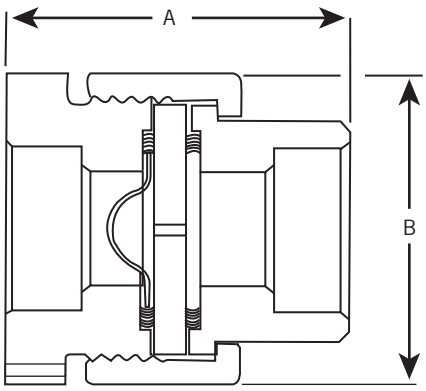
* Note: Other materials available

Sizing*

Consult Factory–required information:

Condensate Load _____
Inlet Pressure _____
Outlet Pressure _____
Elevation of return line over trap (if any) _____

* Specify orifice size when ordering



DUA

Connections: 1/2" – 1" NPT or Socketweld

Temperature/Pressure Ratings	
Temperature* °F 100	**Pressure (PSIG) Carbon Steel 3000**
200	2735
300	2655
400	2565
500	2425
600	2220
700	2155

*Minimum recommended temperature is -20°F.

Dimensions			
Pipe Size NPT	**Inches**		**Weight Lbs.***
	A	**B**	
1/2	2.42	1.8	1.2
3/4	2.73	2.20	1.8
1	2.94	2.57	2.6

*Average weight-actual weights may vary slightly.

NOTES

CLEAN STEAM PRODUCTS

CDS SANITARY
THERMOSTATIC STEAM TRAPS

Pressures to 100 PSIG (6.9 barg)
Temperatures to 338°F (170°C)

Steepest Interior Surfaces - Designed to completely drain without puddling.

Stainless Steel Body - Body Material is 316L Stainless Steel with 20 µ in. Ra internal finish and 32 µ in. Ra external finish. Available with electropolish polishing to 10 µ in. Ra and/or electropolish.

Self centering Valve - Leak tight shut off. Assembly of actuator and valve to impingement plate allows the valve to self align with center of the orifice.

Temperature Sensitive Actuator - One moving part. 316L Stainless Steel, fail open, welded actuator for maximum corrosion, thermal and hydraulic shock resistance.

Directional Discharge - Erosion prevented by directing discharge to center of piping.

Maintenance - Can be easily removed and disassembled for sterilization and/or repair.

Industry Standard Food Grade Gasket - White Viton food grade gasket offers superior performance for higher pressure steam applications.

Large Orifice Selection - Broad selection of orifice sizes provide greatest sizing and selection flexibility.

Superior Air Handling - Best air handling capability provides for fast startup.

Unique SLR Orifice Option - Provides drainage at saturated temperatures, instant reaction to load changes and fail-open operation for extra critical operations.

Bar Stock - Connection fittings are not welded onto inlet and outlet pieces.

CLEAN STEAM TRAP

MODELS

- **CDS202**–Low capacity
- **CDS203**–Medium capacity
- **CDS204**–High capacity

Applications

- CIP/SIP System Condensate Drainage
- Sterilization of Process Vessels
- Culinary Steam
- Humidifiers
- WFI System Sterilization
- Fermenter Sterilization

Options

- EP - Electropolish
- SLR - SLR Orifice
- Tef-Steel, PTFE, E.P.D.M., & other gasket materials available
- B Bellows for low subcool

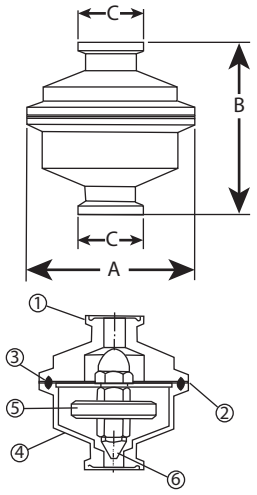
NOTE: Please specify if Material Test Reports (MTR) or Certificates of Conformance (COC) are required.

Canadian Registration # 0E0591.9

Operation

Thermal actuator is filled at its free length with a liquid having a lower boiling point than water. On start-up, valve is normally open to discharge air, non-condensibles and condensate. When steam enters trap, thermal actuator fill vaporizes to a pressure higher than line pressure. This forces valve into seat orifice to prevent any further flow. As condensate collects, it takes heat from the actuator, lowering internal pressure. Line pressure will then compress thermal actuator to open valve and discharge condensate. Valve opening automatically adjusts to load conditions from minimum on very light loads to full lift at maximum load.

CDS SANITARY
THERMOSTATIC STEAM TRAPS



Connections: 1/2" – 1½" Tri-clamp

Dimensions				
Service	inches (mm)			Weight Lbs. (kg)
	A	B	C	
½", ¾"	2½	2⅝	63/64	1.8
1", 1½"	2½	2⅝	1 63/64	2.3

Materials of Construction		
Item	Part Name	Material
1	Body – Inlet	316L
3	Gasket	Viton
5	Actuator (Bellows Assy)	316L
4	Body – Outlet	316L
6	Valve	316L
2	Clamp (not shown)	304

SPECIFICATION

Steam trap shall be of balanced pressure design with inconel welded bellows capable of releasing condensate within 10°F of saturated pressure. All other interior wetted components shall be of 316L stainless. It shall have interior body finish of at least 20 µ in. Ra and exterior body finish of at least 32 µ in. Ra. Trap shall utilize sanitary body clamp allowing disassembly for inspection or cleaning and be entirely self draining when installed in vertical configuration. Trap end connections shall be standard tri-clamp. Thermostatic actuator shall employ a conical valve lapped to the seat. A minimum of three orifices shall be available. Traps shall have SLR orifice where drainage at saturated temperatures is required.

Maximum operating conditions

PMO: Max. Operating Pressure	100 psig	(6.9 barg)
TMO: Max. Operating Temperature	338°F	(170°C)
PMA: Max. Allowable Pressure	150 psig	(10.3 barg)
TMA: Max. Allowable Temperature	366°F	(186°C)

Body Surface Finish

Mechanical Polishing results in 20 micro in. Ra internal, 32 micro in. Ra External is standard.

Electropolish results in 13 micro in. Ra internal, 20 micro in. Ra External.

Gasket approvals

FDA, USDA, USPH Class 6, 3A Sanitary Standard, NSF

Service Notes

Trap is designed to be self draining for vertical installation (discharge down).

1/2" - 3/4" service trap should be installed with 3/4" inlet gasket.

1" - 11/2" service trap should be installed with 11/2" inlet gasket.

Polishing procedure

All surface finishes are achieved without the use of additional buffing, compounds or grit.

SLR orifice option

Specify when immediate elimination of condensate and improved sensitivity is desired. A 1/32" orifice at the apex of the valve allows for continuous discharge of condensate. Trap will nominally pass 50 lb/hr of condensate at 50 psi within 2°F of saturated temperature.

B bellow

3ºF subcool for sensitive applications under 45 psi

Maximum Capacity—lbs/hr 10°F Below Saturation (Kg/hr 5°C Below Saturation)												
Trap	Orifice Inches	Differential PSIG (barg)										
		5 (0.34)	10 (0.7)	20 (1.4)	30 (2.1)	40 (2.8)	50 (3.4)	60 (4.2)	70 (4.9)	80 (5.6)	90 (6.2)	100 (6.9)
CDS 202	5/32	291 (132)	411 (186)	581 (264)	719 (326)	831 (377)	919 (417)	1000 (454)	1075 (488)	1130 (513)	1174 (533)	1207 (547)
CDS 203	1/4	550 (249)	825 (374)	1210 (549)	1495 (678)	1750 (794)	1975 (896)	2175 (987)	2350 (1066)	2525 (1145)	2650 (1202)	2825 (1281)
CDS 204	5/16	861 (391)	1217 (552)	1722 (781)	2150 (975)	2475 (1123)	2722 (1235)	2940 (1334)	3125 (1417)	3290 (1492)	3450 (1565)	3575 (1622)

For Kg/Hr Multiply by .454

NOTE: Please specify if Material Test Reports (MTR) or Certificates of Conformance (COC) are required.

CDH SANITARY
THERMOSTATIC STEAM TRAPS

Pressures To 100 PSIG (6.9 barg)
Temperatures to 338°F (170°C)

Universally Configurable - Horizontal connections from any direction on standard model; AI and AO models feature one multi-directional horizontal and one vertical connection.

Steepest Interior Surfaces - Designed to completely drain without puddling, even in significantly sloped lines.

Stainless Steel Body - Body Material is 316L Stainless Steel with 20 µ in. Ra internal finish and 32 µ in. Ra external finish. Available with electropolish.

Self centering Valve - Leak tight shut off. Assembly of actuator and valve to impingement plate allows the valve to self align with center of the orifice.

Temperature Sensitive Actuator - One moving part. 316L Stainless Steel, fail open, welded actuator for maximum corrosion, thermal and hydraulic shock resistance.

One Size Suits Most Services - Universal ferruled end connection fits both 1/2" and 3/4" piping.

Maintenance - Can be easily removed and disassembled for sterilization and/or repair.

Inventory Standard Food Grade Gasket - White Viton food grade gasket offers superior performance for higher pressure steam applications.

Superior Air Handling - Best air handling capability provides for fast startup.

Unique SLR Orifice Option - Provides drainage at saturated temperatures, instant reaction to load changes and fail-open operation for extra critical operations.

Bar Stock - Connection fittings are not welded onto inlet and outlet pieces

MODELS

- **CDH-AI-AO**–Horizontal inlet and outlet
- **CDH-AI**–Horizontal inlet, vertical outlet
- **CDH-AO**–Vertical inlet, horizontal outlet

Applications

- CIP/SIP System Condensate Drainage
- Sterilization of Process Vessels
- Culinary Steam
- Humidifiers
- WFI System Sterilization
- Fermenter Sterilization

Options

- EP - Electropolish
- SLR - SLR Orifice
- Tef-Steel, PTFE, E.P.D.M., & other gasket materials available
- B Bellows for low subcool

NOTE: Please specify if Material Test Reports (MTR) or Certificates of Conformance (COC) are required.

Canadian Registration # 0E0591.9C

Operation

Thermal actuator is filled at its free length with a liquid having a lower boiling point than water. On start-up, valve is normally open to discharge air, non-condensibles and condensate. When steam enters trap, thermal actuator fill vaporizes to a pressure higher than line pressure. This forces valve into seat orifice to prevent any further flow. As condensate collects, it takes heat from the actuator, lowering internal pressure. Line pressure will then compress thermal actuator to open valve and discharge condensate. Valve opening automatically adjusts to load conditions from minimum on very light loads to full lift at maximum load.

CDH SANITARY
THERMOSTATIC STEAM TRAPS

SPECIFICATION

Steam trap shall be of balanced pressure design with inconel welded bellows capable of releasing condensate within 10°F of saturated pressure. All other interior wetted components shall be of 316L stainless. It shall have interior body finish of at least 20 µ in. Ra and exterior body finish of at least 32 µ in. Ra. Trap shall utilize sanitary body clamp allowing disassembly for inspection or cleaning and be entirely self draining in horizontal or angle piping configuration. Trap end connections shall be standard tri-clamp. Thermostatic actuator shall employ a conical valve lapped to the seat. Traps shall have SLR orifice where drainage at saturated temperatures is required.

Maximum operating conditions

PMO: Max. Operating Pressure	100 psig	(6.9 barg)
TMO: Max. Operating Temperature	338°F	(170°C)
PMA: Max. Allowable Pressure	150 psig	(10.3 barg)
TMA: Max. Allowable Temperature	366°F	(186°C)

Body surface finish

Mechanical Polishing results in 20 micro in. Ra internal, 32 micro in. Ra External is standard.

Electropolish results in 13 micro in. Ra internal, 20 micro in. Ra External.

Gasket approvals

FDA, USDA, USPH Class 6, 3A Sanitary Standard, NSF

SLR orifice option

Specify when immediate elimination of condensate and improved sensitivity is desired. A 1/32" orifice at the apex of the valve allows for continuous discharge of condensate. Trap will nominally pass 50 lb/hr of condensate at 50 psi within 2°F of saturated temperature.

Connection

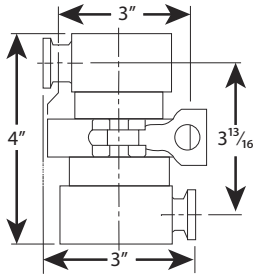
Sanitary Ferrule accommodates 1/2" and 3/4" service

B Bellow

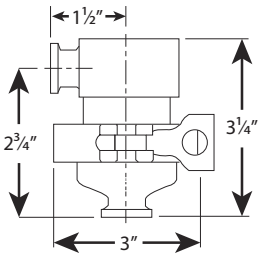
3ºF subcool for sensitive applications under 45 psi

Polishing procedure

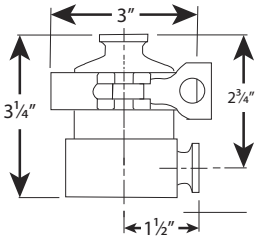
All surface finishes are achieved without the use of additional buffing, compounds or grit.



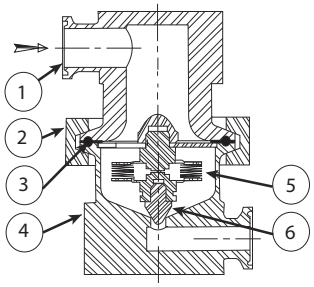
CDH-AI-AO - 3.9 LB.



CDH - AI - 2.6 LB.



CDH-AO - 3.1 LB.



Connections: ½⁄¾" Tri-clamp

Materials of Construction		
Item	**Part Name**	**Material**
1	Body – Inlet	316L
2	Clamp	304
3	Gasket	Viton
4	Body – Outlet	316L
5	Actuator (Bellows Assy)	316L SS
6	Valve	316 L

Maximum Capacity—lbs/hr 10°F Below Saturation (Kg/hr 5°C Below Saturation												
Trap	**Orifice Inches**	**Differential PSIG (barg)**										
		5 (0.34)	**10 (0.7)**	**20 (1.4)**	**30 (2.1)**	**40 (2.8)**	**50 (3.4)**	**60 (4.2)**	**70 (4.9)**	**80 (5.6)**	**90 (6.2)**	**100 (6.9)**
CDH	1/4	550 (249)	825 (374)	1210 (549)	1495 (678)	1750 (794)	1975 (896)	2175 (987)	2350 (1066)	2525 (1145)	2650 (1202)	2825 (1281)

For Kg/Hr Multiply by .454

DS100/DS110
THERMOSTATIC STEAM TRAPS

Pressures To 150 PSIG (10.3 barg)
Temperatures to 366°F (186°C)

Stainless Steel Body - Body materials of all models are Type 316L Stainless Steel.

Self Centering Valve - Leak tight shut off. Assembly of actuator and valve to impingement plate allows valve to self-align with center of valve seat orifice. Provides long lasting valve and seat.

Temperature Sensitive Actuator - 316L Stainless welded actuator for maximum corrosion, thermal and hydraulic shock resistance. One moving part.

Thermal and Hydraulic Shock Resistant - Impingement plate plus welded construction prevents damage to actuator.

Long Life Valve and Seat - Stainless steel valve and seat matched together for water tight seal.

Maintenance - All models are sealed and maintenance free.

Directional Discharge - Erosion prevented by directing discharge into the center of pipe or tubing.

Best Air Handling Capacity - Fast start up and operation.

Fast Response - Quickly adjusts to condensate load or temperature changes.

One Size Suits Most Services - Universal ferruled end connection fits both 1/2" and 3/4" piping.

CLEAN STEAM TRAP

MODELS

- **DS100**–Ferrule clamp end 1⅞" OAL
- **DS100TE**–Tube end
- **DS110**–Ferrule clamp end 2⅝" OAL

Applications

- CIP/SIP System Condensate Drainage
- Sterilization of Process Vessels
- Culinary Steam
- Humidifiers
- WFI System Sterilization
- Main Drips

Options

- Check Valve for DS110

NOTE: Please specify if Material Test Reports (MTR) or Certificates of Conformance (COC) are required.

Canadian Registration # 0E0591.9C

Operation

Thermal actuator is filled at its free length with a liquid having a lower boiling point than water. On start-up, valve is normally open to discharge air, non-condensibles and condensate. When steam enters trap, thermal actuator fill vaporizes to a pressure higher than line pressure. This forces valve into seat orifice to prevent any further flow. As condensate collects, it takes heat from thermal actuator, lowering internal pressure. Line pressure will then compress thermal actuator to open valve and discharge condensate. Valve opening automatically adjusts to load conditions from minimum on very light loads to full lift at maximum load.

DS100/DS110
THERMOSTATIC STEAM TRAPS

SPECIFICATION

Steam trap shall be thermostatically actuated and maintenance free. Actuator shall be of single piece, fail open design consisting of 1.2" diameter, welded 316L stainless plates. Trap shall be constructed entirely of 316L stainless steel components with wetted body surfaces finished to 20 µ inch Ra or better. Trap shall be self draining when installed vertically in piping systems. Trap shall have tube or universal ferruled connections. Ferruled connections shall be Tri-clamp compatible and designed to fit both 1/2" and 3/4" service.

Maximum operating conditions

PMO: Max. Operating Pressure	150 psig	(10.3 barg)
TMO: Max. Operating Temperature	366°F	(170°C)
PMA: Max. Allowable Pressure	300 psig*	(20.7 barg)
TMA: Max. Allowable Temperature	500°F	(260°C)

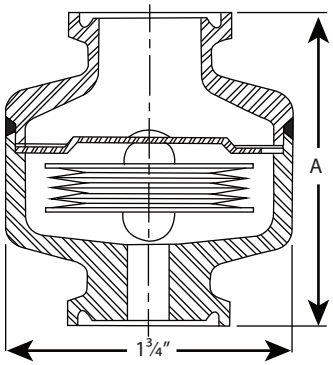
*May be limited by rating of utilized end connection

Body surface finish

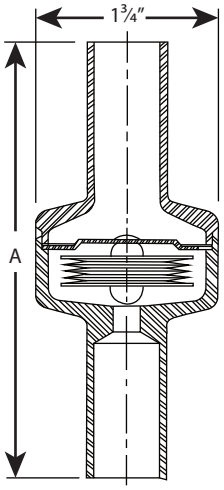
<20 µ in. Ra internal
Machine Polished external

Service notes

Trap is designed to be self draining for vertical installation (discharge down).
½" - ¾" ferrule service trap should be installed with ¾" inlet gasket.



TRI-CLAMP CONNECTION



TUBE CONNECTION

Connections: ½" – 1" Tube ½⁄¾" Tri-clamp

Dimensions			
Trap	End Connections	Size	inches (mm) A
DS100	Tube	½", ¾", & 1"	4⅛ (104.8)
DS100	Ferrule	½", & ¾"	1⅞ (47.6)
DS110	Ferrule	½", & ¾"	2⅝ (66.7)

Materials of Construction	
Part Name	**Material**
Body – Inlet	316L
Actuator	316L
Body – Outlet	316L
Valve	316L

Maximum Capacity—lbs/hr 10°F Below Saturation (Kg/hr 5°C Below Saturation)														
Trap	**Orifice Inches**	**Differential PSIG (barg)**												
		5 (0.34)	10 (0.7)	20 (1.4)	30 (2.1)	40 (2.8)	50 (3.4)	60 (4.2)	70 (4.9)	80 (5.6)	90 (6.2)	100 (6.9)	125 (8.62)	150 (10.3)
DS 100	1/4	550 (249)	825 (374)	1210 (549)	1495 (678)	1750 (794)	1975 (896)	2175 (987)	2350 (1066)	2525 (1145)	2650 (1202)	2825 (1281)	3140 (1424)	3425 (1554)

DS200 SERIES
THERMOSTATIC STEAM TRAPS

Pressures To 100 PSIG (6.9 barg)
Temperatures to 338°F (170°C)

Stainless Steel Body - Body materials are Type 316L Stainless Steel.

Self Centering Valve - Leak tight shut off. Assembly of actuator and valve to impingement plate allows valve to self-align with center of valve seat orifice. Provides long lasting valve and seat.

Temperature Sensitive Actuator - One moving part. Inconel welded actuator for maximum corrosion, thermal and hydraulic shock resistance.

Thermal and Hydraulic Shock Resistant - Impingement plate plus welded construction prevents damage to actuator.

Valve and Seat - Long life, stainless steel valve and seat lapped and matched together for water tight seal.

Maintenance - All models are sealed and maintenance free.

Additional Features - Best air handling capability for fast start up and operation. Fastest response to condensate load or temperature changes. Broad application range. Selection of orifice and pipe sizes meet majority of condensate removal demands in deionized steam systems.

Unique SLR Orifice Option - Provides drainage at saturated temperatures, instant reaction to load changes and fail-open operation for extra critical operations.

CLEAN STEAM TRAP

Applications

- Platen Presses
- Plating Tanks
- Sterilizers
- Tire Presses
- Cooking Equipment
- Laundry Equipment
- Other Process Equipment

Canadian Registration # OE0591.9C

MODELS

- **DS202**–Low capacity
- **DS203**–Medium capacity
- **DS204**–High capacity

Operation

Thermal actuator is filled at it's free length with a liquid having a lower boiling point than water. As assembled, valve is normally open. On startup, air passes through vent. As air is eliminated, hot steam reaches vent and the thermal actuator fill vaporizes to a pressure higher than line pressure. This forces valve into seat orifice to prevent any further flow. Should more air collect, it takes heat from the actuator, lowering internal pressure. Line pressure will then compress thermal actuator to open valve and discharge air. Valve lift automatically adjusts to variations.

DS200 SERIES
THERMOSTATIC STEAM TRAPS

SPECIFICATION

Steam trap shall be of balanced pressure design with stainless steel welded bellows capable of releasing condensate within 10°F of saturated pressure. Where drainage at saturated temperatures is required, trap shall have SLR orifice. All other components shall be of 316 or 316L stainless steel. Trap shall be self draining and normally open.

Maximum operating conditions

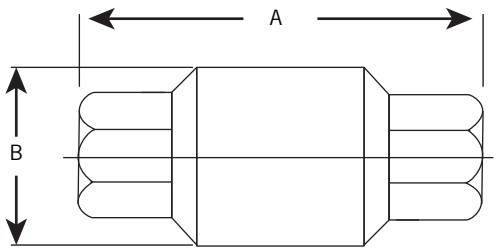
PMO: Max. Operating Pressure	100 psig	(6.9 barg)
TMO: Max. Operating Temperature	338°F	(170°C)
PMA: Max. Allowable Pressure	150 psig*	(10.3 barg)
TMA: Max. Allowable Temperature	366°F	(186°C)

Materials of construction

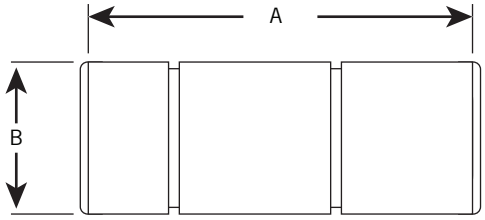
Body ..... ASTM 743 CF-8M Stainless Steel
..... 1" - 316SS, ASME SA479
Welded Actuator ..... 316L Fittings & Plates
Valve & Seat ..... 316L Stainless Steel

SLR Orifice Option

Specify when immediate elimination of condensate and improved sensitivity is desired. A 1/32" orifice at the apex of the valve allows for continuous discharge of condensate. Trap will nominally pass 50 lbs/hr of condensate at 50 psi within 2°F of saturated temperature.



3/8" - 3/4" BODY



1" BODY

Connections: 3/8" - 1" NPT or socketweld

Dimensions			
NPT or Socket weld	Inches (mm)		Weight Lbs. (kg)
	A	B	
⅜", ½"	3¾ (95)	1¾ (44)	1.1 (0.5)
¾"	3 15/16 (100)	1¾ (44)	1.2 (0.54)

Maximum Capacity—lbs/hr 10°F Below Saturation (Kg/hr 5°C Below Saturation)															
Trap	Orifice Inches	Differential PSIG (barg)													
		5 (0.34)	10 (0.7)	20 (1.4)	50 (3.5)	100 (6.9)	125 (8.6)	150 (10.3)	200 (13.8)	250 (17.2)	300 (20.7)	350 (24.1)	400 (27.6)	450 (31.0)	500 (34.5)
DS202	1/8 (3)	216 (98)	265 (120)	375 (170)	592 (269)	778 (354)	838 (381)	890 (405)	980 (445)	1055 (480)	1121 (510)	1180 (536)	1235 (561)	1284 (584)	1323 (601)
DS203	1/4 (6)	550 (249)	825 (374)	1210 (549)	1975 (896)	2825 (1281)	3140 (1424)	3425 (1554)	3650 (1656)	3960 (1796)	4100 (1860)	4230 (1919)	4420 (2005)	4600 (2086)	4760 (2161)
DS204	5/16 (8)	860 (390)	1220 (554)	1725 (783)	2725 (1237)	3575 (1623)	3850 (1748)	4090 (1857)	4505 (2045)	4850 (2202)	5155 (2340)	5425 (2463)	5675 (2576)	5900 (2679)	6110 (2774)

NOTES

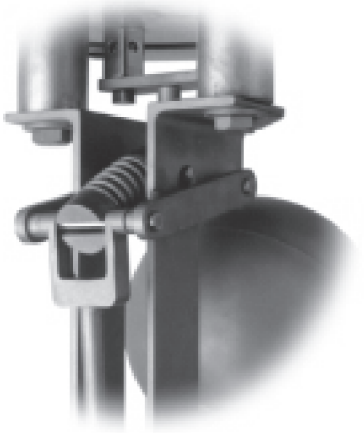
CONDENSATE RECOVERY

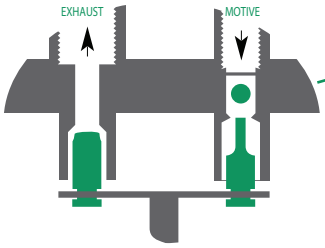
CONDENSATE COMMANDER
PUMP

Pressures to 250 PSIG (17.2 barg)
Temperatures to 650ºF (343ºC)

Applications

- Collection of condensate
- Where electrical service is unavailable
- Submerged or remote sumps and manholes
- Hazardous fluids and process fluids
- Low pressure and vacuum systems
- High back pressure systems
- High capacity process applications





Inlet Supply and Vent Valves

Lapped valves and seats for tight shutoff

Stainless steel construction resists corrosion

Floating ball design and hardened sealing surface of supply valve provide long service life

Floating disk and ball valves feature an infinite number of seating surfaces

Self centering design assures reliable performance

Cycle Counter

accurately depicts number of cycles and assists in maintenance scheduling

Retrofit Mechanism Available

Head assembly fits many manufacturer's tanks

ASME Code Stamped Tank

Fabricated steel tank is standard on most models

Unique Patented Single Spring Mechanism

Eliminates pump breakdown due to spring failure

Snap acting mechanism actuates the valve

Heavy duty spring operating in compression

Unaffected by turbulence

Stainless steel construction maximizes reliability and service life

Valve and linkage positioning above condensate level minimizes

CONDENSATE COMMANDER
PUMP

Pressures To 250 PSIG (17.2 barg)
Temperatures to 650°F (343°C)

No Electricity Needed
– Uses pressurized gas or steam as the pumping force.
– Preferable for remote or hazardous locations.

Spring
– Single spring mechanism operates in compression only to assure long service life
– Stainless steel snap action mechanism in continuous compression offers superior performance.

Rugged Mechanism
– Unaffected by turbulence.
– No adjustments or maintenance necessary.

Superior Valve Technology
– Supply and exhaust valves are lapped for tight shutoff.
– Self centering design assures reliable performance.
– Unique floating ball design and hardened sealing surface of the supply valve provide long service life.

Suitable for a Wide Variety of Liquids
– Condensate from steam systems.
– High back pressure, low pressure and vacuum systems.
– Ideal in a sump or other submersible applications.
– Suitable for acids and other process fluids that may be incompatible with conventional pumps.

ASME Code Stamped Tank
– Fabricated steel tank is standard on most models.

Retrofit Mechanism Available
– Head assembly can fit other manufacturer's tanks.

Required suction head is minimal
– Optimal performance achieved at only 12 inches.

MODELS

- **Classic**–Standard capacity, vertical tank
- **Big Boy**–Super capacity, horizontal tank
- **Horizontal**–Standard capacity, high pressure, horizontal tank
- **Little Boy**–Reduced capacity, vertical tank
- **Skid**–Standard or custom multiplex configurations

Applications

Collection of Condensate
- Remote Locations such as tank farms
- Low pressure and vacuum systems
- Condensate systems with high back pressure
- High capacity process applications such as heat exchangers

Electrical Service is Unavailable or Prohibited
- Remote locations
- Hazardous locations

Submerged Areas
- Sumps or low lying areas
- Manholes

Hazardous Fluids
- Process fluids that may be difficult for conventional electric pump technology to handle

Options

- Glass Water Gage
- Cycle Counter
- Bronze or Stainless Steel Check Valves
- Insulating Jacket
- Supply Pressure Regulator
- Stainless Steel Tanks
- High Temperature
- High Pressure

Operation

The vent valve is open, the pressure supply valve is closed and the float is positioned in the lower part of the tank as the condensate or other liquid enters the tank through the inlet check valve. As the tank fills with liquid, the float rises to the point where the spring mechanism snaps past the center position. The compressed spring instantly closes the vent valve and opens the pressure supply. This allows pressure into the tank which forces the liquid through the outlet check valve.
As the liquid level falls, the float lowers to the point where the spring mechanism snaps past the center position which immediately closes the pressure supply valve and opens the vent valve. The pressure in the tank decreases, allowing liquid to flow through the inlet check valve, repeating the cycle

CONDENSATE COMMANDER
CLASSIC PUMP

SPECIFICATION

Pump shall be a pressure vessel drainer operated by steam, compressed air or other pressurized gas to 200 psig. Body shall be fabricated steel ASME code to 200 psi. Pump mechanism shall be all stainless steel without external packing or seals. Mechanism shall employ one spring operating in continuous compression. When required, unit shall be equipped with an external cycle counter, sight glass and insulating jacket.

Maximum operating conditions

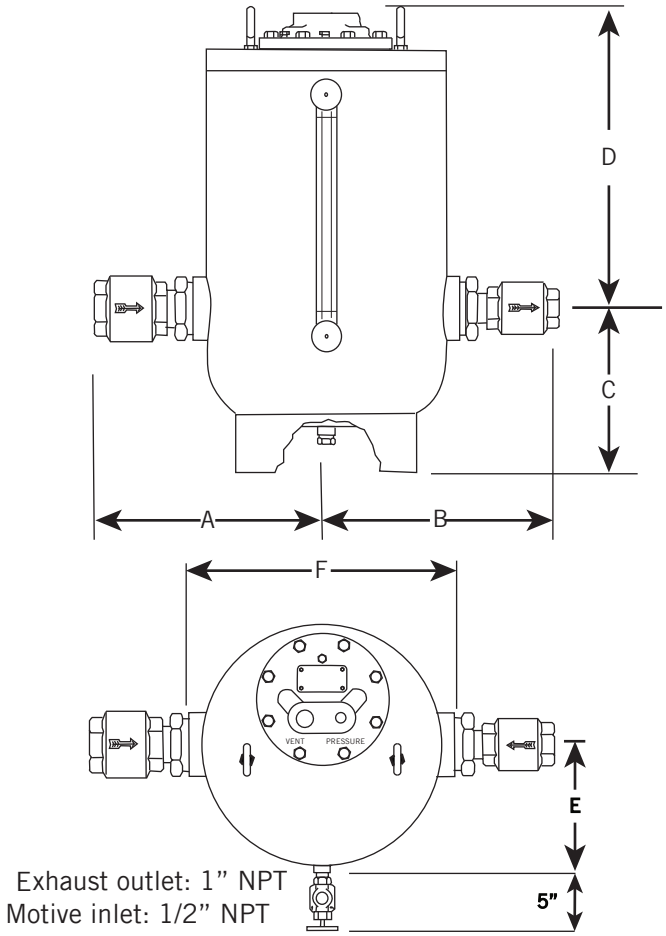
PMO: Max. Operating Pressure	200 psig	(13.8 barg)
TMO: Max. Operating Temperature	400°F	(204°C)
PMA: Max. Allowable Pressure	200 psig	(13.8 barg)
TMA: Max. Allowable Temperature	400°F	(204°C)
With optional Temperature/Pressure upgrades:		
PMO: Max. Operating Pressure	250 psig	(17.2 barg)
TMO: Max. Operating Temperature	650°F	(343°C)
PMA: Max. Allowable Pressure	250 psig	(17.2 barg)
TMA: Max. Allowable Temperature	650°F	(343°C)

Materials of construction

Tank Weldment	Steel
Trip Mechanism w/Flange	DI/StI/SS
Gasket	Graphite
Bolt, Hex Head	Steel
Eye Bolt	Steel
Nut	Steel
Nameplate	Aluminum
Drive Screw	Steel
Pipe Plug, 1/2" NPT	Steel
Water Level Gage	Bronze
Inlet Reducer	M. Iron
Inlet Nipple	Steel
Inlet Check Valve	Bronze/Stainless Steel
Outlet Reducer	M. Iron
Outlet Nipple	Steel
Outlet Check Valve	Bronze/Stainless Steel

Operating Characteristics

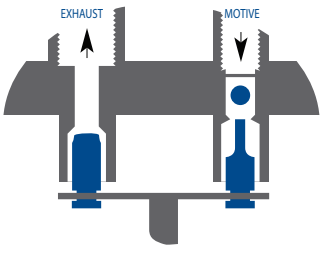
Pump Discharge per Cycle:	7.8 - 8.6 Gal
Max. Instantaneous Discharge Rate:	90 GPM (w/2" outlet check)
Steam Consumption:	≈3 lbs per 1000 lbs. of liquid pumped
Air Consumption:	≈100 SCF per 1000 lbs. of liquid pumped
Recommended Filling Head:	12"



Connections: 1", 1 1/2", 2", or 3" x 2" Screwed

Dimensions							
Size	Dimensions, Inches (mm)						Weight lbs (kg)
	A	B	C	D	E	F	
1"x 1"	13⅜ (340)	13⅜ (340)	11 (279)	21¾ (552)	9 (278)	17¾ (451)	168 (76)
1½"x 1½"	14 ¾ (375)	14¾ (375)	11 (279)	21¾ (552)	9 (278)	17¾ (451)	170 (77)
2"x 2"	15 (381)	15 (381)	11 (279)	21 (552)	9 (278)	17¾ (451)	173 (79)
3"x 2"	16½ (419)	15 (381)	11 (279)	21¾ (552)	9 (278)	17¾ (451)	185 (84)

*Add 5" for Water Gage.
†Allow additional 21" clearance for maintenance.



CONDENSATE COMMANDER
BIG BOY PUMP

SPECIFICATION

Pump shall be a pressure vessel drainer operated by steam, compressed air or other pressurized gas to 150 psig. Body shall be fabricated steel ASME code to 150 psi. Mechanism shall employ one spring operating in continuous compression. When required, unit shall be equipped with an external cycle counter and sight glass.

Maximum operating conditions

PMO: Max. Operating Pressure	150 psig	(10.3 barg)
TMO: Max. Operating Temperature	400°F	(204°C)
PMA: Max. Allowable Pressure	150 psig	(10.3 barg)
TMA: Max. Allowable Temperature	400°F	(204°C)

Materials of construction

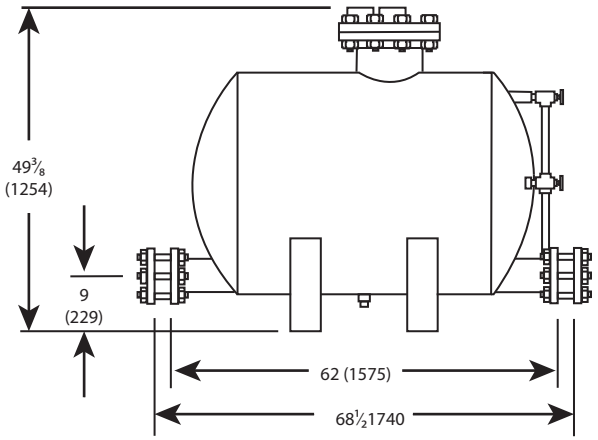
Tank Weldment	Steel
Trip Mechanism w/Flange	Stl/SS
Gasket	Graphite
Stud, Flange	Steel
Nut,Hex	Steel
Nameplate	Aluminum
Drive Screw	Steel
Pipe Plug, 3/4" NPT	Steel
Water Level Gage	Bronze
Inlet Check Valve	Bronze/Stainless Steel
Inlet Flange	Steel
Outlet Check Valve	Bronze/Stainless Steel
Outlet Flange	Steel

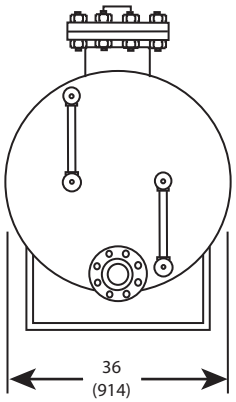
Options

- High Back Pressure for back pressures above 60 psi

Operating Characteristics

Pump Discharge per Cycle:	140 - 185 Gal
Max. Instantaneous Discharge Rate:	195 GPM
Steam Consumption:	≈3 lbs per 1000 lbs. of liquid pumped
Air Consumption:	≈100 SCF per 1000 lbs. of liquid pumped
Recommended Filling Head:	24"





Exhaust outlet: 2" NPT

Motive inlet: 2" NPT

Dimensions–Inches (mm)

See Capacities on page 91

Connections: 4" x 4" Flanged

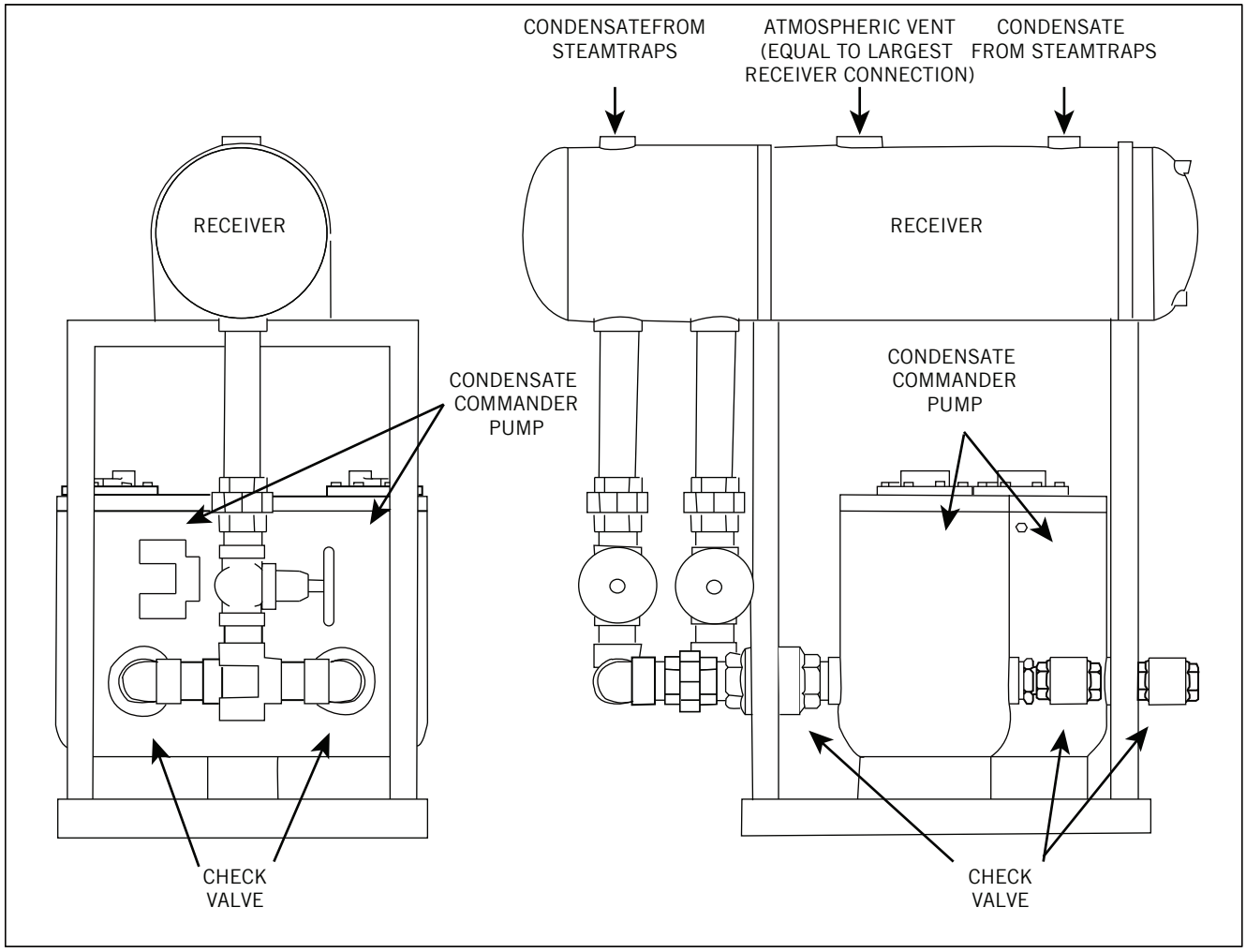
CONDENSATE COMMANDER
PUMP CAPACITY TABLE*

Motive Pressure		Back Pressure		Fill Head 6" Little Boy		Fill Head 12" Classic & Horizontal				Fill Head 24 Big Boy	Fill Head 12" Clas-sic Duplex
psig	barg	psig	barg	1 X 1	1.5 X 1.5	1 X 1	1.5 X 1.5	2 X 2	3 X 2	4 X 4	3 X 2
250	17.24	40	2.76	–	–	2703	6392	10196	11537	–	23073
		60	4.14	–	–	3670	7203	7787	8551	–	17101
		80	5.52	–	–	3457	6071	6531	7105	–	14209
		100	6.90	–	–	3891	5278	5753	6202	–	12404
		120	8.28	–	–	3700	4730	5213	5587	–	11173
		150	10.34	–	–	3196	4074	4552	4842	–	9683
		175	12.07	–	–	2845	3624	4092	4331	–	8663
		200	13.79	–	–	2456	3152	3650	3847	–	7694
		225	15.52	–	–	1963	2732	3221	3380	–	6761
200	13.79	40	2.76	–	–	2503	5919	9441	10682	–	21364
		60	4.14	–	–	3398	6669	7210	7918	–	15835
		80	5.52	–	–	4021	5579	6110	6619	–	13238
		100	6.90	–	–	3741	4855	5403	5804	–	11607
		120	8.28	–	–	3286	4242	4768	5088	–	10177
		150	10.34	–	–	2741	3533	4058	4297	–	8593
		175	12.07	–	–	2151	2926	3476	3661	–	7321
150	10.34	25	1.72	1814	5739	2314	5722	10376	12105	47994	24210
		40	2.76	3058	4860	3386	7077	8465	9450	45382	18899
		60	4.14	3127	4234	4464	6338	6995	7630	39757	15260
		80	5.52	2620	3472	3763	4974	5607	6040	35452	12080
		100	6.90	2261	2957	3168	4150	4743	5064	27971	10128
		120	8.28	1935	2530	2669	3522	4156	4408	20613	8815
125	8.62	25	1.72	2470	5645	2942	6740	10712	12337	48101	24674
		40	2.76	3215	4619	3983	7197	7965	8836	44256	17672
		60	4.14	2788	3768	4066	5513	6220	6758	38625	13516
		80	5.52	2358	3117	3326	4416	5064	5432	33012	10863
		100	6.90	1920	2535	2656	3544	4216	4482	25862	8964
		115	7.93	1491	2151	1952	2976	3589	3788	17512	7575
100	6.90	15	1.03	2036	6211	2762	6393	11889	14241	47156	28482
		25	1.72	3132	5336	3763	7658	9818	11170	45212	22340
		40	2.76	3082	4323	4569	6603	7403	8164	42041	16327
		60	4.14	2534	3406	3612	4893	5641	6092	35589	12184
		80	5.52	1959	2620	2716	3681	4428	4721	27783	9442
75	5.17	15	1.03	2975	6022	3867	7978	11977	14038	46485	28075
		25	1.72	3340	4940	4649	7823	8914	10026	43084	20052
		40	2.76	2817	3891	4078	5723	6654	7273	40027	14546
		60	4.14	2003	2732	2786	3863	4721	5057	20002	10114
50	3.45	10	0.69	3701	6273	4692	9227	12492	14737	46092	29474
		25	1.72	2976	4250	4343	6387	7603	8421	39727	16843
		40	2.76	2053	2891	2863	4120	5172	5578	19899	11156
25	1.72	5	0.34	3872	6625	5825	10486	13760	16560	45329	33120
		10	0.69	3315	5063	4845	7774	9812	11193	39945	22385
		15	1.03	2751	4016	3950	6043	7657	8513	18694	17026
10	0.69	2	0.14	3894	6646	5610	10348	14520	17621	–	35242
		5	0.34	2945	4600	4150	6954	9708	11085	–	22170
5	0.34	2	0.14	2981	5115	4130	7602	11747	13781	–	27562

*Capacities shown are obtained with factory supplied check valves
For Kg/Hr multiply by .454
For other multiplex capacities, consult factory.

CONDENSATE COMMANDER
SKID MOUNTED SYSTEM

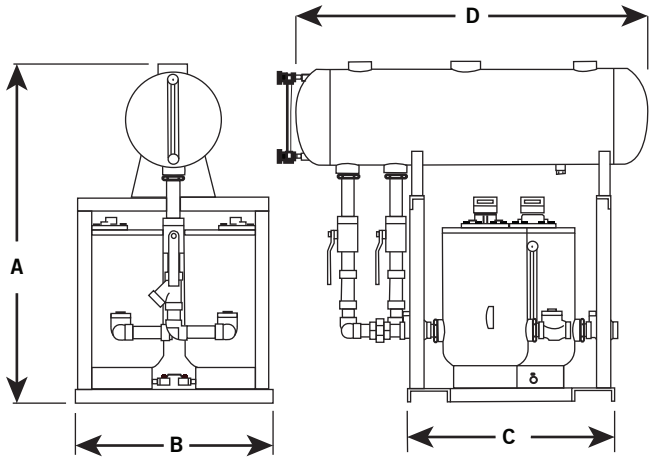
Where the condensate load exceeds the capacity of one Condensate Commander Pump, multiple pumps may be used in tandem. Skid mounted units may be simplex (one pump), duplex (two pumps), triplex (three pumps) or quadruplex (four pumps). The units are equipped with a receiver, Condensate Commander Pump(s) and all necessary piping fully connected and ready for use.



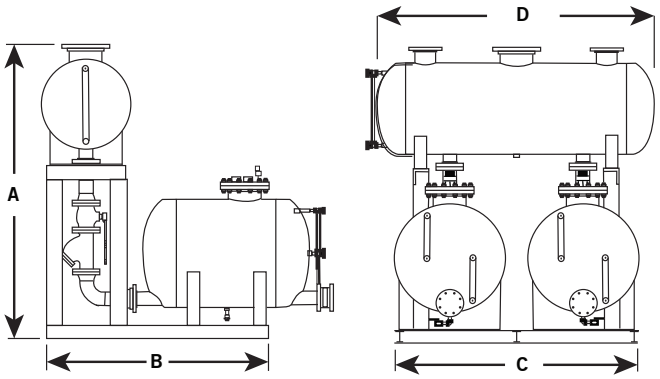
Typical Duplex Condensate Commander Pump Skid Mount System

The skid mount systems are designed to provide a complete condensate collection and condensate pump unit ready to pipe. All necessary connections are in place. The filling head dimension has already been determined.

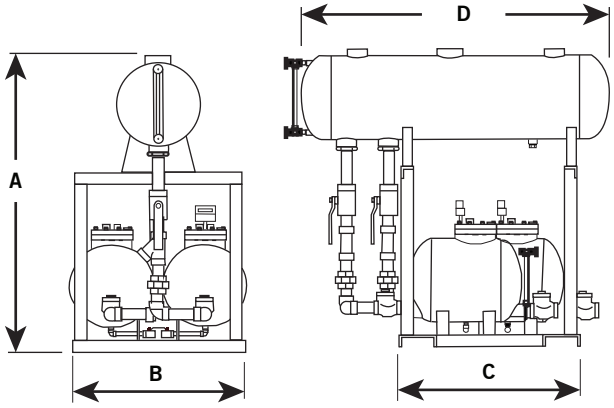
CONDENSATE COMMANDER
PUMP SKID MOUNTED SYSTEM



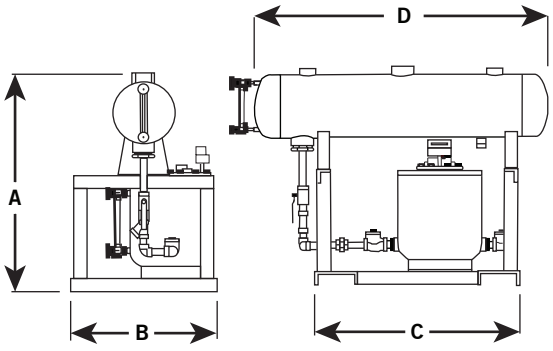
CLASSIC VERTICAL



BIG BOY



CLASSIC HORIZONTAL



LITTLE BOY

Dimensions							
Style	Configuration	Receiver Gallons	Inches (mm)				Weight Lb (kg)
			A	B	C	D	
Little Boy	Simplex	25	41 (1054)	27 (686)	39 (991)	56 (1422)	435 (198)
Classic, Vertical	Simplex	25	58 (1486)	27 (686)	39 (991)	56 (1422)	576 (262)
		65	64 (1638)	27 (686)	39 (991)	66 (1689)	635 (289)
Classic, Vertical	Duplex	65	64 (1638)	36 (914)	39 (991)	66 (1689)	1050 (477)
		80	66 (1689)	36 (914)	39 (991)	68 (1727)	1095 (498)
Classic, Horizontal	Simplex	25	58 (1486)	27 (686)	39 (991)	56 (1422)	596 (2713)
		65	64 (1638)	27 (686)	39 (991)	66 (1689)	655 (298)
Classic, Horizon-tal	Duplex	65	64 (1638)	36 (914)	39 (991)	66 (1689)	1095 (498)
		80	66 (1689)	36 (914)	39 (991)	68 (1727)	1135 (516)
Big Boy	Simplex*	115	87 (2228)	50 (1270)	70 (1791)	96 (2438)	1900 (864)
Big Boy	Duplex	250	97 (2482)	76 (1930)	80 (2032)	92 (2337)	3050 (1386)

*The layout for the Big Boy Simplex is the same as the Classic Horizontal.

CONDENSATE COMMANDER
HORIZONTAL PUMP

SPECIFICATION

Pump shall be a pressure vessel drainer operated by steam, compressed air or other pressurized gas to 250 psig. Body shall be fabricated steel ASME code to 250 psi. Pump mechanism shall be all stainless steel without external packing or seals. Mechanism shall employ one spring operating in continuous compression. When required, unit shall be equipped with an external cycle counter, sight glass and insulating jacket.

Maximum operating conditions

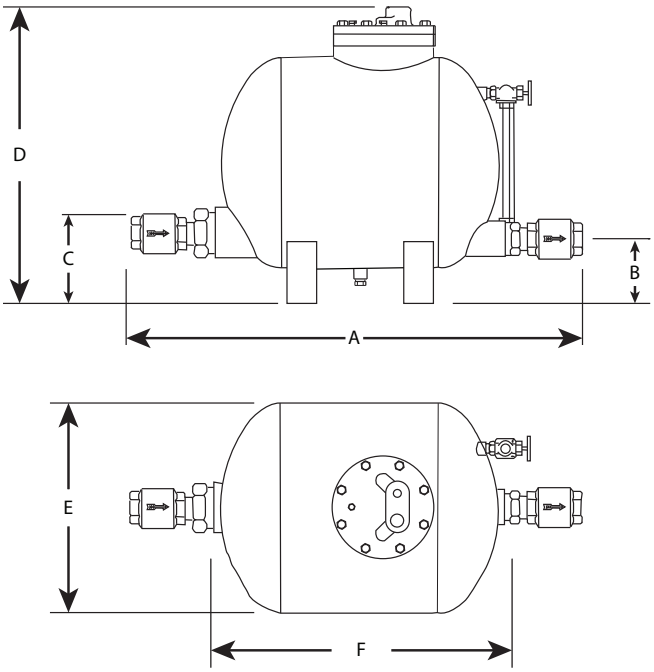
PMO: Max. Operating Pressure	250 psig	(17.2 barg)
TMO: Max. Operating Temperature	400°F	(204°C)
PMA: Max. Allowable Pressure	250 psig	(17.2 barg)
TMA: Max. Allowable Temperature	400°F	(204°C)

Materials of construction

Tank Weldment	Steel
Trip Mechanism w/Flange	DI/Stl/SS
Gasket	Graphite
Bolt, Hex Head	Steel
Nameplate	Aluminum
Drive Screw	Steel
Pipe Plug, 1/2" NPT	Steel
Water Level Gage	Bronze
Inlet Reducer	M. Iron
Inlet Nipple	Steel
Inlet Check Valve	Bronze/Stainless Steel
Outlet Reducer	M. Iron
Outlet Nipple	Steel
Outlet Check Valve	Bronze/Stainless Steel

Operating Characteristics

Pump Discharge per Cycle:	8.8 - 11 Gal
Max. Instantaneous Discharge Rate:	90 GPM (w/2" outlet check)
Steam Consumption:	≈3 lbs per 1000 lbs. of liquid pumped
Air Consumption:	≈100 SCF per 1000 lbs. of liquid pumped
Recommended Filling Head:	12"



Exhaust outlet: 1" NPT

Motive inlet: 1/2" NPT

See Capacities on page 91

Connections: 1", 1" to 3" x 2" Screwed

Dimensions							
Size	Dimensions, Inches (mm)						Weight lbs (kg)
	A	B	C	D	E	F	
1"x 1"	34¼ (879)	5½ (140)	6 (152)	25¼ (641)	18 (457)	25 (635)	174 (79)
1½"x 1½"	36¾ (933)	5½ (140)	6 (152)	25¼ (641)	18 (457)	25 (639)	178 (81)
2"x 2"	37⅛ (943)	5½ (140)	6 (152)	25¼ (641)	18 (457)	25 (639)	183 (83)
3"x 2"	38¼ (971)	5½ (140)	6 (152)	25¼ (641)	18 (457)	25 (639)	190 (86)

†Allow additional 21" clearance for maintenance.

CONDENSATE COMMANDER
LITTLE BOY PUMP

SPECIFICATION

Pump shall be a pressure vessel drainer operated by steam, compressed air or other pressurized gas to 150 psig. Body shall be fabricated steel. Mechanism shall employ one spring operating in continuous compression. When required, unit shall be equipped with an external cycle counter and sight glass.

Maximum operating conditions

PMO: Max. Operating Pressure	150 psig	(10.3 barg)
TMO: Max. Operating Temperature	400°F	(204°C)
PMA: Max. Allowable Pressure	150 psig	(10.3 barg)
TMA: Max. Allowable Temperature	400°F	(204°C)

Materials of construction

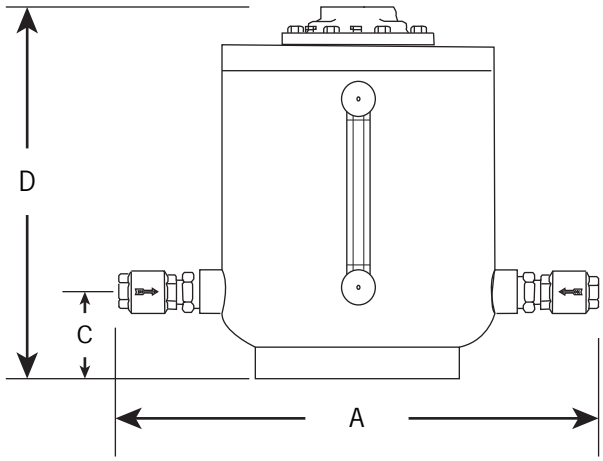
Tank Weldment ..... Steel
Trip Mechanism w/Flange .... DI/Stl/SS
Gasket..... Graphite
Bolt, Hex Head..... Steel
Nameplate ..... Aluminum
Drive Screw ..... Steel
Water Level Gage..... Bronze
Inlet Reducer ..... M. Iron
Inlet Nipple..... Steel
Inlet Check Valve..... Bronze/Stainless Steel
Outlet Reducer..... M. Iron
Outlet Nipple ..... Steel
Outlet Check Valve..... Bronze/Stainless Steel

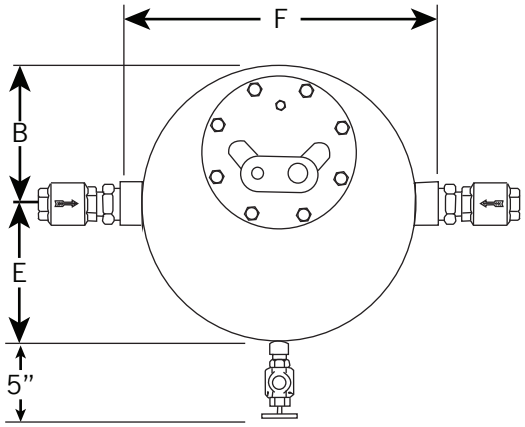
Options

- High Back Pressure for back pressures above 60 psi

Dimensions							
Size	Inches (mm)						Weight lbs (kg)
	A	B	C	D	E	F	
1"x 1"	26 (679)	8 (203)	5 (127)	21 (540)	9 (229)	17 (451)	17 (451)
1½"x 1½"	29 (749)	8 (203)	5 (127)	21 (540)	9 (229)	17 (451)	155 (71)

*Add 5" for Water Gage.
†Allow additional 18" clearance for maintenance.





See Capacities on page 91

Connections: 1", 1" to 11/2" x 2 NPT

Operating Characteristics

Pump Discharge per Cycle:	4.2 - 5.1 Gal
Max. Instantaneous Discharge Rate:	60 GPM (w/1½" outlet check)
Steam Consumption:	≈3 lbs per 1000 lbs. of liquid pumped
Air Consumption:	≈100 SCF per 1000 lbs. of liquid pumped
Recommended Filling Head:	6"

CONDENSATE COMMANDER PUMP PRIMER

The Condensate Commander belongs to a class of pressure operated pumps primarily intended to move condensate or other fluids without the use of electricity. When compared to conventional electrical pumps, the Condensate Commander is particularly suited to pumping "difficult" media such as high temperature condensate and corrosive fluids. Pressure operated pumps and the Condensate Commander in particular enjoy a reputation of long life with very little required maintenance. Generally these types of pumps, by eliminating rotating seals, electrical motors, and impellers, last five to ten times as long as conventional electrical pumps while eliminating most of the standard maintenance.

- Returns hot condensate conserving boiler feed water chemicals and reducing fuel cost associated with reheating boiler feed water.
- Pumps without requiring electrical service.
- Pump design provides safe operation for hazardous or explosive environments.
- Operates on steam, compressed air or gas from 5 psig to 250 psig depending on model.
- Capacities to 48,000 lbs./hr.

OPERATION

The Condensate Commander pumps by displacing fluid with steam or compressed gas. The float is connected to a linkage and spring that simultaneously actuates a motive valve and an exhaust valve. During the fill cycle the motive valve closes while the exhaust valve opens, allowing condensate to fill the pump housing. When the float, rising with the entering fluid level, reaches the top of its stroke, the mechanism releases the spring, opening the motive and closing the exhaust valves. Steam or compressed gas then flows into the pump displacing the fluid. Check valves positioned at the inlet and outlet of the pump direct the fluid in the direction of the flow.

CHARACTERISTICS

Flow capacity is dependent on several parameters. Bearing in mind that the Condensate Commander pumps in discreet, relatively consistent slugs of fluid, the total capacity will depend on how quickly the Commander cycles. Motive pressure available and resistance in the flow line are the obvious causative and limiting factors of capacity. Less obvious is the Cv of the check valves, pressure or head of the incoming fluid, resistance in the vent line, and characteristics of the motive gas used.

There is no "vacuum" side of a Commander pump. While there certainly is an inlet side, it is important to understand that the class of pumps the Condensate Commander belongs to does not draw or suck fluid into it. The media must flow by gravity into the pump. The greater the pressure and/or head, the greater the Cv of the inlet check, and to a lesser extent the greater the Cv of the exhaust vent, the faster the fill portion of the cycle will complete. With the fill portion completed the Commander mechanism will shut off the exhaust vent and open the motive valve. Steam or compressed gas will now displace the fluid contained in the pump housing. Factors controlling the speed of the discharge portion of the cycle include pressure of motive steam or gas, outlet check Cv, downstream backpressure, and potentially temperature of flow media and/or ambient conditions if steam is utilized as the motive gas. This last component is often overlooked, but the fact that steam will condense and reduce actual motive pressure could become significant in some applications.

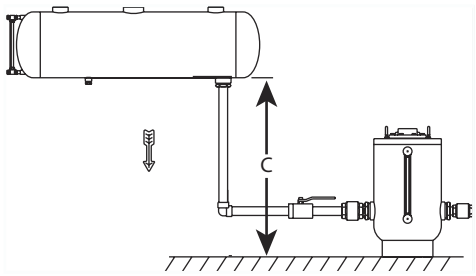
RECEIVER

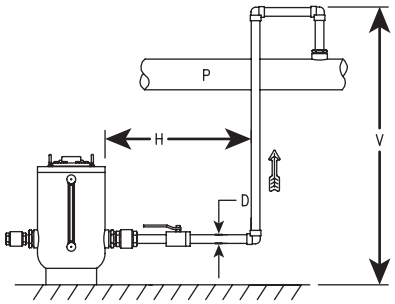
Conventional electric condensate pumps typically require a receiver sized to allow condensate to cool and vent flash steam. This is necessary, as the suction side of the pump will lower pressure potentially allowing the hot condensate to boil as it is drawn past the impeller. This action, known as cavitation, will quickly erode the impeller. While the temperature of the flow media is generally not a concern it must be remembered that the Condensate Commander pumps in discrete cycles. While the Commander is expelling fluid the body is pressurized and cannot receive fluid. If fluid is draining to the Commander in a continuous fashion, a receiver sized to accommodate the maximum volume expected during the time required to discharge the commander must be utilized. Failure to do so will back condensate up and possibly increase pressure, potentially causing problems.

CONDENSATE COMMANDER PUMP CHECKLIST

(A) Sizing Requirements

1. What is the Fluid to be Pumped? _____
2. What is the fluid's Specific Gravity (i.e.: water = 1)? _____
3. What is the fluid's Fluid Temperature? _____ °F
4. *What is the required Flow Rate? _____ ☐ lb/hr ☐ GPM
5. What is the Clearance (C)? _____ feet
6. Does the system have a Modulating Control Valve? ☐ Yes ☐ No





(B) Installation Requirements

Pump Connections: _____ Inlet _____ Inlet ☐ NPT ☐ Flanged ☐ Other

*Motive Gas: _____ psig _____ °F ☐ Air ☐ Steam ☐ Other

*Total Return Header Pressure (P): _____ psig

Horizontal Run to Return Header (H): _____ feet

Downstream Pipe Size (D): _____

Vertical Lift to Return Header (V): _____

Can pump be vented to atmosphere? ☐ Yes ☐ No

If "No", please explain _____

Does the system have an existing flash tank or receiver tank? ☐ Yes ☐ No

If "Yes", is it vented to atmosphere or under pressure? ☐ Atmospheric ☐ Pressure _____

(C) Materials & Accessories

Tank Material:	☐ Carbon Steel (STD)	☐ Stainless Steel	☐ Other _____	
Tank Style:	☐ Little Boy	☐ Classic Vertical	☐ Classic Horizontal	☐ Big Boy
Receiver Size:	☐ 25 ☐ 65	☐ 80	☐ 115	☐ 250
Number of Pumps:	☐ One	☐ Two	☐ Three	☐ Four
Check Valve:	☐ Bronze (STD)	☐ Stainless Steel	☐ Other _____	
Options:	☐ Gage Glass Ass'y on Pump	☐ Cycle Counter	☐ Motive Pressure PRV†	
	☐ Gage Glass Ass'y on Receiver	☐ Insulation Jacket	☐ Safety Relief Valve	
	☐ Skid Mounted Package	☐ Pressure Gages	☐ Temperature Gages	

*Required Fields

CONDENSATE COMMANDER PUMP PRIMER SELECTION GUIDELINES

To correctly select a Condensate Commander Pump that meets the requirements of the application, some specific data is needed.

1. Condensate load in lbs/hr. *
2. Motive pressure available (air or steam).
3. Total lift in feet (hydraulic head).
4. Pressure in return piping.
5. Filling head available in inches (recommended minimum of 12 inches).

EXAMPLE 1: Steam motive:

1. Condensate Load: 4,000 lb/hr.
2. Steam pressure available: 50 psig
3. Total vertical lift: 20 ft.
4. Pressure in return piping: 10 psig
5. Filling head available: 12 inches

For filling head other than 12 inches, multiply capacity by correction factor found in Table 3.

SOLUTION:

1. Calculate total back pressure. Back pressure is the total head in feet multiplied by 0.433 plus the pressure in the return piping.

   (20 ft. x .433) + 10 psig = 19

2. Select from the Pump Capacity Table a pump with 50 psig motive pressure and greater than 19 (25) psig total back pressure: a 1" x 1" Condensate Pump.

EXAMPLE 2: Air motive:

(conditions same as Example 1)

1. To determine correction factor for air, divide total back pressure from Example 1 by motive pressure available (BP÷MP).

   19 ÷ 50 = 38%

   Correction factor from Table 2 is 1.10

2. Divide required condensate load by correction factor.

   4000 ÷ 1.10 = 3636

   Select from the Pump Capacity Table (Table 1) a 1" x 1" Condensate Pump.

*CONVERSIONS:

GPM to lbs/hr: GPM x 500
Lbs/hr to GPM: Lbs/hr. x .002
Lbs/hr to KG/hr: Lbs/hr. x .454

Table 1 – Pump Capacity, Classic - (lbs/hr)

Operating Pressure Inlet (psig)	Total Back-pressure (psig)	Stainless Steel Check Valves				
		1"x1"	1 ½" x 1 ½"	2"x2"	3"x2"	3"x2" Duplex
5	2	4130	7602	11747	13781	27562
10	5	4150	6954	9708	11085	22170
	2	5610	10348	14520	17621	35242
25	15	3950	6043	7657	8513	17026
	10	4845	7774	9812	11193	22386
	5	5825	10486	13760	16560	33120
50	40	2863	4120	5172	5578	11156
	25	4343	6387	7603	8421	16842
	10	4692	9227	12492	14737	29474
75	60	2786	3863	4721	5057	10114
	40	4078	5723	6654	7273	14546
	15	3867	7978	11997	14038	28076
100	80	2716	3681	4428	4721	9442
	60	3612	4893	5641	6092	12184
	40	4569	6603	7403	8164	16328
	15	2762	6393	11889	14241	28482
125	115	1952	2976	3589	3788	7576
	100	2656	3544	4216	4482	8964
	80	3326	4416	5064	5432	10864
	60	4066	5513	6220	6758	13516
	40	3983	7197	7965	8836	17672
	25	2942	6740	10712	12337	24674
150	120	2669	3522	4156	4408	8816
	100	3168	4150	4743	5064	10128
	80	3763	4974	5607	6040	12080
	60	4464	6338	6995	7630	15260
	40	3386	7077	8465	9450	18900
	25	2314	5722	10376	12105	24210

Table 2 – Capacity Correction Factors for Motive Gas Supply other than Steam

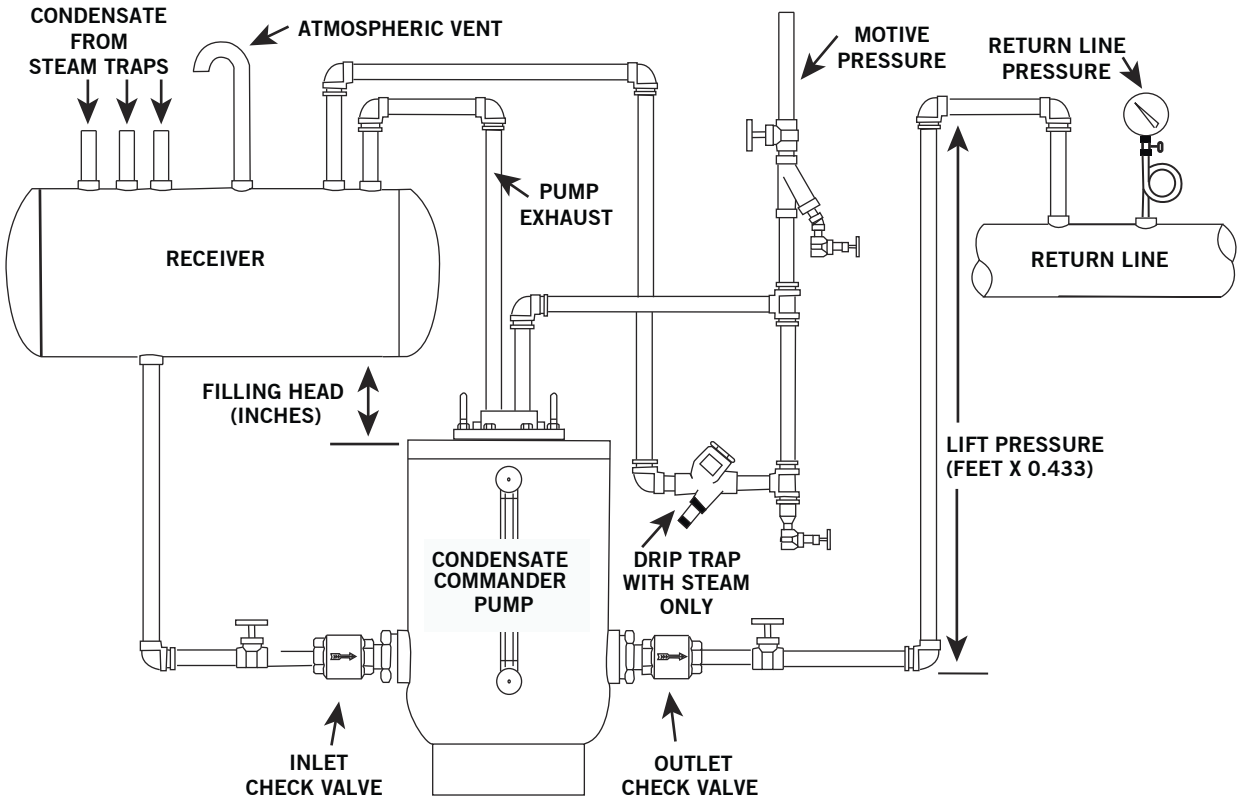
% Back Pressure vs. Motive Pressure (BP ÷ MP)								
10%	20%	30%	40%	50%	60%	70%	80%	90%
1.04	1.06	1.08	1.10	1.12	1.15	1.18	1.23	1.28

Table 3 – Capacity Correction Factor for Filling Head Variation

Filling Head (inches)	Check Valve and Piping Size Inches				
	1"	1½"	2"	3" x 2"	4"
6	0.70	0.70	0.70	0.84	—
12	1.00	1.00	1.00	1.0	0.7
24	1.20	1.20	1.20	1.08	1.0
36	1.35	1.35	1.35	1.20	1.1
48	—	—	—	—	1.15

TYPICAL INSTALLATION OF A CONDENSATE COMMANDER PUMP WITH A VENTED RECEIVER

Condensate is being pumped from a vented receiver to an overhead elevated condensate return line that may contain pressure. For safety, the pump exhaust and receiver should be vented to atmosphere if steam is used for the motive pressure.



To efficiently drain condensate from an open system, the vented receiver should be horizontally located a minimum of twelve inches above the pump. To allow for sufficient volume of condensate and flash vapor, the receiver must be sized adequately to permit the complete separation of flash vapor from condensate. The receiver may be either an ASME coded tank or a length of large diameter pipe.

Sizing Example: Condensate Load = 10,000 lb/hr. Traps are draining a Heat Exchanger running at 100 psig and the receiver is vented to atmosphere. Table 5 shows 13.3% of the condensate flashes to steam, so total flash steam = 10,000 x .133 = 1,333 lb/hr flash steam. Table 4 indicates a vent size of 6" and a receiver size of 16" Dia. x 36" long.

Table 4 – Vented Receiver Sizing

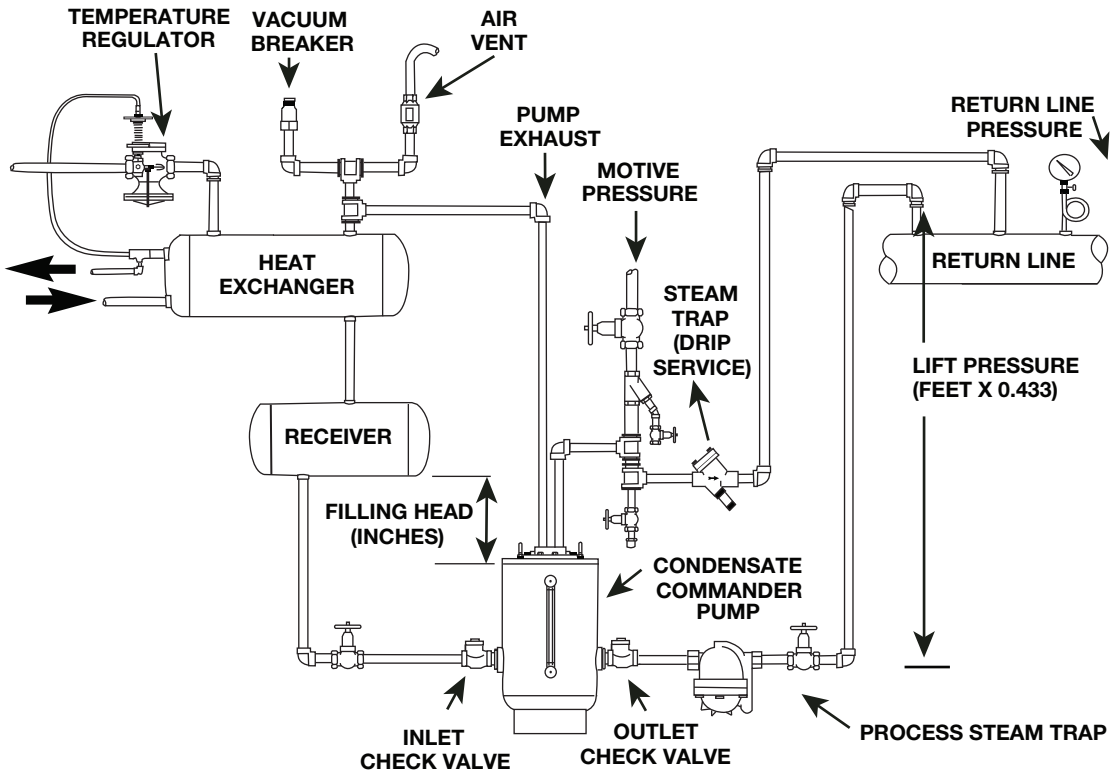
Receiver size based on 36" OAL		
Flash Vapor (lbs/hr)	**Pipe Diameter (inches)**	**Vent Line Size (inches)**
75	4	1½
150	6	2
300	8	3
600	10	4
900	12	6
1200	16	6
2000	20	8

Table 5 – Vented Receiver Sizing

Initial Steam Pressure psig	Sat. Temp. °F	Receiver Tank Pressure, psig 0
10	239	3.0
25	267	5.7
50	298	9.0
75	320	11.3
100	338	13.3
125	353	14.8

TYPICAL INSTALLATION OF A CONDENSATE COMMANDER PUMP IN A CLOSED SYSTEM

Condensate is flowing from a pressurized system to another pressurized system with greater pressure. Both the inlet and return line may be elevated. This installation will also service a high capacity process installation using a pressurized receiver.



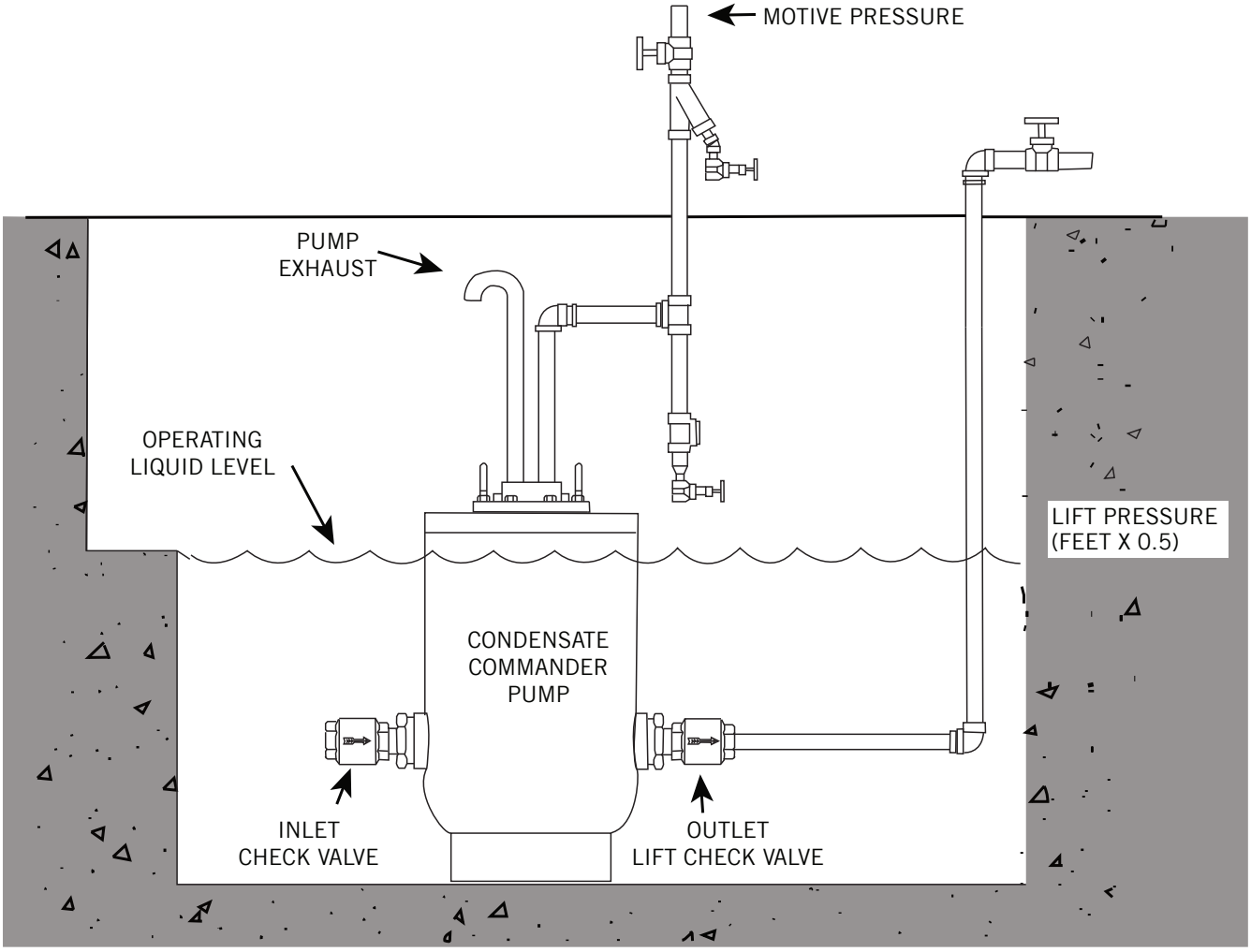
To efficiently drain condensate in a closed system, the receiver should be horizontally located a minimum of twelve inches above the pump to allow for sufficient condensate collection. The receiver must be sized to provide the minimum condensate capacity required to prevent equipment flooding. The receiver may be either an ASME coded tank or a length of large diameter pipe. A safety relief valve may be required. Consult factory for capacity when a steam trap is utilized after the pump.

Table 6 – Inlet Receiver Sizing

Liquid	Receiver Pipe Size (feet)				
(lb/hr)	3"	4"	6"	8"	10"
>500	2	—	—	—	—
1000	2	—	—	—	—
1500	3	2	—	—	—
2000	3.5	2	1	—	—
3000	—	3	2	—	—
4000	—	4	2	1	—
5000	—	6	3	2	—
6000	—	—	3	2	—
7000	—	—	3	2	—
8000	—	—	4	2	—
9000	—	—	4.5	3	2
10,000	—	—	5	3	2
11,000	—	—	5	3	2

TYPICAL INSTALLATION OF A CONDENSATE COMMANDER PUMP IN A SUBMERGED APPLICATION

Liquid is pumped from a sump, manhole or other low-lying area where it may accumulate. For back pressure applications, multiply the total vertical lift by .5 plus any back pressure in the return line.



Condensate Commander Pumps can pump liquids from low lying areas such as manholes, steam pits or any area that may collect liquid or flood. The non-electric feature makes it a good choice if compressed air or any other gas is readily available for use as the driving force. Steam is not recommended as a motive vapor because a submerged pump may quickly condense the motive steama, potentially reducing performance.

AIR TRAPS/
LIQUID DRAINERS

DRAIN AIR

Condensate Removal from Air Systems
Pressures To 600 PSIG (41.4 barg)
Temperatures to 220°F (104°C)

Automatic and Positive Drain - Effectively removes condensate from compressed air systems with minimum air loss and rapid shutoff on no load conditions.

Reliable - Only one moving part.

Low Maintenance Cost - No adjustments necessary. Replaceable cartridge for in line repair and/or cleaning.

Long Service Life - Stainless Steel internals.

Freezeproof - Will not freeze when installed in vertical position with muffler removed.

Quiet Operation - Meets OSHA noise standards.

Simplifies Startup - No need to drain air lines through manual valves or petcocks. Top performance is reached without waiting for system to purge.

Sized for Most Applications - Drain-Air available in 3/8" and 1/2".

Applications

- Air Header Drainage (pocket risers, end of line)
- Air Station or Location where petcock is used for blowdown, collecting wells, separators.

MODELS

- **Drain Air**–Forged body w/SS internal mechanism & nylon muffler

Canadian Registration # OE0591.9C

PNEUMATIC MUFFLERS ARE AVAILABLE SEPARATELY IN PIPING SPECIALTIES SECTION

Operation

A simple disc is used with no linkage or close fitting parts to eliminate problems found in ordinary small float or piston-operated devices used in drip legs on air lines. Disc will lift off seat on a periodic time cycle, allowing moisture to be discharged and atomized through the muffler. Positive action of the disc assures reliable condensate removal with minimum loss of air and rapid shutoff on no load condition. Intermittent discharges atomize condensate to avoid messy accumulations produced by other devices. Highly effective, specially designed muffler eliminates noise and diffuses moisture so that discharge drain piping is usually unnecessary. Freeze proof when mounted in vertical position with outlet facing down and muffler removed.

DRAIN AIR

SPECIFICATION

The liquid drain trap shall be of thermodynamic design with screwed NPT connections. Internal mechanism shall be stainless steel with hardened working surfaces. A pneumatic muffler shall be employed to reduce exhaust sound pressure level.

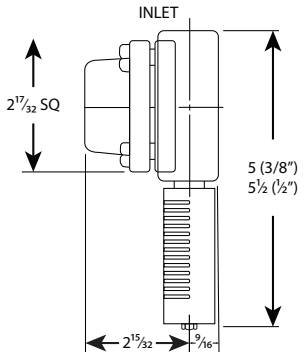
Maximum operating conditions

PMO: Max. Operating Pressure	600 psig	(41.4 barg)
TMO: Max. Operating Temperature	200°F	(104°C)
PMA: Max. Allowable Pressure	600 psig	(41.4 barg)
TMA: Max. Allowable Temperature	800°F	(426°C)

Materials of construction

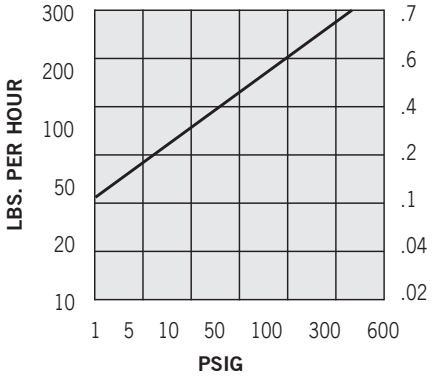
DRAIN-AIR

Body & Cover: ..... ASTM A105 Forged Steel
Celtron® Cartridge: ..... 416 Stainless Steel w/hardened disc & seat
Bolts: ..... High temperature alloy
Cover Gasket: ..... 347 Stainless Spiral-wound w/graphite filler
Integral Strainer: ..... 304 Stainless Steel
Muffler: ..... Nylon Housing, Aluminum
Screen Connections: ..... 3/8"-1/2" NPT

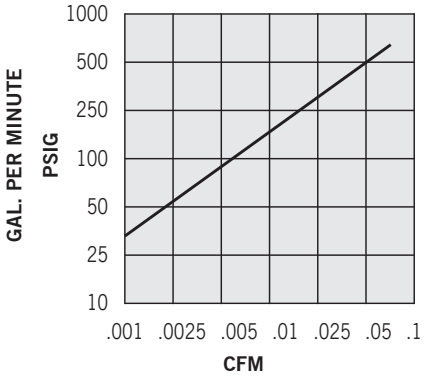


3/8" & 1/2" DRAIN-AIR
2.3 LBS.

DISCHARGE CAPACITY



AIR LOSS - NO LOAD CONDITION



TAV SERIES
THERMOSTATIC AIR VENT

Pressures To 650 PSIG (44.8 barg)
Temperatures to 750°F (400°C)

Sealed Stainless Steel Body - Lightweight, compact and corrosion resistant. No bolts or gaskets. Eliminates body leaks.

Self Centering Valve - Leak tight shutoff. Improved energy savings. Assembly of actuator and valve to impingement plate allows valve to self-align with center of valve seat orifice. Provides long lasting valve and seat.

Temperature Sensitive Actuators - One moving part. Stainless Steel, fail open, welded actuator for maximum corrosion, thermal and hydraulic shock resistance.

Thermal and Hydraulic Shock Resistant - Impingement plate plus welded construction prevent damage to actuator.

Hardened Stainless Steel Valve and Seat - Long life. Lapped as a matched set for steam tight seal.

Inexpensive - Low initial cost.

Maintenance Free - Sealed unit. Replacement traps cost less than repair of more expensive in-line repairable vents.

Directional Discharge - Pipe thread erosion prevented by directing discharge to center of pipe.

Applications

- Platen Presses
- Plating Tanks
- Sterilizers
- Tire Presses
- Cooking Equipment
- Laundry Equipment
- Other Process Equipment

Canadian Registration # OE0591.9C

MODELS

- **TAV**–High capacity w/welded SS actuator

Operation

Thermal actuator is filled at it's free length with a liquid having a lower boiling point than water. As assembled, valve is normally open. On startup, air passes through vent. As air is eliminated, hot steam reaches vent and the thermal actuator fill vaporizes to a pressure higher than line pressure. This forces valve into seat orifice to prevent any further flow. Should more air collect, it takes heat from the actuator, lowering internal pressure. Line pressure will then compress thermal actuator to open valve and discharge air. Valve lift automatically adjusts to variations.

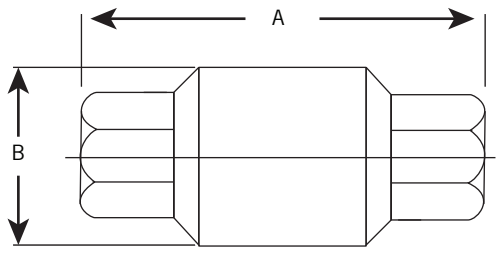
TAV SERIES
THERMOSTATIC AIR VENTER

SPECIFICATION

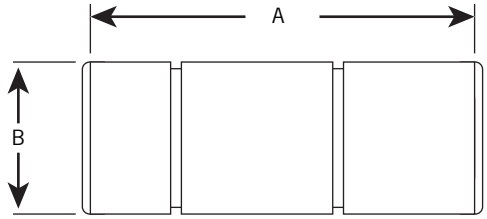
Air vent shall be of balanced pressure design stainless steel welded actuator capable of discharging air within 35°F of saturated temperature. Thermostatic actuator shall employ a conical valve lapped in matched sets with the seat ring assuring tight shut off. Vent shall be stainless steel bodied suitable for pressures to 650 psig and available in 3/8" through 1" NPT or socketweld.

Maximum operating conditions

PMO: Max. Operating Pressure	650 psig	(44.8 barg)
TMO: Max. Operating Temperature	650°F	(343°C)
PMA: Max. Allowable Pressure	650 psig	(44.8 barg)
TMA: Max. Allowable Temperature	750°F	(400°C)



3/8" - 3/4" BODY



1" BODY

Connections: 3/8" – 1" NPT or socketweld

Dimensions			
NPT or Socket weld	inches (mm)		Weight Lbs. (kg)
	A	B	
⅜", ½"	3¾ (95)	1¾ (44)	1.1 (0.5)
¾"	3 15/16 (100)	1¾ (44)	1.2 (0.54)
1"	4⅜ (111)	1¾ (44)	1.6 (0.73)

Materials of construction

Body & Cover: ..... ASTM A351 Grade CF3M (316L)
1" is 316SS, ASME SA479
Actuator: ..... Welded Stainless Steel
Valve & Seat: ..... Hardened 416 Stainless Steel

Air Capacity—SCFM for 14.7 PSIA @ 60°F (dm³/s)																
Vent	Orifice Inches (mm)	Inlet Pressure (barg)														
		10 (0.7)	50 (3.5)	100 (6.9)	125 (8.62)	150 (10.3)	200 (13.8)	250 (17.2)	300 (20.7)	350 (24.1)	400 (27.6)	450 (31.0)	500 (34.5)	550 (37.9)	600 (41.4)	650 (44.8)
TAV	5/16 (8)	33 (16)	34 (20)	156 (74)	192 (91)	230 (109)	300 (142)	370 (175)	440 (208)	510 (241)	580 (274)	650 (307)	720 (340)	790 (373)	860 (406)	930 (439)

DRAINER NLD SERIES

FREE-FLOATING LEVER DRAINER ALL STAINLESS STEEL

Pressures to 400 psig (28 barg)
Temperatures to 500°F (260°C)

Automatic and Positive Drain - Effectively removes liquids from compressed air systems with minimum air loss and rapid shutoff on load conditions

Inexpensive - Low maintenance and initial cost

Steel Body - Durable heavy wall construction provides years of reliable service and resists corrosion and freezing.

Maintenance Free - Sealed body design prevents tampering and no gaskets or adjustments are necessary

All Stainless Steel Construction - Long lasting, rugged, and corrosion resistant

Direct Lever Action - Ensures proper seating under all operating conditions

MODELS

- **NLD** - Free Float liquid Drainer

Applications

- Removes liquid from air or gas systems
- Removes liquid from air or gas storage

Operation

The all stainless steel drainer removes liquids from a pressurized air /gas system. The float and lever operated design provides instantaneous and automatic adjustment to variations In flow and pressure. As liquid enters the top of the drainer, It starts to lift the float up and open the valve. When the liquid is removed, it falls back down to close the valve. This cycle repeats as more liquid accummulates in the drainer.

DRAINER NLD SERIES

FREE-FLOATING LEVER DRAINER ALL STAINLESS STEEL

SPECIFICATION

The liquid drain trap shall be of a float type design with all stainless steel components Including, sealed body, seat and valve. It Is available in 3/4" x 1/2" NPT connections.

Material of construction

Body ..... AISI304 SS
Connectors ..... AISI 304 SS
Float ..... AISI 304 SS
Lever ..... AISI 304 SS
Bracket Clip ..... AISI 304 SS
Valve ..... Hardened Chrome Steel AISI 03
Valve Seat ..... Hardened Chrome Steel AISI 03

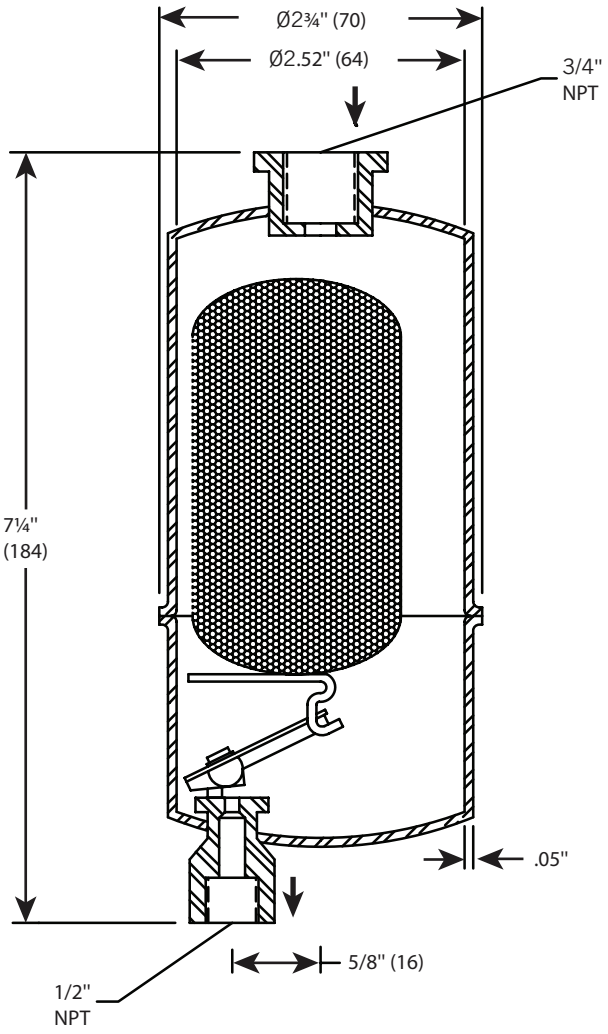
Maximum operating conditions

PMO: Max. Operating Pressure	See table below	
PMA: Max. Allowable Pressure	400 psig	(28 barg)
TMA: Max. Allowable Temperature	500°F	(260°C)

Orifice	Max. Operating Pressure PSI (bar)
1/8"	175 PSi (12)
3/32"	300 PSi (21)
5/64"	400 psi (28)

Critical Dimensions

Height ..... 7¼"
Diameter ..... 2¾"
Wall ..... 0.05"
Pipe Connections ..... NPT



VENTER NAV SERIES
FREE-FLOATING LEVER AIR VENTER

Pressures to 400 psig {28 barg)
Temperatures to 500"F (260°C)

Automatic and Positive Vent - Effectively provides automatic positive venting of Air/Gas under pressure

Inexpensive - Low maintenance and initial cost

Stainless Steel Body - Durable heavy wall construction provides years of reliable service and resists corrosion and freezing.

Maintenance Free - Sealed body design prevents tampering and no gaskets or adjustments are necessary

All Stainless Steel Construction - Long lasting, rugged, and corrosion resistant

Direct Lever Action - Ensures proper seating under all operating conditions

MODELS

- **NAV** - Free Float Air/Gas Vents

Applications

- For Hot or Cold Water and Non-VIscous Liquid Systems
- For the removal of air and other gases
  - From hydronlc heating
  - From cooling systems
  - Liquid chilling operations and other light liquid services.

ORDERING CODE

Model				Inlet Size	Outlet Size	Orifice
N	A	V	-	2	1	1
1	2	3	4	5	6	7

MODEL - Position 1 - 3 NAV - Venter Series	OUTLET SIZE - Position 6 1 = 1/2"
DASH - Position 5	ORIFICE - Position 7 1 = 1/8" 2 = 3/32" 3 - 5/64"
INLET SIZE - Position 5 1 = 1/2" 2 = 3/4"	

Operation

The all stainless steel air/gas vent allows for the removal of air/gas from a pressurized liquid system. The float and lever-operated design provides Instantaneous and automatic adjustment to variations in flow and pressure.

The valve Is closed In the presence of liquid. As air/qas enters the bottom of the venter, the float begins to drop and open the valve. When air is removed, it lifts back up to close off the valve. This cycle repeats as more air/gas builds up.

VENTER NAV SERIES
FREE-FLOATING LEVER AIR VENTER

SPECIFICATION

The air/gas vent shall be of a float-type design capable of discharging air or gas In a pressurized liquid system. All components Including sealed body, seat, and valve are made of stainless steel and are available with a 1/2" or 3/4" NPT inlet and 1/2" NPT outlet.

Material of construction

Body ..... AISI304 SS
Connectors ..... AISI 304 SS
Float ..... AISI 304 SS
Lever ..... AISI 304 SS
Bracket Clip ..... AISI 304 SS
Valve ..... Hardened Chrome Steel AISI 03
Valve Seat ..... Hardened Chrome Steel AISI 03

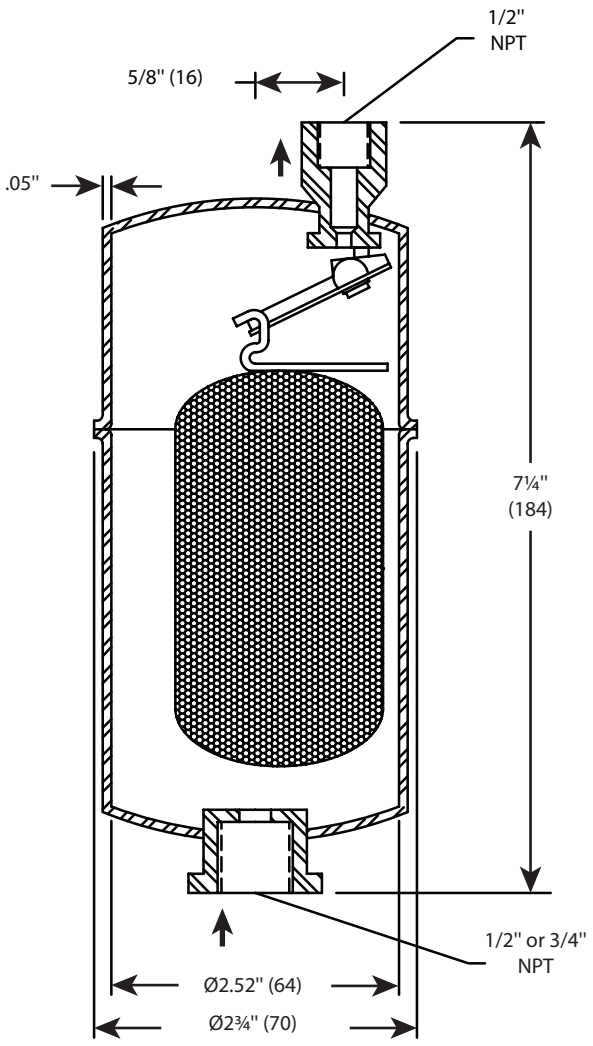
Maximum operating conditions

PMO: Max. Operating Pressure	See table below	
PMA: Max. Allowable Pressure	400 psig	(28 barg)
TMA: Max. Allowable Temperature	500°F	(260°C)

Orifice	Max. Operating Pressure PSI (bar)*
1/8"	175 PSi (12)
3/32"	300 PSi (21)
5/64"	400 PSi (28)

Critical Dimensions

Height ..... 7"¼
Diameter ..... 2¾"
Wall ..... 0.05"
Pipe Connections ..... NPT



PIPING SPECIALTIES

UNIFLEX
CARBON/STAINLESS STEEL PIPE COUPLINGS

Pressures To 3000 PSIG
Temperatures to 850°F

Applications

- Steam Systems (up to 1500 PSIG superheat)
- Dowtherm
- Manifolds on Steam Traps, Valves, Pumps & Compressors
- Process Fluids & gases to 3000 PSIG CWP (ie: Acids, Caustics Nitrogen, etc.)
- Nuclear Power Plants
- Hydraulic Fluids/Hot Oils

Reduced Energy Costs

Spiral wound gasket assures long life and leak tight seal.

Accepted where Standard Unions are Inadequate

Seal equivalent to flange connections meets fugitive emissions needs.

Suitable for Most Services

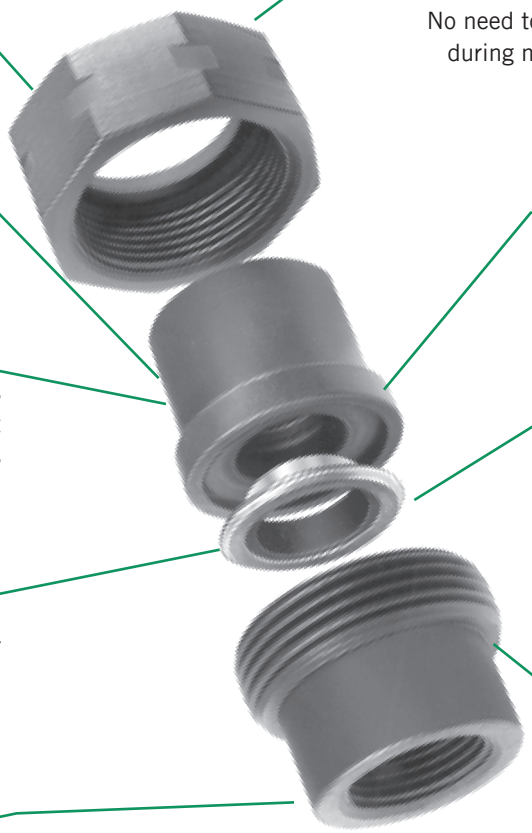
Carbon steel and 316L stainless steel housings and a variety of gasket materials available to meet demands of most applications.

No Welding Damage to Seal

Because seal is installed after welding, the danger of damaging seal is eliminated

Sizes to Meet Most Requirements

Available in 1/2" to 2", socketweld or threaded for a wide variety of piping needs.



Reduced Labor Costs

No need to replace union housing or spring pipe during make-up or disassembly which reduces time by more than 60%.

Reduced Cost of Materials

Only a change of gasket is required when disassembled

Reduced Dollars in Inventory

Only a few gasket kits required. Components may be stocked and replaced individually because mated parts are not needed.

Components Interchangeable

All components within each size class are fully interchangeable.

End connections can be socket weld, threaded or a combination of both.

Meets MSS-SP-83 for 3000 pound unions.

UNIFLEX
STEEL/STAINLESS PIPE COUPLINGS

Pressures To 3000 PSIG (207 barg)
Temperatures to 850°F (454°C)

No Energy Losses - from expensive steam and process fluid leaks. A spiral-wound gasket ensures a leak-tight seal.

Lower Maintenance/Labor Costs - Replacement of the union housing is eliminated. Only a change of gasket is required when the Uniflex Coupling is disassembled. No need to spring the pipe during make-up or disassembly. It is less costly to make and break than flanges.

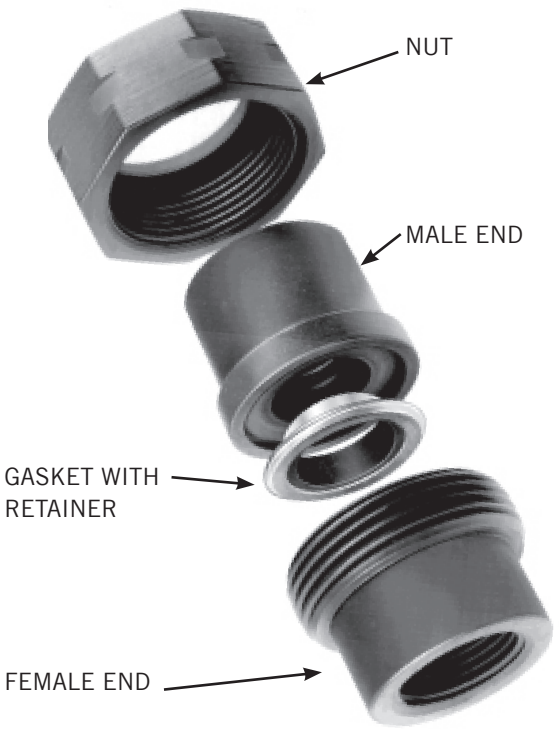
Lower Inventory Costs - Only a few Uniflex Pipe Couplings and gasket kits in each size are required to back up installations. One Uniflex satisfies all pressure series of flanges in pipe sizes 1/2" to 2".

Ease of Installation - The gasket is held firmly in place with a retainer. There is no danger of damaging the seal during installation as it is fully protected from overtorquing.

Welded Piping Systems - With the gasket removed while welding coupling into the piping, the danger of damaging the seal is eliminated. Costly removal of sections of pipe to replace leaky unions is eliminated.

Component Interchangeability - All components of the Uniflex Couplings, in each size class, are fully interchangeable. End connections can be socket weld, threaded, or a combination of both.

Installation Tip: Use UNIFLEX in all Regulator and Trap Stations through 2" to simplify future changeouts.



MODELS

- **SUA-T**–Threaded Carbon Steel
- **SUA-SW**–Socketweld Carbon Steel
- **SUASS-T**–Threaded Stainless Steel
- **SUASS-SW**–Socketweld Stainless Steel
- **SUG**–Gasket Kit includes 10 gaskets.
- **SUGR**–Gasket Kit includes 10 gaskets and 10 retaining rings

Canadian Registration # 0A0583.9C

Applications

- Steam Systems–up to 1500 PSIG Superheat
- Dowtherm
- Variety of process fluids and gases to 3000 PSIG CWP, i.e.: Acids, Caustics, Nitrogen, etc.
- Steam Trap, Valve, Pump & Compressor
- Manifolds
- Nuclear Power Plants
- Hydraulic Fluids/Hot Oils

Options

- Teflon Gasket Filler
- Type 347 SS, Type 316 SS (other materials available on request)

Operation

The Uniflex Pipe Coupling (SUA) has successfully solved frequent leakage, intensive maintenance and stocking difficulties associated with ground joint-pipe unions.
The SUA is a modified forged steel or stainless steel pipe union utilizing a Spiral-Wound Gasket to provide a leak-tight joint. This design, similar in principle to flange joints, has been proven in the field for many years. Because the joint seal is formed by the replaceable gasket (not a ground joint finish), failures caused by poor mating surfaces are eliminated. Components may be stocked and replaced individually because mated parts are not required for sealing.

UNIFLEX
STEEL/STAINLESS PIPE COUPLINGS

SPECIFICATION

Union shall be of the straight-through design with connections oppositely aligned, suitable for either horizontal or vertical piping installations. Union shall meet standards of MSS SP-83 for 3000 lb. unions. Connections shall be either screwed or socketweld and union shall have threaded nut. Gasket shall be of the spiral wound design and a retainer shall be utilized to locate and hold gasket during installation.

Union housing shall be forged steel ASTM A105 and have a pressure rating of 3000 PSIG at 100°F or type 316L stainless steel and have a pressure rating of 2430 PSIG at 100°F. Gasket winding shall be type 304 stainless steel with filler material of graphite. Gasket retainer shall be of type 316 stainless steel.

Maximum operating conditions

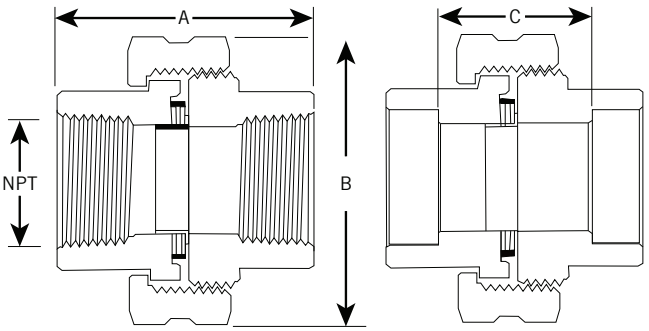
PMO: Max. Operating Pressure	see Chart
TMO: Max. Operating Temperature	see Chart

Materials of construction

Housing:	Forged Carbon Steel, ASTMA-105 or Type 316L SS
Gasket:	Spiral wound 304 Stainless w/graphite filler
Gasket Retainer:	Type 316 Stainless Steel

Temperature/Pressure Ratings†		
Temperature	**Pressure (PSIG) Carbon Steel**	**Pressure (PSIG) 316L SS**
100°F	3000 (-20°F*)	2430 (-325°F*)
200°F	2735	2050
300°F	2655	1835
400°F	2565	1670
500°F	2425	1545
600°F	2220	1460
700°F	2155	1390
800°F	—	1330
850°F	—	1300

*Minimum recommended temperature
†For 3000 lb. unions from MSS SP-83.



Uniflrx Model SUA-T Uniflrx Model SUA- SW

Connections: 1/2"-2" NPT or socketweld

Dimensions				
Size	**Inches (mm)**			**Weight lbs (kg)**
	A	**B**	**C**	
½"	2.0 (51)	1.8 (46)	.9 (24)	0.8 (.36)
¾"	2.2| (56)	2.2 (56)	1.1 (29)	1.2 (.55)
1"	2.4 (62)	2.6 (65)	1.1 (29)	1.6 (.73)
1¼"	2.8 (71)	3.0 (77)	1.4 (35)	2.5 (1.2)
1½"	3.0 (76)	3.4 (86)	1.5 (38)	3.3 (1.5)
2"	3.4 (86)	4.1 (103)	1.6 (41)	4.7 (2.2)

Average weights listed–actual weights may vary slightly

ORDERING NOTE: If ordering different connection types (SW and NPT) on each end, the female end should be specified first.

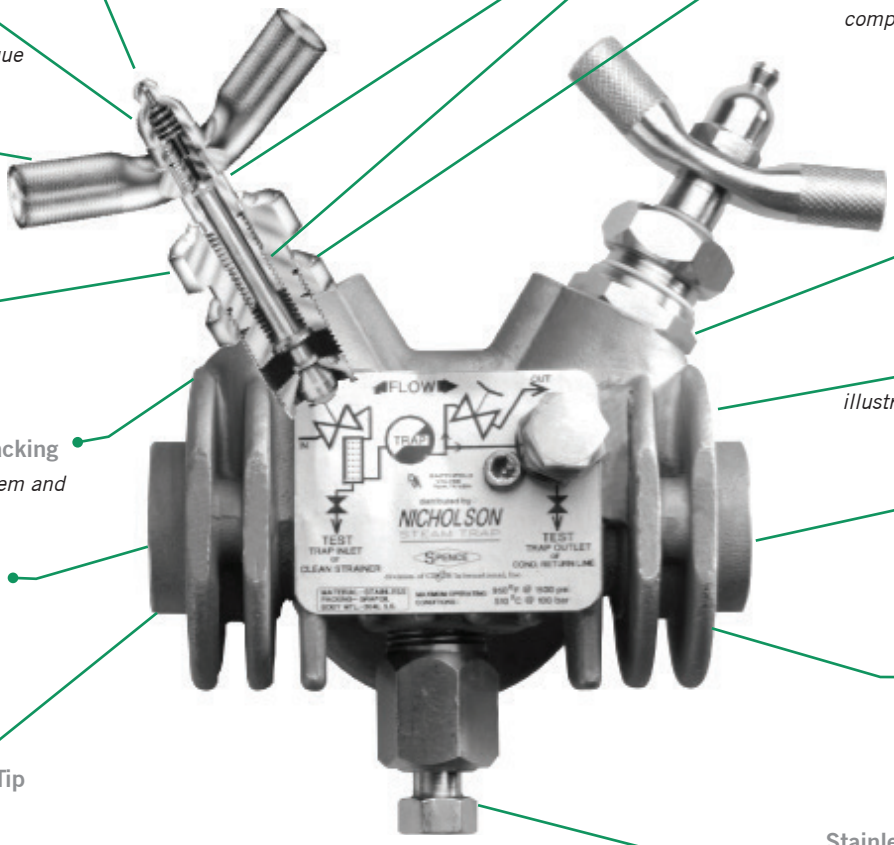
Ex.: SUA-T (SW / NPT) = SW female / NPT male.

BIG BLOCK UMT VALVE STATION

Pressures To 1440 PSIG
Temperatures to 750°F

Applications

- Unit Heaters
- Steam Tracing
- Drip Legs
- Heating
- Tire Presses
- Cooking Equipment
- Laundry Equipment
- Plating Tanks
- Platent Presses
- Refinery
- Process



Zerk Cap Nut
standard grease fitting for lubrication and flushing of contaminants through one-way external seals

Snap Ring
prevents accidental removal and/or overtorque in an open position

Slip Clutch
prevents overtorque in the closed position

Packing Nut
can be tightened to prevent leaks

Adjustable Grafoil Packing
simultaneously seals stem and valve body

Blowout Proof Lower Assembly
remains intact if upper assembly is damaged

Hardened 440 Stainless Steel Ball Tip
floats for tight seal and proper alignment

Inner and Outer Stems
isolate rotation from packing, reducing wear

One-Way Teflon® Seals
allow lubrication and cleaning of all components while protecting from contaminants

Test Port
provides visual indication of trap function and backflow

Faceplate
illustrates operation and flow direction

Connections
available in 1/2" and 3/4" NPT or Socketweld

Ventilation Fins
disperse heat and protect valve during welding

Stainless Steel Screen with Blowdown Valve
for easy cleaning

Minimum 1/4" Ports Throughout
assures high flow capacity

Compact Size
for easy installation

BIG BLOCK
UNIVERSAL MOUNT TRAP VALVE STATION

Pressures to 1440 PSIG (99 bar)
Temperatures to 750°F (399°C)

Compact Size - Isolation valves, test ports, strainer and blowdown valve combined in one "Big Block" for easy installation.

Universal Mount - Universal two bolt swivel trap mount installs permanently into system, simplifying installation and removal of trap.

Highest Pressure and Temperature Ratings - Suitable for virtually all applications.

All Stainless Steel - Body, internal wetted parts and polished inner stem are durable and corrosion resistant.

Blowout Proof Isolation Valves - Feature grease fittings to lubricate one way Teflon® seals and flush contaminants. Protected from overtorque.

Adjustable Grafoil Packing - Simultaneously seals stem and valve body.

Inner and Outer Valve Stems - Reduce wear.

Hardened 440 Stainless Steel Ball Tip - provides tight seal and proper alignment.

High Capacity - All internal ports at least 1/4".

MODELS

- **UMTVS-BB**

Applications

- Unit Heaters
- Steam Tracing
- Drip Legs
- Heating
- Tire Presses
- Cooking Equipment
- Laundry Equipment
- Plating Tanks
- Platent Presses
- Refinery
- Process

OPTIONS

- SW - Socketweld Connections

CODES

- Designed per ASME B16.5, Class 600

Operation

The UMTVS Big Block may be used in conjunction with any two-bolt universal mount steam trap. It combines a universal mount connector block with isolation valves, strainer, blowdown valves and test port to permit fast and easy testing, maintenance, and repair or replacement of a universal mount steam trap.

Integral Strainer and Blowdown Valve
The built-in strainer captures dirt and scale. The blowdown valve at the bottom of the connector block may be used periodically to clean out the strainer.

1st Inlet Isolation Valve (left)
Turning the first isolation valve to the off position (clockwise) stops the flow before it reaches the universal mount stream trap, strainer and blowdown valve. If the first isolation valve is opened (counter-clockwise) flow will be directed through the strainer and blowdown valve ports and to the universal mount steam trap.

Test port (on face)
Condensate exiting the universal mount steam trap is directed to the test port. Fully open the test port by loosening the larger test port valve located on the face of the block (counter-clockwise). This will provide a visual indication of the trap discharge pattern to determine the steam trap functionality.

2nd Outlet Isolation Valve (right)
Turning the second isolation valve to the off position (clockwise) stops the flow to the outlet connection. The flow still may be exhausted through any of the previously mentioned ports. When the second isolation valve is open (counterclockwise), flow to the outlet connection will continue. Downstream backflow discharge may be observed through the open test port by closing the first Inlet Isolation Valve and blowdown valve and opening the second Outlet Isolation Valve.

BIG BLOCK
UNIVERSAL MOUNT TRAP VALVE STATION

SPECIFICATION

Big Block Universal Mount Trap Valve Station shall be a universal mount connector block with integral strainer, blow-down valve, test ports, and dual isolation valves. Body shall be 304L stainless steel. It shall be suitable for pressures to 1440 PSIG. End connections shall be NPT or Socketweld and accommodate connection sizes of 1/2" and 3/4". It shall function in any orientation. It shall accept universal mount steam traps. The isolation valves shall be bonnetless and blowout proof with a relubrication system.

Maximum operating conditions

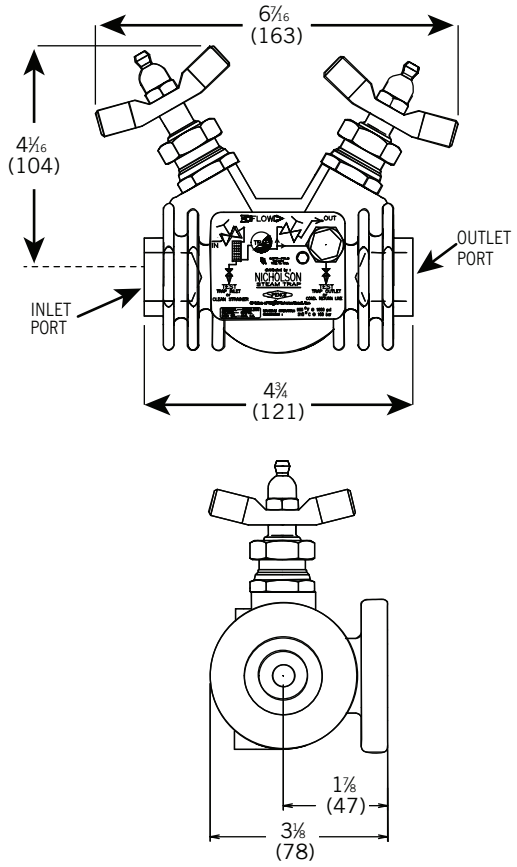
Class 600 -	855 psig	(59 barg)
	750°F	(399°C)
	1440 psig	(99 barg)
	100°F	(170°C)

Materials of construction

Body	Investment Cast 304L Stainless Steel**
Blowdown Valve	304 Stainless Steel
Strainer	304 Stainless Steel .033 Perf
Test Port & Lock Nut	303 Stainless Steel
Internal Components	Stainless Steel
External Seals	Teflon®
Packing	Grafoil

*Per ASME B16.5, Class 600

** Per ASTM A351-CF



DIMENSIONS - INCHES (MM)
WEIGHT: 6 LBS. (2.7 KG)

Connections: 1/2" & 3/4" NPT or Socketweld

PIPING SPECIALTIES

PNEUMATIC MUFFLERS

Pressures To 600 PSIG (41.4 barg)
Temperatures to 220°F (104°C)

Reduces Noise to Acceptable Levels - Specifically designed to reduce the noise of exhaust.

Compact and Lightweight - Adds minimal space and weight to installation.

Durable Construction - Will provide years of service.

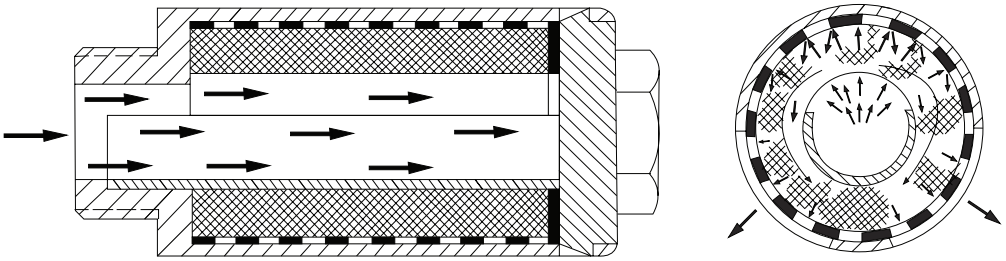
Corrosion Proof - Nylon and felt construction will not corrode in most services.

Applications

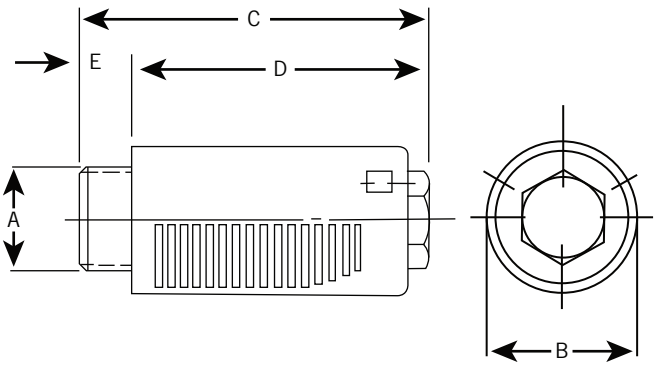
- 2, 3 and 4-way Valves
- Pneumatic Cylinders
- Air Motors
- Air Tools
- Instrumentation
- Bench Fixtures
- Test Panels
- Relief Valves

Operation

The muffler housing and plug are made of nylon. compressed exhaust air enters the muffler as shown by the flow arrows. It is then diverted by a plastic insert sleeve through a packing of sound deadening felt and out through exit slots. A fine mesh screen shields the felt packing and retains it in position.



PNEUMATIC MUFFLERS



Connections: 1/8" – 1/2" NPT

Maximum operating conditions

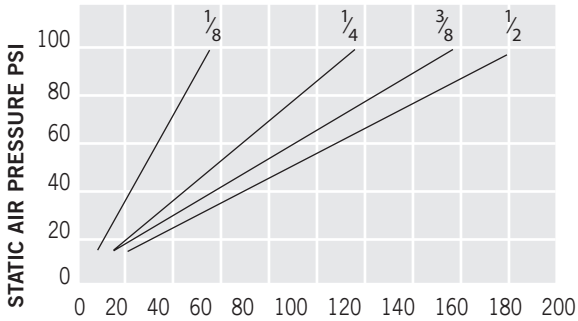
PMO: Max. Operating Pressure	600 psig	(41.3 barg)
TMO: Max. Operating Temperature	220°F	(104°C)
PMA: Max. Allowable Pressure	600 psig	(41.3 barg)
TMA: Max. Allowable Temperature	220°F	(104°C)

Dimensions				
A NPT Size	Inches (mm)			
	B	C	D	E
⅛"	.63	1.72	1.38	.34
¼"	.83	2.06	1.66	.40
⅜"	.99	2.43	2.03	.40
½"	1.18	2.90	2.37	.53

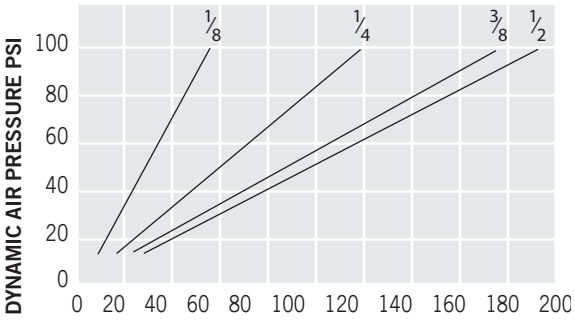
Materials of construction

Housing: .....Nylon
Screen .....Aluminum
Media: .....Felt

AIR FLOW AND SOUND MEASUREMENTS OF SPENCE PNEUMATIC MUFFLERS

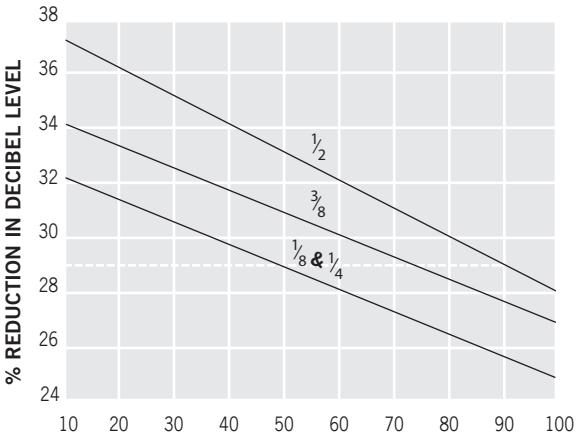


AIR FLOW CUBIC FEET/MINUTE
STATIC AIR FLOW = FLOW FROM CLOSED CHAMBER



AIR FLOW CUBIC FEET/MINUTE
DYNAMIC AIR FLOW = FLOW THRU WORKING LINE

SOUND LEVELS ON A WEIGHING SCALE



AIR PRESSURE PSI

USING GRAPH

Condition: Exhaust of air at 90 PSI produces a noise level of 100 dbA. Noise must be reduced to an acceptable level.

Solution: 1/2" Muffler will reduce level 29%. Muffled discharge will be at 71 dbA.

VACU-BREAK SERIES
VACUUM BREAKERS

Pressures to 125 psig (8.6 barg)
Temperatures to 350°F (177°C)

- Prevent potential equipment damage
- Improve system efficiency - Allows proper system operation
- Easy installation
- Maintenance free
- Unsealable on steam or liquid systems
- Cracking pressure of 0.36 psi

Applications

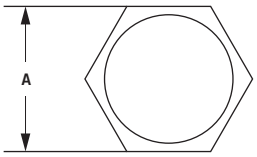
- Air Coils
- Heating Coils
- Heat Exchangers
- Condensate Lines
- Jacketed Kettles
- Steam Boilers
- Water Tanks
- Steam Mains

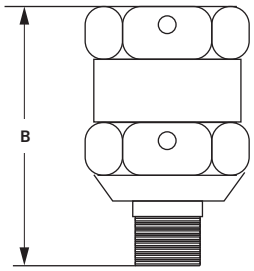
Materials of construction

Body ..... Brass
Disk ..... Brass
Spring ..... 304 SS
Seat ..... EPDM

Connections: 1/8, 1/2 and 3/4 in.

Dimensions		
NPT Size	**A, in. (mm)**	**B, in. (mm)**
1/8	13/16 (20.6)	1-7/16 (36.5)
1/2	13/16 (20.6)	2-1/16 (52.3)
3/4	1-1/16 (26.9)	2-3/16 (55.5)





Operation

A simple resilient disk with no linkage will lift off seat when vacuum begins to form and provide a quiet opening to prevent a build-up of vacuum through the addition of atmospheric pressure. Once the vacuum is relieved, the disk once again closes quietly to restore a tight shut-off. An integral spring prevents chatter during operation.

TECHNICAL REFERENCE

THERMOSTATIC STEAM TRAPS

Thermostatic steam traps, as their name implies, operate in direct response to the temperature within the trap. There are two primary types: *BELLOWS* and *BIMETALLIC*.

BELLOWS TRAPS

Of all actuating devices, the bellows trap most nearly approaches ideal operation and efficiency and is most economical. It is positive in both directions, is fast acting and does not require adjustment.

Bellows traps employ only one moving part - a liquid filled metal bellows - which responds quickly and precisely to the presence or absence of steam.

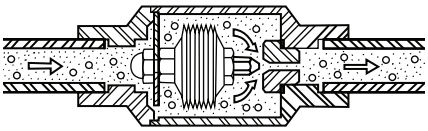
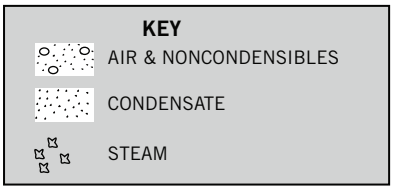


Figure 13

During startup and warmup, a vacuum in the bellows keeps it retracted, with the valve lifted well clear of the seat permitting air and non-condensibles to be freely discharged (Figure 13).



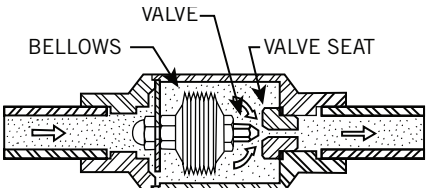


Figure 14

Next, condensate is discharged (Figure 14). Then heat from arriving steam will cause the liquid in the bellows to vaporize and close the valve (Figure 15).

At temperature, the valve will remain closed indefinitely opening only when condensate, air or other non-condensibles cause it to retract and open. When live steam re-enters the trap housing, the bellows extends immediately, trapping the steam (Figure 15).

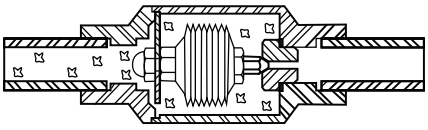


Figure 15

The bellows, unlike a disc trap, is a temperature sensitive rather than a time cycle device. There is no way that air can be mistaken for steam and cause binding, since bellows react to temperature only. And unlike bucket traps, bellows traps do not require a variety of sizes for valves and seats for various pressures.

BIMETALLIC TRAPS

Bimetallic traps work like the differential metal strip in a thermostat, using the unequal expansion of two different metals to produce movement which opens and closes a valve.

Figure 16: When the cooler condensate contacts the bimetallic discs, the discs relax. Inlet pressure forces the valve away from its seat and permits flow.

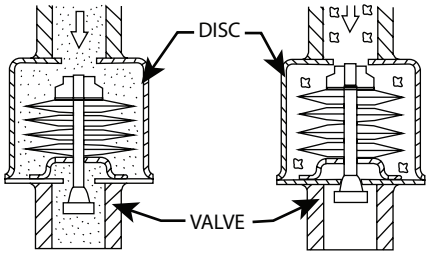


Figure 16 *Figure 17*

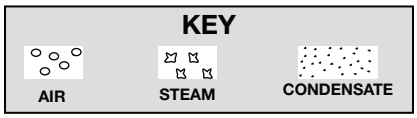
Figure 17: When steam enters the trap and heats the bimetallic discs, the discs expand forcing the valve against its seat preventing flow. Bimetallic traps are simple and positive in both directions. However, they have a built-in delay factor which makes them inherently sluggish. Moreover; they do not maintain their original settings because the elements tend to take a permanent set after use, which requires repeated adjustment to maintain efficiency.

MECHANICAL STEAM TRAPS

There are two basic types of mechanical steam traps:

1) FLOAT & THERMOSTATIC
2) INVERTED BUCKET

Inverted bucket traps, as their name suggests, operate like an upside down bucket in water.



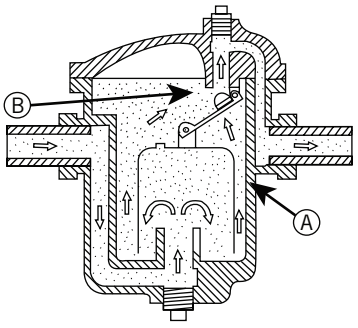


Figure 1

Figure 1: During startup, the trap is filled with water, with the bucket (A) at the bottom and the valve (B) fully open to allow condensate to flow out freely

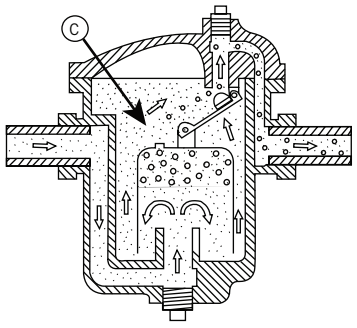


Figure 2

Figure 2: Air trapped in the bucket escapes through a vent hole (C).

MECHANICAL STEAM TRAPS
CONT'D.

In some buckets, additional vent holes are controlled by a bimetallic strip which is kept closed by the steam. Therefore, the vent only operates during startup. This limits bucket trap air handling capacity.

Figure 3: At temperature, steam enters under the bucket and causes it to float

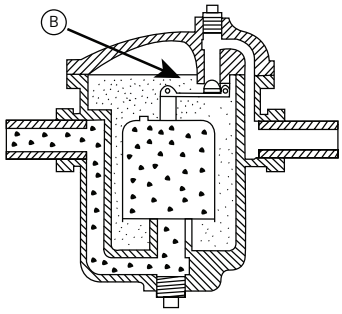


FIGURE 3

close the valve (B). During heat use, any condensate entering the line is forced

up into the bucket. The bucket looses buoyancy and drops down, reopening the valve and discharging the condensate. (see Figure 1)

Bucket traps are rugged and reliable, however, air building up in the bucket can bind them closed causing condensate to back up in the line. Also, they can waste steam if they lose their prime

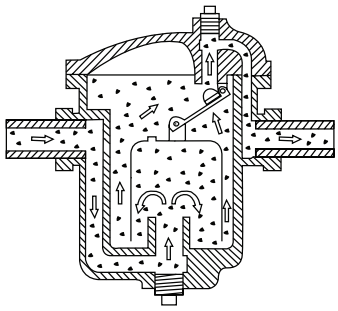


FIGURE 4

see Figure 4). Bucket traps require priming water in the trap which makes them vulnerable to freeze up unless expensive insulation is added.

Because bucket traps rely on a fixed force, the weight of the bucket, discharge orifices must be sized by pressure. For example, a trap sized to operate at 50

PSIG will not open at 150 PSIG. Float traps are manufactured in a variety of sizes, shapes and configurations. The most commonly used (for steam service) is the float and thermo- static, or F & T. F & T traps combine the excellent air venting capabilities of a thermostatic trap with the liquid level controlling capabilities of a float trap.

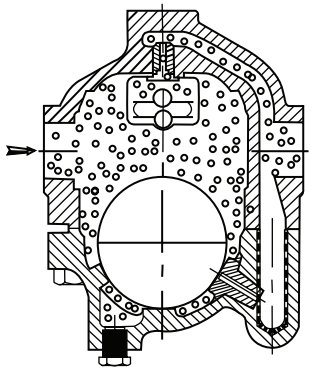


FIGURE 5

Figure 5: During startup, before condensate reaches the trap, the thermostatic element is fully open to discharge air. The float rests on the lower seat.

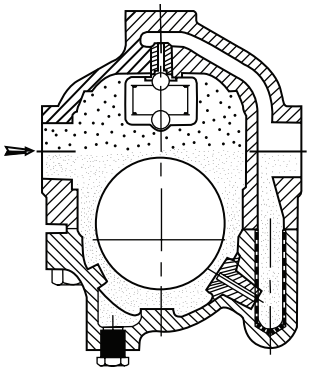


FIGURE 6

Figure 6: As hot condensate and steam reach the trap, the thermostatic element expands, closing the air vent. Condensate lifts the float, allowing condensate to flow out of the trap

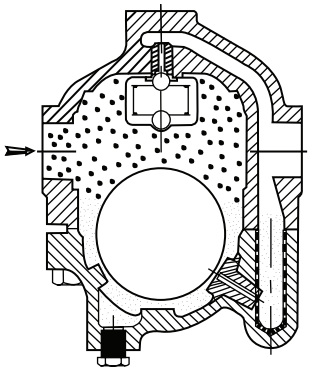


FIGURE 7*

Figure 7: As the condensing rate decreases, the float lowers, reducing flow through the trap. The buoyancy of the float will maintain a liquid level seal above the lower seat ring, preventing the escape of steam. As with inverted bucket traps, float and thermostatic traps rely on a fixed force (the buoyancy of the float).

Discharge orifices must be sized by differential pressure. Placing a low pressure float and thermostatic trap in high pressure service will result in the trap locking up. A contrasting characteristic of both the float and thermostatic and inverted bucket is the discharge cycle. A float & thermostatic trap tends to continuously discharge condensate while the inverted bucket trap discharges condensate in cycles.

*NFT Steam Trap shown

THERMODYNAMIC STEAM TRAPS

Essentially, a thermodynamic steam trap is a time cycle device which responds to imbalances of pressure applied to a valving device, usually a disc.

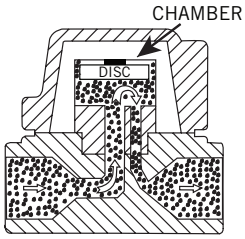


Figure 9

Figure 9: Pressure caused by air or condensate lifts the disc permitting flow through the trap.

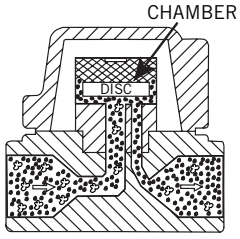


Figure 10

Figure 10: When steam arrives at the inlet port, blowby at a high velocity creates low pressure under the disc. Some of the flashing condensate is blown past the disc into the upper chamber, forcing the disc downward.

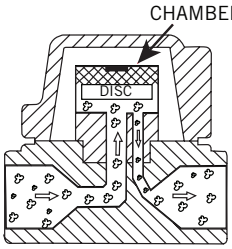


Figure 11

Figure 11: Further flow is stopped when sufficient pressure is trapped in the chamber above the disc. During operation, a decrease in chamber pressure permits inlet pressure to lift the disc and open the trap (Figure 9).

The decrease in the chamber pressure should only be caused by the presence of cooler condensate. Due to the design of most thermodynamic traps, especially in cold or wet conditions, the chamber may be prematurely cooled causing improper or frequent cycling as well as steam loss and increased wear. Advanced TD designs have a steam jacket which surrounds the chamber and prevents ambient conditions affecting the operation of the disc.

This type of trap is also subject to water binding. If water pressure is trapped above disc, trap will fail closed.

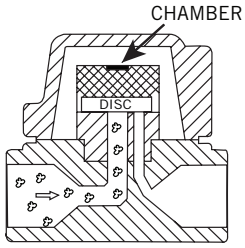
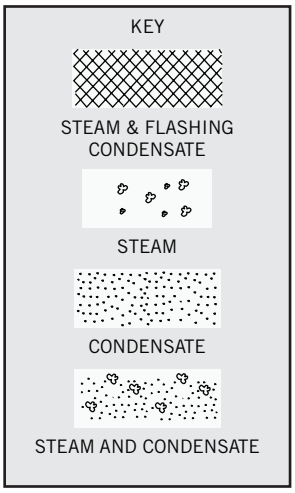


Figure 12

Figure 12: Trap is easily affected by dirt and/or other foreign matter which will cause trap to fail open.

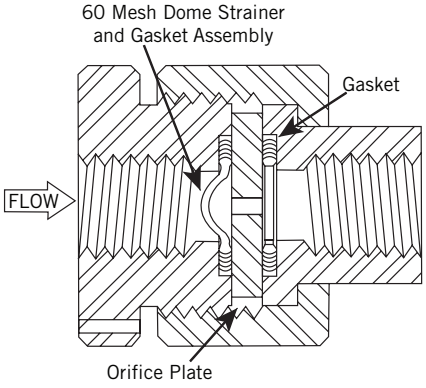


ORIFICE STEAM TRAPS

Orifice type traps are engineered continuous flow devices. Orifice traps discharge air, condensate and all other non-condensible gases with minimal live steam loss.

The fixed orifice size is calculated, for a given application, to discharge the condensate load at maximum thermal efficiency. Approximately 10 to 25 percent of discharging hot condensate flashes to steam at the downstream side of the orifice, at a constant pressure drop. This flashing effect further restricts the flow of saturated steam. In actual conditions, a minimum percentage of steam, by weight, is discharged with condensate, since the specific volume of steam is relatively large compared to that of the condensate. The velocity through the orifice is highly turbulent. The initial calculated steam loss can be expected to remain relatively constant over the expected trap life. The major factor for energy efficient performance is based on initial orifice sizing for the application. Properly sized, thermal efficiencies of 98 percent plus can be attained.

While Orifice Traps can be applied at all pressures, they are ideally suited for use on saturated or superheated steam 250 PSIG or greater.



1/2", 3/4" and 1" FNPT, or Socket Weld End Connections available

SIZING STEAM TRAPS

HOW TO DETERMINE THE PROPER SIZE TRAP

Capacity tables that follow show maximum discharge rates in pounds per hour. To select the correct size trap from these tables, the normal condensing rate should be converted to a "pounds per hour" basis and multiplied by a safety factor.

REASON FOR SAFETY FACTORS

For steam applications, the condensation rate varies with:

(1) The starting or warming-up condition.

(2) The normal operating condition.

(3) Any abnormal operating condition.

Of these, the condensing rate for the normal condition is occasionally known, or it can be estimated with sufficient accuracy for trap selection; the loads imposed by warm-up and abnormal conditions are seldom known and practically impossible to predict.

During warm-up the trap load is heavy, since air as well as large quantities of condensate must be discharged. Condensate forms at a rapid rate as the cold equipment and connecting piping are brought up to temperature. This usually results in pressure drop at the trap inlet, thereby reducing its capacity during the period when the load is maximum.

Safety factors are therefore necessary, to compensate for start- up conditions, variation of steam pressure and product initial temperature, the process cycle speed required, and discrepancies between assumed and actual conditions which determine the normal condensing rate.

The selection of a safety factor depends on the type of trap and the operating conditions. If the known or calculated normal condensing rate is multiplied by the recommended factor from the pages which follow, efficient trapping will be assured.

EFFECT OF BACK PRESSURE ON TRAP CAPACITY

Most trap installations include piping the outlet into a common return system or to an available disposal location. In either case a constant static back pressure may exist, against which the trap must discharge. This back pressure may be unintentional or deliberately produced.

Unintentional back pressure in condensate return piping is caused by lifting the condensate to a higher level, piping which is too small for the volume of liquid conveyed, piping with insufficient or no pitch in the direction of flow, pipe and fittings clogged with rust, pipe scale or other debris, leaking steam traps, etc. In steam service an intentional back pressure is instigated by means of a pressure regulating or spring-loaded valve in the discharge system, when a supply of flash steam at a pressure less than the trap pressure is needed.

If very hot condensate is discharged to a pressure less than that existing in the trap body, some of it will flash into steam, with a tremendous increase in volume and consequent choking and build-up of pressure in the trap's discharge orifice and the passages and piping adjacent thereto. For condensate at or close to steam temperature, this flash pressure is quite high, usually considerably higher than any static back pressure existing in the trap outlet piping.

For this reason, capacity tables for thermostatic and thermodynamic traps are based on gage pressure at the trap inlet, instead of on the difference between trap inlet and discharge pressures. Experiments have shown that, for the temperatures applying to these tables, unless the static back pressure in the return piping exceeds 25% of the trap inlet pressure, no reduction of the trap capacity results. For back pressures greater than 25% of the trap inlet pressure there is a progressive decrease of trap capacity.

Thus, if the return piping static pressure is less than 25% of the trap inlet pressure, the capacities shown in these tables should be utilized for trap selection. If the return piping pressure is greater than 25% of the trap inlet pressure, reduce the table capacities by the percentage indicated in second line of Table A on the following pages.

Above data does not apply to mechanical traps, capacities are based on differential pressure, obtained by subtracting any static back pressure from trap inlet pressure.

WHEN THE NORMAL CONDENSING RATE IS KNOWN

Normal condensing rate means the pounds of steam condensed per hour by the average conditions which prevail when the equipment drained

is at operating temperature.

If this amount is known, simply multiply by the safety factor recom- mended for the service and conditions, obtained from the pages which follow, and determine size directly from the capacity tables for the type of trap selected.

WHEN THE NORMAL CONDENSING RATE IS UNKNOWN

Determine by utilizing proper formula for the service and equipment to be trapped. Multiply the result by safety factor recommended for the operating conditions. See examples on the following pages.

SIZING STEAM TRAPS
CONT'D.

EXPLANATION OF SYMBOLS USED IN NORMAL CONDENSING RATE FORMULAS

A = Heating surface area, square feet (see Table B)

B = Heat output of coil or heater, BTU per hour

C = Condensate generated by submerged heating surfaces, lbs/hr/sq ft (Table F)

D = Weight of material processed per hour after drying, pounds

F = Steam flow, lbs/hr

G = Gallons of liquid heated per unit time

H = Heat loss from bare iron or steel heating surface, BTU/sq ft/°F/hr

L = Latent heat of steam at pressure utilized, BTU/lb (see Table C or obtain from Steam Table)

M = Metal weight of autoclave, retort or other pressure vessel, pounds

Qh = Condensate generated, lbs/hr

Qu = Condensate generated, lbs/unit time (Always convert to lbs/hr before applying safety factor. See Examples using formulas 7 and 10 on next page).

S = Specific heat of material processed, BTU/lb/°F

Ta = Ambient air temperature, °F

Tf = Final temperature of material processed, °F

Ti = Initial temperature of material processed, °F

Ts = Temperature of steam at pressure utilized, °F (see Table C or obtain from Steam Table)

U = Overall coefficient of heat transfer, BTU/sq ft/°F/hr (see Table E)

V = Volume of air heated, cubic feet/minute

Wg = Liquid weight, lbs/gallon

Wh = Weight of material processed per hour, lbs

Wu = Weight of material processed per unit time, lbs

X = Factor for $\frac{Tf-Ti}{L}$ (obtain from Table D)

Y = Factor for $\frac{H(Ts-Ta)}{L}$, lbs/hr/sq ft (obtain from Table C)

AIR HEATING

Steam Mains; Pipe Coil Radiation; Convectors; Radiators; etc. (Natural Air Circulation)

(1) Qh = A Y

Recommended Safety Factors

For Steam Mains
Ambient Air Above Freezing:

1st Trap After Boiler..... 3
At End of Main 3
Other Traps 2

Ambient Air Below Freezing:

At End of Main 4
Other Traps 3

Steam mains should be trapped at all points where condensate can collect, such as at loops, risers, separators, end of mains, ahead of valves, where mains reduce to smaller diameters, etc., regardless of the condensate load. Installation of traps at these locations usually provides ample capacity.

For Pipe Coil Radiation, Convectors and Radiators

Single Continuous Coil ... 2
Multiple Coil 4

Damp Space Pipe Coil Radiation; Dry Kilns; Greenhouses; Drying Rooms; etc. (Natural Air Circulation)

(2) Qh = 2.5 A Y

Recommended Safety Factors

Single Continuous Coil 2
Multiple Coil 4

Steam Line Separators; Line Purifiers

(3) Qh = .10 F

Recommended Safety Factors

Indoor Pipe Line 2
Outdoor Pipe Line 3
If Boiler Carry-Over Anticipated... 4 to 6
(Depending on probable severity of conditions)

Unit Heaters; Blast Coils (Forced Air Circulation)

(4) When BTU Output is Known:

$$Qh = \frac{B}{L}$$

(5) When BTU Output is Unknown, Heat Transfer Area is Known:
Qh = 5 A Y

(6) When Volume of Air Heated is Known: Qh = 1.09 V X

Recommended Safety Factors

Intake Air Above Freezing - Constant Steam Pressure 3
Intake Air Above Freezing - Variable Steam Pressure 4
Intake Air Below Freezing - Constant Steam Pressure 4
Intake Air Below Freezing - Variable Steam Pressure 5

Example: 11,500 cubic feet of air per minute heated by blast coil from 50°F to 170°F with 50 PSIG constant steam pressure.

Solution: By formula (6), Qh = 1.09 x

11,500 x .132 = 1655 lbs/hr. Recommended safety factor, 3 for intake air above freezing and constant steam pressure. 3 x 1655 = 4965 lbs/hr trap capacity required.

SIZING STEAM TRAPS
CONT'D.

LIQUID HEATING

Submerged Coils; Heat Exchangers; Evaporators; Stills; Vats; Tanks; Jacketed Kettles; Cooking Pans; etc.

(7) When Quantity of Liquid to be Heated in a Given Time is Known:

$$Qu = G\ Wg\ S\ X$$

(8) When Quantity of Liquid to be Heated is Unknown:

$$Qh = A\ U\ X$$

(9) When Heating Surface Area is Larger than Required to Heat Known Quantity of Liquid in a Given Time:

$$Qh = A\ C$$

When maximum heat transfer efficiency is desired, or when in doubt, use formula (9) in preference to formulas (7) and (8).

RECOMMENDED SAFETY FACTORS

For Submerged Coil Equipment; Heat Exchangers; Evaporators; etc.

Constant Steam Pressure:

Single Coil, Gravity Drainage 2
Single Coil, Siphon Drainage 3
Multiple Coil, Gravity Drainage 4

Variable Steam Pressure:

Single Coil, Gravity Drainage 3
Single Coil, Siphon Drainage 4
Multiple Coil, Gravity Drainage 5

For Siphon Drained Equipment, specify traps with "Steam Lock Release Valve".

For Jacketed Equipment; Cooling Kettles; Pans; etc.

Slow Cooking:

Gravity Drainage 3
Siphon Drainage 4

Moderately Fast Cooking:

Gravity Drainage 4
Siphon Drainage 5

Very Fast Cooking:

Gravity Drainage 5
Siphon Drainage 6

For Siphon Drained Equipment, specify traps with "Steam Lock Release Valve".

Example: Heat exchanger with single submerged coil, gravity drained, heating 1250 gallons of petroleum oil of 0.51 specific heat, weighing 7.3lbs/gal, from 50°F to 190°F in 15 minutes, using steam at 100 PSIG.

Solution: By formula (7), Qu = 1250 X 7.3 x .51 x .159 = 740 pounds of condensate in 15 minutes, or 4 x 740 = 2960 lbs/hr. Recommended safety factor is 2 for single coil, gravity drained. 2 x 2960 = 5920 lbs/hr trap capacity required.

DIRECT STEAM CONTACT HEATING

Autoclaves; Retorts; Sterilizers; Reaction Chambers; etc.

(10) Qu = Wu S X + .12 M X

Recommended Safety Factors

Slow Warm-up Permissible 3

Fast Warm-up Desired 5

Example: An autoclave which weighs

400 pounds before loading is charged with 270 pounds of material having a specific heat of .57 and an initial temperature of 70°F. Utilizing steam at 50 PSIG, it is desired to bring the temperature up 250°F in the shortest possible time.

Solution: By formula (10), Qu = (270 x .57 x .198) + .12(400 x .198) = 40 pounds of condensate. Using safety factor of 5 recommended for fast warm-up and assuming 5 minutes as the time required to complete the reaction, a trap capacity of 40 x 12 x 5 = 2400 lbs/hr is required.

INDIRECT STEAM CONTACT HEATING

Cylinder Dryers, Drum Dryers, Rotary Steam Tube Dryers, Calenders; etc.

(11) Qh = 970 (W- D) + Wh X L

Recommended Safety Factors

For Siphon or Bucket Drained Rotating Cylinder, Drum and Steam Tube Dryers; Cylinder Ironers; etc.

Small or medium Size,

Slow Rotation 4

Small or Medium Size,

Fast Rotation 6
Large Size, Slow Rotation 6
Large Size, Fast Rotation 8

For Siphon or Bucket Drained Equipment, specify traps with "Steam Lock Release Valve". Each cylinder should be individually trapped.

For Gravity Drained Chest Type Dryers and Ironers

Each Chest Individually Trapped 2
Entire Machine Drained By

Single Trap .....4 to 6
Depending on number of Chests

For Platen Presses

Each Platen Individually Trapped ... 2

*Entire Press Drained by Single Trap, Platens Piped in Series 3

*Entire Press Drained by Single Trap, Platens Piped in Parallel .....4 to 6

Depending on number of Platens

Example: A medium size rotary steam tube dryer with condensate lifted to a discharge passage in the trunion, dries 4000 lbs/hr of granular material to 3300 pounds, with 15 PSIG steam, initial temperature of material 70°F, final temperature 250°F.

Solution: By formula (11) $Qh = \frac{970\ (4000 - 3300)}{945} + (4000 \times .191)$ = 1483 lbs/hr. Using safety factor of

4 recommended for medium size, slow rotation: 4 x 1483 = 5932 lbs/hr trap capacity required.

**A separate trap for each heating surface (coil, chest, platen, etc.) is recommended for maximum heating efficiency. Sluggish removal of condensate and air is certain when more than one unit is drained by a single trap, resulting in reduced temperatures, slow heating and possible water-hammer damage.*

Table A — EFFECT OF BACK PRESSURE ON STEAM TRAP CAPACITY										
Back Pressure as Percent of Inlet Pressure	10	20	25	30	40	50	60	70	80	90
Percent Reduction of Trap Capacity	0	0	0	2	5	12	20	30	40	55

TABLE B – SQUARE FEET OF SURFACE PER LINEAL FOOT OF PIPE

Nominal Pipe Size (In.)	1/2	3/4	1	11/4	11/2	2	21/2	3	4	5	6	8	10	12	14	16	18	20	24
Area, Sq. Ft. per Lineal Ft.	.22	.28	.35	.44	.50	.63	.76	.92	1.18	1.46	1.74	2.26	2.81	3.34	3.67	4.19	4.71	5.24	6.28

TABLE C - FACTOR Y - H(Ts-Ta)/L - APPROXIMATE CONDENSING RATE FOR BARE IRON AND STEEL PIPE*

Steam Pressure - PSIG	1	2	5	10	15	20	25	50	75	100	150	200	250	300	350	400	450	500	600
Steam Temperature - °F	215	219	227	239	250	259	267	298	320	338	366	388	406	422	436	448	460	470	489
Latent Heat - BTU/lb	968	966	961	952	945	939	934	911	895	879	856	839	820	804	790	776	764	751	728
Factor Y Cond - lbs/hr/sq.ft	.0.45	0.46	0.49	0.53	0.56	0.59	0.71	0.84	1.02	1.10	1.34	1.47	1.58	1.80	1.91	2.00	2.35	2.46	2.65

*Based on still air at 60F, recommended safety factors compensate for air at other temperatures. Used for steam trap selection only.

TABLE D — FACTOR X = (Tf–Ti)/L

Tf-Ti °F	STEAM PRESSURE - PSIG																		
	°F	2	5	10	15	20	25	50	75	100	150	200	250	300	350	400	450	500	600
40	.041	.041	.042	.042	.042	.043	.043	.044	.045	.045	.047	.048	.049	.050	.051	.052	.052	.053	.055
60	.062	.062	.062	.063	.064	.064	.064	.066	.067	.068	.070	.072	.073	.075	.076	.077	.079	.080	.082
80	.083	.083	.083	.084	.085	.085	.086	.087	.089	.091	.093	.096	.098	.100	.101	.103	.105	.106	.110
100	.103	.103	.104	.105	.106	.106	.107	.110	.112	.114	.117	.120	.122	.124	.127	.129	.131	.133	.137
120	.124	.124	.125	.126	.127	.128	.129	.132	.134	.136	.140	.144	.146	.149	.152	.155	.157	.160	.165
140	.145	.145	.146	.147	.148	.149	.150	.154	.156	.159	.163	.167	.171	.174	.177	.180	.183	.186	.192
160	.165	.166	.167	.168	.169	.170	.172	.176	.179	.182	.187	.191	.195	.199	.203	.206	.210	.213	.220
180			.187	.189	.191	.192	.193	.198	.201	.204	.210	.215	.220	.224	.228	.232	.236	.240	.248
200				.211	.212	.213	.214	.219	.224	.227	.234	.239	.244	.249	.253	.258	.262	.266	.275
220						.235	.236	.242	.246	.250	.257	.262	.268	.274	.279	.283	.288	.293	.303
240								.263	.268	.273	.280	.286	.292	.299	.304	.309	.314	.319	.330
260									.290	.296	.304	.310	.317	.324	.329	.335	.340	.346	.357
280									.313	.319	.327	.334	.342	.349	.354	.361	.367	.373	.385
300											.350	.358	.366	.373	.380	.387	.393	.400	.412

TABLE E — FACTOR U, HEAT TRANSFER COEFFICIENTS BTU/HR/SQ FT/°F TEMP. DIFFERENTIAL

TYPE OF HEAT EXCHANGER	AVERAGE DESIGN VALUES	
	NATURAL CIRCULATION	FORCED CIRCULATION
STEAM TO WATER	125	300
STEAM TO OIL	20	45
STEAM TO MILK	125	300
STEAM TO PARAFFIN WAX	25	80
STEAM TO SUGAR & MOLASSES SOLUTIONS	75	150

Coefficients shown are suggested average design values. Higher or lower figures will be realized for many conditions. Use for steam trap selection only.

TABLE F — FACTOR C, APPROXIMATE CONDENSING RATE FOR SUBMERGED SURFACES, LBS/HR/SQ FT

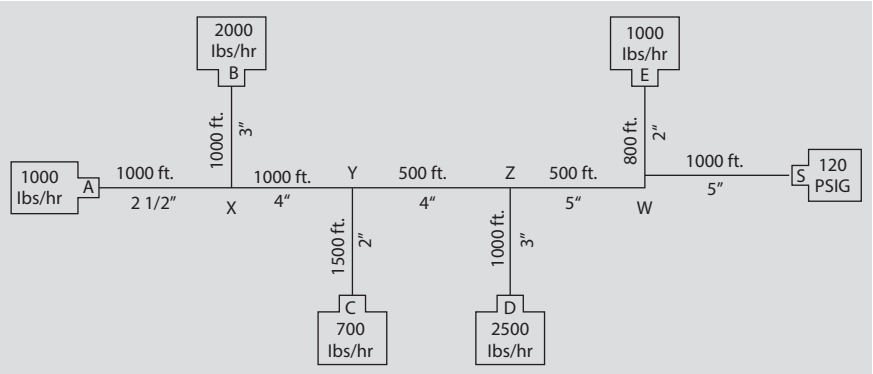
HEATING SURFACE	DIFFERENCE BETWEEN STEAM TEMPERATURE AND MEAN WATER TEMPERATURE*											
	25	50	75	100	125	150	175	200	225	250	275	300
IRON OR STEEL	1.6	5	10	17	25	34	45	57	70	84	99	114
BRASS	2.6	8	16	27	40	54	72	91	112	134	158	182
COPPER	3.2	10	20	34	50	68	90	114	140	168	198	228

* Mean water temperature is 1/2 the sum of inlet temperature plus outlet temperature. Table based on heating surfaces submerged in water with natural circulation. Safety factor of 50% has been included to allow for moderate scaling. If surface will remain bright, multiply above figures by 2. Use for steam trap selection only.

SIZING STEAM TRAPS

SIMPLE SIZING CRITERIA

Proper detailed design of a steam system should be done using detailed calculations for frictional losses in steam piping. The following examples and rules are meant to provide simple guidelines to see if steam pipe sizes are possibly undersized. They do not imply any design liability by Spence. Undersizing of steam lines can lead to reduced pressure to process equipment and impaired performance of valves, heat exchangers and steam traps. Steam line sizing along with condensate return line sizing should always be checked when a system is not performing up to expectations.



EXAMPLE: The system shown in Figure 3.1 will be used as our example. The Supply "S" at the right is 120 psig steam which is branching off to steam users A, B, C, D & E. The equipment usage is indicated in lbs/hr. The segments of piping will be addressed going backwards from the furthest end user A. The steam flow going through the pipe segment from the intersection X to equipment A is 1000 lb/hr (the usage of A). *A simple rule of thumb* for smaller steam piping (6" and below) is to keep steam velocities below 10,000 feet/minute (165 feet/second) for short *lengths of pipe only*.

The length of the steam line between X and A is 1000 feet, so the simple rule of thumb can not be applied here because the pressure drop will be too high. The pressure drop should be kept to a minimum, or supply pressure to the equipment will droop.

SOLUTION BY CHART: The chart is a graphic solution to help select pipe sizes. The pressure values used for this chart are in psia (absolute). For values given in gage pressure (psig), you must add 15 psi (14.7 psi actual). The example we will use is for saturated steam flow, but this chart does have corrections for superheat. There will be an overall system pressure drop, so that the pressure is assumed to be 5 to 10 psig below the supply pressure of 120 psig (135 psia). Enter the chart at the top at a point representing 130 psia and proceed vertically downward. Enter the chart at the right at the value of the steam flow in Lb/minute (1000 lb/hr = 16.7 lb/min) and move horizontally across until the horizontal line intersects the vertical line. You will proceed along the diagonal, downward and to the right, parallel with the other diagonal lines.

This chart can be used two ways: either to determine the pressure drop of an existing pipe or to determine the correct pipe size for a specific pressure drop.

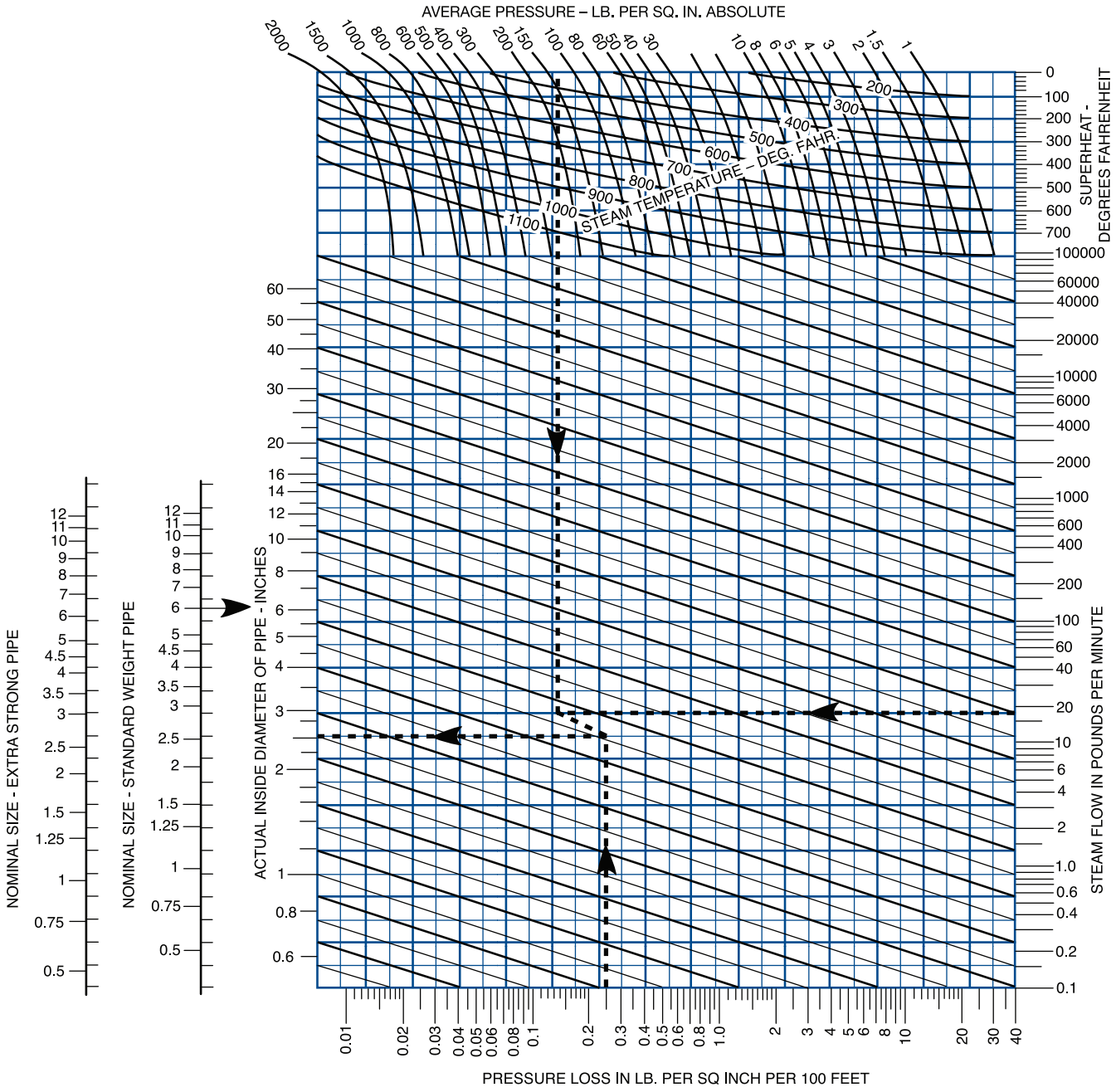
TO SIZE LINES: On the bottom of the chart is a pressure drop per 100 feet of pipe, select a value of 0.25 psi per 100 feet. This indicates 2.5 psi as the total loss for 1000 feet. Enter the chart at the bottom at .25 and move upward until you intersect the diagonal line. Proceed from the intersection horizontally left until you reach the actual pipe inside diameter to determine the pipe size. In this example, the pipe size for section X to A should be 2 1/2" pipe.

TO FIGURE PRESSURE DROP: Enter the chart on the left side at your pipe size and proceed horizontally until you intersect with the diagonal line. Proceed vertically downward to determine the pressure drop per 100 feet of pipe. The next section of pipe to determine would be X to B. This would have the same pressure, but the intersection of the vertical line would be at the horizontal steam flow of 33 lb/min (2000 lb/hr) for user B. The choice of pipe sizes can be argued, a 4" will yield 0.1 psi/100 feet pressure drop (1.0 psi per 1000 feet), but the more economical solution of a 3" pipe yields a 0.4psi/100 feet pressure drop. *Note*: when selecting the smaller more economical pipe size, there is less room for expansion and pressure drops will increase should additional process capacity arise.

For common sections of header such as Y to X, the steam flow for both steam users A and B must be combined. The vertical line will now intersect with the horizontal steam flow line coming across at 50 lb/min (3000 lb/hr). Using a 4" line will bring the pressure drop to a value of 0.22 psi/100 feet, or 2.2 psi for the 1000 foot section.

Remember that pressure drop figures from the bottom of the chart are per 100 feet, so segments such as Y to C have a larger total pressure drop because the distance is longer. Similarly, the total pressure drop from Z to Y is less because the distance is only 500 feet. The values for steam flow continue to be additive for each steam user; Z to Y is 3700 lb/hr (61.7 lb/min), W to Z is 6200 lb/hr (103.3 lb/min) and S to W is 7200 lb/hr (120 lb/min). Pipe sizes in Figure 3.1 are given for your reference and provide the user with reasonable pressure drops in the steam lines.

SIZING STEAM LINES
CONT'D.



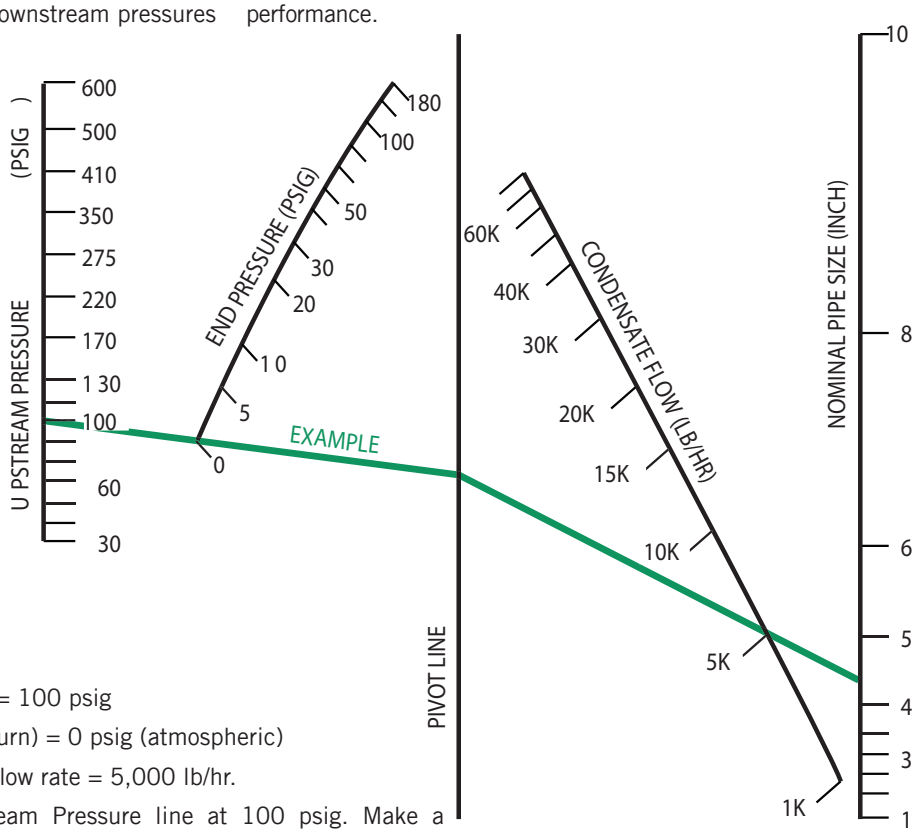
SIZING CONDENSATE RETURN LINES

SIZING CONDENSATE RETURN LINES

When condensate passes through a steam trap orifice, it drops from the upstream pressure in the heat exchanger to the downstream pressure in the condensate return line. The energy in the upstream condensate is greater than the energy in the downstream condensate. As the condensate passes through the steam trap, the additional energy from the upstream condensate forms a percentage of flash steam that changes based upon the upstream and downstream pressures (this percentage can be seen in Table 5 in the Condensate Commander section).

When sizing condensate return lines after the steam trap, it is important to take into account the amount of flash steam created when hot, saturated condensate undergoes a pressure drop. The flash steam has very large volume and can cause very high velocities if the return line is not sized properly. These high velocities can create high backpressure in the return line that often leads to poor steam trap performance.

We will size the condensate return line based upon flash steam velocities, The percentage of flash steam versus condensate (water) is usually on the order of 20 to 1, so the effect of the water in the system sizing is usually small. Choosing a velocity of flash steam is often subjective and different manufacturers will suggest different values. The nomograph below sizes return lines based upon 50 feet/second.



EXAMPLE:

Inlet Trap Pressure = 100 psig

Outlet Pressure (return) = 0 psig (atmospheric)

Actual condensate flow rate = 5,000 lb/hr.

Start at the Upstream Pressure line at 100 psig. Make a straight line through the End (Downstream) Pressure of 0 psig and stop at the pivot line. From that point, make a straight line through the Condensate Flow Rate of 5,000 and stop at the Nominal Pipe size line. It intersects slightly higher than 4". You may select the 4" line size without concern for undersizing the line because a low velocity of 50 ft/sec was used.

Note: If design requirements dictate using a velocity other than the 50 ft/sec value in the Nomograph, a ratio can be made of the pipe size because the velocity is proportional to the Pipe Diameter squared. For example, if you require a Pipe Diameter for 80 ft/sec, use the following equation:

$$\text{Nomograph Diameter} \times \sqrt{\frac{50\ \text{FT/SEC}}{\text{New Velocity (FT/SEC)}}}$$

Example: The Nomograph Diameter determined in the previous example is 4.2". Using the above formula, the Pipe Diameter for 80 ft/sec is 3.3".

STEAM TRACING DESIGN GUIDELINES

V.1.1 INTRODUCTION

Steam tracing is one of many ways to preheat, add heat and prevent heat loss from piping systems and their components. Some other ways are:

- Jacketed piping
- Hot water and oil tracing
- Dowtherm tracing

Jacketed piping systems are used pri marily to maintain a constant high temperature. Due to its high cost of construction, jacketed systems are seldom used except where temperature control is critical. Hot water and oil must be pumped at a high velocity to maintain

a desired temperature, and must have

a separate return header as does Dow-therm. Hot water, oil or dowtherm are also an additional system which add to the cost of a plant.

Steam tracing is most often selected because:

- There is generally available a surplus of low and/or medium pressure steam.
- Steam has a high latent heat and heat-transfer-coefficient.
- Steam condenses at a constant temperature.
- Steam flows to end-point without the aid of pumps (when designed correctly).
- A small amount of return piping is needed due to existing condensate headers.

V.1.2 USES

Freeze Protection (winterizing)

- Adding sufficient heat to above- grade piping systems and equip- ment which are exposed to ambient temperatures below the freezing point of their media prevents freezing

Maintaining A Desired Temperature

- The viscosity of some liquids becomes higher as their tempera- tures become lower causing more difficult and costly pumping and leading to down-time for cleaning.
- Condensation may occur in some gases if the ambient temperature falls below the dewpoint which is harmful and expensive in such systems as:

-Natural Gas where control valves freeze up and burners malfunction.

-Compressor Suction Lines where compressors can be damaged.

V.1.3 MATERIAL

Steam tracing material is normally as follows:

-Use the material specified for steam piping from the steam header (through the distribution manifold, if applicable) to and including the tracer block valve.

-Use 1/4" through 7/8" O.D. copper or stainless steel tubing (depending on the design conditions) from the block valve to the steam trap. Though sizes may vary with different applications, 3/8" and 1/2" O.D. are the most often used. Tube fittings and adapters are normally flareless compression type or 37 degree flared type.

-Use the material specified for condensate piping from the steam trap (through the collection manifold, if applicable) to the condensate header or end-point (drain or grade).

V.1.4 DESIGN GUIDELINES

1. Steam piping should be run within 12" of the line or equipment being traced to minimize exposed tubing.
2. Spiral tracing should be limited to vertical piping using multiple tracers on horizontal lines which require more heat.
3. Tracers should be designed so that the flow is always down. Avoid pockets! Where vertical flow is unavoidable, steam pressure should be a minimum of 25 PSIG for every 10' of rise.
4. Tracers should be a maximum of 100' long and continuous from the supply to the collection manifold or endpoint. For lines over 100' long, provide another tracer and overlap the two 3 inches to avoid cold spots.
5. Tracers should have no branch tees except as indicated in Section V.3.
6. Provide each tracer with a separate strainer and steam trap.
7. Manifolds can be horizontal or vertical depending upon the design conditions.
8. Tracers should be attached to the pipe at 8" to 10" maximum intervals with stainless steel wire. Wire tension should be sufficient to hold the tracer secure and flush against the pipe.
9. Some piping materials, such as lined pipe, might require spacer blocks to avoid "hot spots".
10. Tracer loops with unions are necessary:
    - when joining tubing lengths.
    - at all break flanges and unions.
    - at all flanged valves.
11. Tracer discharge lines should be as short as possible since long discharge lines can freeze even with a fully functioning steam trap

CLEAN STEAM DESIGN GUIDELINES

Clean Steam is a general term used to describe a range of steam pureness. It may be generated by such methods as:

- Filtration of plant steam typically requiring the removal of particles larger than 5 microns
- An independent steam generator. E.g. Stainless steel reboiler fed with distilled water.
- One stage of a multi-effect still within the overall water purification system.
- Uses for Clean Steam vary by industry, however typical appli- cations include:
- In-line sterilization of storage tanks and equipment
- Powering sterilizers and autoclaves
- Cleaning and sterilizing process piping systems without disassembling the piping system - commonly known as CIP (Clean in Place)
- Pasteurization utilizing Ultra High Temperature Processing (UHT)

The highest quality clean steam however, is typically used by the Pharmaceutical and Biotechnical industries. This steam, occasionally referred to as "Pure Steam", is most often supplied by an independent steam generator utilizing Water for Injection (WFI) as feed water. WFI is typically produced by a Reverse Osmosis (RO) generator and then distilled thus removing any traces of organics, bacteria, and pyrogens. Pure steam is required for the sterilization of cell culture processing equipment such as incubators where contaminants could adversely affect cell growth. Other uses include pharmaceutical manufacture and direct steam injection pasteurization where contaminants could collect in products intended for human consumption.

Clean steam produced from high purity make up water is highly corrosive due to the minimal ion content. High purity water, pure steam and the resultant condensate will aggressively attempt to absorb or leach ions from their environment to achieve a more natural balance. Additionally, chemicals used to passivate steam and condensate in conventional systems are generally prohibited from clean steam system as such chemicals could contaminate or alter sensitive end products. Should corrosion begin, the oxidation byproducts may travel through the steam system catalyzing corrosion throughout in a process known as 'rouging'.

To combat the corrosive nature of clean steam, design practices require piping, fittings and valving to be comprised of corrosion resistant materials. Current industry accepted materials include 304L, 316 and 316L stainless steel and higher alloys such as Inconel. While these materials have proven themselves in practice, it should be noted that there are currently no U.S. governmental standards specifying materials for clean steam service. Regulatory agencies concern them- selves with the purity and quality of the product, leaving the design standards entirely up to the manufacturer.

In addition to the use of corrosion resistant materials in sanitary systems, features designed to inhibit bacterial growth are often required. Piping, valves and fittings should be free draining and maintain industry standard surface finishes. Free draining valves and fittings are designed not to retain or 'Puddle' condensate when installed correctly. After shut down of the steam system, any puddled condensate could potentially promote bacterial growth. Inadequate surface finishes reduce the effectiveness of system sterilization techniques, increasing the possibility of bacterial contamination. Industry standard surface finishes are measured in micro inches, the lower the number the smoother, and are expressed as an arithmetic average (Ra). Typical industry specified surface finishes range from 32 to 10 µ in. Ra.

STEAM TABLE

h = Total heat of steam, Btu per pound
v = Specific volume, cubic feet per pound

Pressure psi (gage)	Temperature F° (sat.)		Saturated Liquid	Saturated Vapor	TOTAL TEMPERATURE, °F												
					220	240	260	280	300	320	340	360	380	400	420	440	460
0	212	h v	180.1 0.0167	1150.4 26.80	1154.4 27.15	1164.2 28.00	1173.8 28.85	1183.3 29.70	1192.8 30.53	1202.3 31.37	1211.7 32.20	1221.1 33.03	1230.5 33.85	1239.9 34.68	1249.3 35.50	1258.8 36.32	1268.2 37.14
5	228	h v	196.2 0.0168	1156.3 20.089		1162.3 20.48	1172.2 21.11	1182.0 21.74	1191.6 22.36	1201.2 22.98	1210.8 23.60	1220.3 24.21	1229.7 24.82	1239.2 25.43	1248.7 26.04	1258.2 26.65	1267.6 27.25
10	240	h v	208.4 0.0169	1160.6 16.303			1170.7 16.819	1180.6 17.330	1190.5 17.836	1200.2 18.337	1209.8 18.834	1219.4 19.329	1229.0 19.821	1238.5 20.31	1248.1 20.80	1257.6 21.29	1267.1 21.77
15	250	h v	218.8 0.0170	1164.1 13.746			1169.1 13.957	1179.3 14.390	1189.3 14.816	1199.1 15.238	1208.9 15.657	1218.6 16.072	1228.3 16.485	1237.9 16.897	1247.5 17.306	1257.0 17.714	1266.6 18.121
20	259	h v	227.9 0.0171	1167.1 11.898			1167.5 11.911	1177.9 12.288	1188.1 12.659	1198.1 13.025	1208.0 13.387	1217.8 13.746	1227.5 14.103	1237.2 14.457	1246.8 14.810	1256A 15.162	1266.1 15.512
25	267	h v	236.0 0.0171	1169.7 10.498				1176.5 10.711	1186.8 11.040	1197.0 11.364	1207.0 11.684	1216.9 12.001	1226.7 12.315	1236.5 12.628	12462 12.938	1255.9 13.247	1265.5 13.555
30	274	h v	243.4 0.0172	1172.0 9.401				1175.0 9.484	1185.6 9.781	1195.9 10.072	1206.0 10.359	1216.0 10.643	1225.9 10.925	1235.8 11.204	1245.6 11.482	1255.3 11.758	1265.0 120033
40	287	h v	256.3 0.0173	1175.9 7.787					1183.0 7.947	1193.6 8.192	1204.0 8.432	1214.3 8.668	1224.4 8.902	1234.3 9.134	1244.3 9.364	1254.1 9.592	1263.9 9.819
50	298	h v	267.5 0.0174	1179.1 6.655					1180.3 6.676	1191.3 6.889	1202.0 7.096	1212.5 7.300	1222.7 7.501	1232.9 7.700	1242.9 7.896	1252.9 8.091	1262.8 8.285
60	308	h v	277.4 0.0175	1181.9 5.816						1188.9 5.9321	1199.9 6.116	1210.6 6.296	1221.1 6.473	1231.4 6.648	1241.6 6.820	1251.7 6.991	1261.7 7.161
70	316	h v	286.4 0.0176	1184.2 5.168						1186.4 5.200	1197.7 5.366	1208.7 5.528	1219.4 5.687	1229.9 5.843	1240.2 5.997	1250.4 6.150	1260.6 6.301
80	324	h v	294.6 0.0177	1186.2 4.652							1195.5 4.773	1206.7 4.921	1217.7 5.065	1228.3 5.207	1238.8 5.347	1249.2 5.485	1259.4 5.621
90	331	h v	302.1 0.0178	1188.1 4.232							1193.2 4.292	1204.7 4.429	1215.9 4.562	1226.7 4.693	1237.4 4.821	1247.9 4.947	1258.2 5.071
100	338	h v	309.1 0.0178	1189.7 3.882							1190.8 3.895	1202.7 4.022	1214.1 4.146	1225.2 4.267	1236.0 4.385	1246.6 4.502	1257.1 4.617
125	353	h v	324.8 0.0180	1193.0 3.220								1197.3 3.258	1209.4 3.365	1211.1 3.468	1232.3 3.569	1243.3 3.667	1254.1 3.764
150	366	h v	338.5 0.0182	1195.6 2.752									1204.5 2.818	1216.7 2.910	1228.4 2.998	1239.8 3.085	1251.0 3.169
175	378	h v	350.8 0.0183	1197.6 2.404									1199.3 2.414	1212.2 2.498	1224.5 2.577	1236.3 2.655	1247.8 2.730
200	388	h v	361.9 0.0185	1199.3 2.134										1207.4 2.180	1220.3 2.253	1232.6 2.324	1244.5 2.393
225	397	h v	372.1 0.0186	1200.6 1.9183										1202.5 1.9276	1216.0 1.9964	1228.8 2.062	1241.1 2.126
250	406	h v	381.6 0.0187	1201.7 1.7422											1211.5 1.7870	1224.9 1.8488	1237.6 1.9081
275	414	h v	390.5 0.0188	1202.6 1.5954											1206.8 1.6130	1220.8 1.6717	1234.0 1.7277
300	422	h v	398.8 0.0190	1203.2 1.4711												1216.5 1.5222	1230.3 1.5755
350	436	h v	414.1 0.0192	1204.1 1.2720												1207.5 1.2831	1222.4 1.3326
400	448	h v	428.1 0.0194	1204.6 1.1194													1214.0 1.1468
450	460	h v	440.9 0.0196	1204.6 0.9985													
500	470	h v	452.9 0.0198	1204.2 0.9004													
550	480	h v	464.1 0.0200	1203.7 0.8191													
600	489	h v	474.7 0.0202	1203.0 0.7503													

STEAM TABLE

h = Total heat of steam, Btu per pound
v = Specific volume, cubic feet per pound

TOTAL TEMPERATURE, °F																	Temperature °F (sat.)	Pressure psi (gage)
480	500	520	540	560	580	600	620	640	660	680	700	720	740	750				
1277.6	1287.1	1296.6	1306.2	1315.7	1325.3	1334.8	1344.5	1354.2	1363.8	1373.5	1383.2	1393.0	1402.8	1407.7	h	212	0
37.96	38.78	39.60	40.41	41.23	42.04	42.86	43.68	44.49	45.31	46.12	46.94	47.75	48.56	48.97	v		
1277.1	1286.6	1296.2	1305.7	1315.3	1324.8	1334.4	1344.1	1353.8	1363.5	1373.2	1382.9	1392.7	1402.6	1407.5	h	228	5
27.86	28.46	29.06	29.67	30.27	30.87	31.47	32.07	32.67	33.27	33.87	34.47	35.07	35.67	35.96	v		
1276.6	1286.2	1295.8	1305.3	1314.9	1324.5	1334.1	1343.8	1353.5	1363.2	1372.9	1382.6	1392.5	1402.3	1407.2	h	240	10
22.26	22.74	23.22	23.71	24.19	24.68	25.16	25.64	26.12	26.60	27.08	27.56	28.04	28.52	28.76	v		
1276.2	1285.7	1295.3	1304.9	1314.5	1324.2	1333.8	1343.5	1353.2	1362.9	1372.6	1382.4	1392.3	1402.1	1407.0	h	250	15
18.528	18.933	19.337	19.741	20.144	20.547	20.95	21.35	21.75	22.15	22.56	22.96	23.36	23.76	23.96	v		
1275.7	1285.3	1294.9	1304.5	1314.1	1323.8	1333.5	1343.2	1352.9	1362.6	1372.3	1382.1	1391.9	1401.8	1406.7	h	259	20
15.862	16.210	16.558	16.905	17.251	17.597	17.943	18.288	18.633	18.977	19.322	19.666	20.01	20.35	20.52	v		
1275.2	1284.8	1294.5	1304.1	1313.8	1323.4	1333.1	1342.8	1352.5	1362.3	1372.1	1381.9	1391.7	1401.6	1406.5	h	267	25
13.862	14.168	14.473	14.778	15.082	15.385	15.688	15.990	16.293	16.595	16.896	17.198	17.499	17.8001	7.951	v		
1274.7	1284.4	1294.0	1303.7	1313.4	1323.1	1332.8	1342.5	1352.2	1362.0	1371.8	1381.6	1391.5	1401.4	1406.3	h	274	30
12.307	12.580	12.852	13.123	13.394	13.665	13.935	14.204	14.473	14.742	15.011	15.279	15.547	15.815	15.949	v		
1273.7	1283.4	1293.2	1302.9	1312.6	1322.4	1332.1	1341.9	1351.7	1361.5	1371.3	1381.1	1391.0	1400.9	1405.8	h	287	40
10.044	10.269	10.493	10.717	10.940	11.162	11.384	11.605	11.826	12.047	12.268	12.488	12.708	12.927	13.037	v		
1272.7	1282.5	1292.3	1302.1	1311.9	1321.7	1331.5	1341.3	1351.1	1360.9	1370.8	1380.6	1390.5	1400.4	1405.4	h	298	50
8.478	8.670	8.861	9.051	9.240	9.429	9.618	9.806	9.993	10.181	10.368	10.555	10.741	10.928	11.021	v		
1271.6	1281.5	1291.4	1301.3	1311.1	1321.0	1330.8	1340.6	1350.5	1360.3	1370.2	1380.1	1390.0	1399.9	1404.9	h	308	60
7.329	7.496	7.663	7.829	7.994	8.159	8.323	8.486	8.649	8.812	8.975	9.138	9.300	9.462	9.543	v		
1270.6	1280.6	1290.5	1300.5	1310.4	1320.2	1330.1	1340.0	1349.9	1359.8	1369.7	1379.6	1389.6	1399.5	1404.5	h	316	70
6.450	6.599	6.747	6.894	7.041	7.187	7.332	7.477	7.622	7.766	7.910	8.054	8.198	8.341	8.413	v		
1269.5	1279.6	1289.6	1299.6	1309.6	1319.5	1329.4	1339.4	1349.3	1359.3	1369.2	1379.1	1389.1	1399.0	1404.0	h	324	80
5.756	5.891	6.024	6.156	6.288	6.419	6.550	6.680	6.810	6.940	7.069	7.199	7.327	7.456	7.520	v		
1268.5	1278.6	1288.7	1298.8	1308.8	1318.8	1328.7	1338.7	1348.7	1358.6	1368.6	1378.5	1388.5	1398.5	1403.5	h	331	90
5.195	5.317	5.439	5.559	5.679	5.799	5.918	6.036	6.154	6.272	6.389	6.506	6.623	6.740	6.798	v		
1267.4	1277.7	1287.8	1297.9	1308.0	1318.0	1328.1	1338.1	1348.0	1358.0	1368.0	1378.0	1388.1	1398.1	1403.1	h	338	100
4.730	4.843	4.955	5.066	5.176	5.285	5.394	5.503	5.611	5.719	5.827	5.934	6.041	6.148	6.201	v		
1264.7	1275.2	1285.5	1295.8	1306.0	1316.2	1326.4	1336.5	1346.6	1356.6	1366.7	1376.8	1386.9	1397.0	1402.0	h	353	125
3.860	3.954	4.047	4.140	4.232	4.323	4.413	4.503	4.593	4.683	4.772	4.861	4.949	5.038	5.082	v		
1261.9	1272.6	1283.2	1293.6	1304.0	1314.3	1324.6	1334.8	1345.0	1355.2	1365.3	1375.4	1385.6	1395.8	1400.8	h	366	150
3.252	3.334	3.414	3.494	3.573	3.652	3.730	3.807	3.884	3.960	4.037	4.113	4.188	4.264	4.301	v		
1259.0	1270.0	1280.8	1291.4	1302.0	1312.4	1322.8	1333.2	1343.5	1353.7	1363.9	1374.2	1384.4	1394.6	1399.7	h	378	175
2.804	2.877	2.948	3.019	3.089	3.157	3.226	3.294	3.361	3.429	3.495	3.562	3.628	3.694	3.727	v		
1256.0	1267.3	1278.3	1289.2	1299.9	1310.5	1321.0	1331.4	1341.8	1352.2	1362.5	1372.8	1383.1	1393.3	1398.5	h	388	200
2.460	2.525	2.590	2.653	2.716	2.777	2.839	2.900	2.960	3.019	3.079	3.139	3.198	3.256	3.286	v		
1253.0	1264.5	1275.8	1286.9	1297.8	1308.5	1319.2	1329.8	1340.3	1350.7	1361.1	1371.5	1381.9	1392.2	1397.3	h	397	225
2.187	2.247	2.306	2.364	2.421	2.477	2.533	2.587	2.642	2.696	2.750	2.804	2.857	2.910	2.936	v		
1249.9	1261.7	1273.2	1284.5	1295.6	1306.5	1317.3	1328.0	1338.7	1349.2	1359.7	1370.2	1380.6	1391.0	1396.2	h	406	250
1.9654	2.021	2,076	2.129	2.181	2.233	2.284	2.334	2.384	2.434	2.483	2.532	2.580	2.629	2.653	v		
1246.6	1258.8	1270.6	1282.1	1293.4	1304.5	1315.5	1326.3	1337.0	1347.7	1358.3	1368.8	1379.3	1389.8	1395.0	h	414	275
1.7816	1.8338	1.8846	1.9342	1.9829	2.031	2.078	2.125	2.171	2.217	2.262	2.307	2.352	2.396	2.418	v		
1243.3	1255.8	1267.9	1279.7	1291.2	1302.5	1313.6	1324.5	1335.4	1346.1	1356.8	1367.4	1378.0	1388.6	1393.8	h	422	300
1.6266	1.6759	1.7237	1.7703	1.8159	1.8607	1.9048	1.9483	1.9912	2.034	2.076	2.118	2.159	2.200	2.220	v		
1236.4	1249.6	1262.4	1274.7	1286.6	1298.2	1309.7	1320.9	1332.0	1343.0	1353.9	1364.7	1375.4	1386.1	1391.4	h	436	350
1.3795	1.4243	1.4675	1.5094	1.5501	1.5900	1.6291	1.6676	1.7056	1.7430	1.7801	1.8168	1.8531	1.8892	1.9071	v		
1229.0	1243.2	1256.6	1269.4	1281.8	1293.9	1305.7	1317.2	1328.6	1339.8	1350.9	1361.9	1372.8	1383.6	1389.0	h	448	400
1.1908	1.2325	1.2724	1.3108	1.3480	1.3842	1.4196	1.4544	1.4885	1.5222	1.5554	1.5883	1.6207	1.6529	1.6689	v		
1221.2	1236.3	1250.5	1264.0	1276.9	1289.4	1301.6	1313.5	1325.1	1336.5	1347.8	1359.0	1370.1	1381.1	1386.5	h	460	450
1.0416	1.0811	1.1186	1.1544	1.1889	1.2224	1.2550	1.2868	1.3180	1.3488	1.3789	1.4088	1.4382	1.4675	1.4819	v		
1212.8	1229.0	1244.0	1258.3	1271.8	1284.8	1297.3	1309.6	1321.5	1333.2	1344.7	1356.1	1367.3	1378.4	1384.0	h	470	500
0.9204	0.9584	0.9941	1.0280	1.0604	1.0917	1.1221	1.1516	1.1805	1.2088	1.2367	1.2641	1.2913	1.3180	1.3313	v		
	1221.4	1237.4	1252.4	1266.5	1280.0	1293.0	1305.6	1317.8	1329.8	1341.6	1353.2	1364.6	1375.8	1381.4	h	480	550
	0.8565	0.8909	0.9234	0.9542	0.9838	1.0124	1.0401	1.0671	1.0935	1.1195	1.1449	1.1700	1.1947	1.2070	v		
	1213.2	1230.3	1246.1	1261.0	1275.1	1288.5	1301.5	1314.1	1326.3	1338.3	1350.2	1361.8	1373.2	1378.9	h	489	600
	0.7703	0.8040	0.8353	0.8649	0.8931	0.9203	0.9465	0.9720	0.9968	1.0211	1.0450	1.0684	1.0916	1.1030	v		

PRESSURE TO VACUUM

Gage Indicated		Absolute Pressure		
PSIG	Inches of Hg	PSIA	Inches of Hg	Torricelli
-14.70000	29.92000	0.0	0.0	0.0
-14.69998	29.91996	0.00002	0.00004	0.001
-14.69996	29.91992	0.00004	0.00008	0.002
-14.69994	29.91988	0.00006	0.00012	0.003
-14.69992	29.91984	0.00008	0.00016	0.004
-14.69990	29.91980	0.00010	0.00020	0.005
-14.69981	29.91961	0.00019	0.00039	0.010
-14.69961	29.91921	0.00039	0.00079	0.020
-14.69942	29.91882	0.00058	0.00118	0.030
-14.69923	29.91843	0.00077	0.00157	0.040
-14.69903	29.91803	0.00097	0.00197	0.050
-14.69806	29.91606	0.00194	0.00394	0.100
-14.69613	29.91212	0.00387	0.00788	0.200
-14.69449	29.90818	0.00551	0.01182	0.300
-14.69226	29.90424	0.00774	0.01576	0.400
-14.69032	29.90030	0.00968	0.01970	0.500
-14.68066	29.88063	0.01934	0.03937	1.000
-14.66698	29.84126	0.03302	0.07874	2.000
-14.64197	29.80189	0.05803	0.11811	3.000
-14.62262	29.76252	0.07738	0.15748	4.000
-14.60329	29.72315	0.09671	0.19685	5.000
-14.50658	29.52630	0.19342	0.39370	10.000
-14.40980	29.32940	0.29020	0.59060	15.000
-14.31320	29.13260	0.38680	0.78740	20.000
-14.21840	28.93570	0.48160	0.98430	25.000
-14.20870	28.920	0.49130	1.000	25.400
-14.11970	28.740	0.58030	1.181	30.000
-13.75700	28.000	0.94330	1.920	48.770
-12.28300	25.000	2.41700	4.920	124.970
-10.31800	21.000	4.38200	8.920	T.570
-8.84400	18.000	5.85600	11.920	302.770
-7.37000	15.000	7.320	14.920	378.970
-5.89600	12.000	8.804	17.920	455.770
-4.91300	10.000	9.787	19.920	505.970
-3.93000	8.000	10.770	21.920	556.770
-2.94800	6.000	11.752	23.920	607.570
-1.96500	4.000	12.735	25.920	658.370
-0.98300	2.000	13.732	27.920	709.170
-0.49100	1.000	14.209	28.920	733.570
-0.24600	0.500	14.454	29.420	747.270
		ATMOSPHERIC		
0.0	**0.0**	**14.700**	**29.920**	**760.000**
+ 0.30		15.000	30.540	775.720
+ 1.00		15.700	31.970	811.910
+ 2.00		16.700	34.000	863.630
+ 10.00		24.700	50.290	277.35

Water Temp.	Saturation Pressure	Weight	Weight Density	Specific Volume
Deg. F	PSIA	lbs/Gallon	lbs/Cu.Ft.	Cu.Ft./lb
32	0.0886	8.344	62.414	0.016022
40	0.1216	8.345	62.426	0.016019
50	0.1780	8.343	62.410	0.016023
60	0.2561	8.338	62.371	0.016033
70	0.3629	8.329	62.305	0.016050
80	0.5068	8.318	62.220	0.016072
90	0.6981	8.304	62.116	0.016099
100	0.9492	8.288	61.996	0.016130
110	1.2750	8.270	61.862	0.016165
120	1.6927	8.250	61.713	0.016204
130	2.2230	8.228	61.550	0.016247
140	2.8892	8.205	61.376	0.016293
150	3.7184	8.180	61.188	0.016343
160	4.7414	8.154	60.994	0.016395
170	5.9926	8.126	60.787	0.016451
180	7.5110	8.097	60.569	0.016510
190	9.340	8.067	60.343	0.016572
200	11.526	8.035	60.107	0.016637
210	14.123	8.002	59.862	0.016705
212	14.696	7.996	59.812	0.016719
220	17.186	7.969	59.613	0.016775
240	24.968	7.898	59.081	0.016926
260	35.427	7.823	58.517	0.017089
280	49.200	7.743	57.924	0.017264
300	67.005	7.661	57.307	0.01745
350	134.604	7.431	55.586	0.01799
400	247.259	7.172	53.648	0.01864
450	422.55	6.880	51.467	0.01943
500	680.86	6.543	48.948	0.02043
550	1045.43	6.143	45.956	0.02176
600	1543.2	5.655	42.301	0.02364
650	2208.4	4.999	37.397	0.02674
700	3094.3	3.651	27.307	0.03662

NOTE:
Weight of water per gallon is based on 7.48052 gallons per cubic foot.
Specific gravity of water @ 60°F = 1.00

CONDENSATION WARM-UP LOADS

Steam Pressure PSIG	HEADER SIZE														0°F* Correct Factor
	2"	2½"	3"	4"	5"	6"	8"	10"	12"	14"	16"	18"	20"	24"	
1	6.4	10.2	13.3	19.0	25.7	33.3	50	71	94	111	145	184	216	301	1.50
5	7.2	11.4	14.9	21.2	28.7	37.2	56	80	105	124	163	206	241	336	1.45
10	7.8	12.4	16.2	23.0	31.2	40.5	61	86	114	135	177	224	262	365	1.41
20	8.8	14.0	18.3	26.0	35.2	45.7	69	98	129	153	200	253	296	413	1.37
40	10.3	16.4	21.4	30.5	41.3	53.6	81	114	151	179	234	296	347	484	1.32
60	11.5	18.2	23.9	34.0	46.0	59.7	90	127	169	200	261	330	387	539	1.29
80	12.5	19.8	25.9	36.9	50.0	64.8	98	138	183	217	283	358	420	585	1.27
100	13.3	21.1	27.7	39.4	53.4	69.3	104	148	195	231	302	383	449	625	1.26
125	14.3	22.6	29.6	42.2	57.2	74.2	112	158	209	248	324	410	481	670	1.25
150	15.1	24.0	31.4	44.7	60.6	78.6	118	168	222	263	343	434	509	709	1.24
175	15.9	25.2	33.0	47.0	63.7	82.7	124	176	233	276	361	457	536	746	1.23
200	16.6	26.4	34.5	49.1	66.6	86.4	130	184	244	289	377	477	560	779	1.22
250	17.9	28.5	37.3	53.0	71.9	93.3	140	199	263	312	407	515	604	842	1.21
300	26.3	40.2	53.8	78.6	109.0	150.0	228	338	464	557	716	896	1096	1555	1.20
400	29.3	44.8	59.9	87.7	121.5	167.0	254	376	517	620	798	998	1221	1733	1.19
500	32.1	48.9	65.5	95.7	132.8	182.5	277	411	566	678	872	1091	1335	1894	1.18
600	34.6	52.9	70.7	103.4	143.4	197.1	299	444	611	732	942	1179	1441	2045	1.17

Condensation loads are in pounds per hour per 100 feet of insulated steam main with ambient temperature of 70°F and an insulation efficiency of 80%.
Loads are based on Schedule 40 pipe for pressures up to and including 250 PSIG and on schedule 80 pipe for pressures above 250 PSIG.

CONDENSATION LOADS

Steam Pressure PSIG	HEADER SIZE														0°F* Correct Factor
	2"	2½"	3"	4"	5"	6"	8"	10"	12"	14"	16"	18"	20"	24"	
1	4.6	5.5	6.6	8.3	10.1	11.8	15.1	18.6	21.8	23.8	26.9	30.1	33.2	39.4	1.40
5	5.1	6.1	7.3	9.3	11.3	13.3	16.9	20.8	24.4	26.6	30.1	33.7	37.2	44.1	1.37
10	5.7	6.8	8.2	10.3	12.6	14.8	18.9	23.2	27.2	29.7	33.7	37.6	41.5	49.3	1.34
20	6.7	8.0	9.7	12.2	14.8	17.4	22.3	27.4	32.1	35.1	39.7	44.4	49.0	58.2	1.29
40	8.4	10.0	12.0	15.1	18.4	21.7	27.7	34.1	40.0	43.6	49.5	55.3	61.0	72.5	1.24
60	9.7	11.6	13.9	17.6	21.4	25.2	32.2	39.6	46.5	50.7	57.5	64.3	71.0	84.3	1.22
80	10.9	13.0	15.6	19.7	24.0	28.2	36.2	44.4	52.2	57.0	64.6	72.2	79.7	94.7	1.20
100	11.9	14.3	17.1	21.6	26.4	31.0	39.7	48.9	57.4	62.6	71.0	79.4	87.7	104.2	1.18
125	13.2	15.7	18.9	23.8	29.1	34.2	43.8	53.9	63.3	69.1	78.4	87.6	96.8	115.0	1.17
150	14.3	17.1	20.5	25.9	31.6	37.2	47.6	58.6	68.8	75.2	85.3	95.3	105.3	125.2	1.16
175	15.3	18.3	22.0	27.8	33.9	40.0	51.2	63.0	74.0	80.9	91.7	102.6	113.3	134.7	1.15
200	16.3	19.5	23.4	29.7	36.2	42.6	54.6	67.2	78.9	86.2	97.8	109.4	120.8	143.7	1.14
250	18.2	21.8	26.2	33.1	40.4	47.6	61.1	75.2	88.3	96.5	109.5	122.4	135.3	160.8	1.13
300	20.0	23.9	28.8	36.4	44.4	52.4	67.1	82.7	97.1	106.1	120.5	134.7	148.9	177.1	1.12
400	23.4	27.9	33.6	42.5	51.9	61.2	78.6	96.8	113.8	124.3	141.1	157.8	174.5	207.6	1.11
500	26.5	31.7	38.2	48.4	59.1	69.7	89.4	110.2	129.5	141.6	160.8	179.8	198.8	236.6	1.10
600	29.6	35.4	42.6	54.0	66.0	77.8	100.0	123.2	144.9	158.4	179.8	201.2	223.5	264.8	1.09

Condensation loads are in pounds per hour per 100 feet of insulated steam main with ambient temperature of 70°F and an insulation efficiency of 80%.
Chart loads represent losses due to radiation and convection for saturated steam.
*For ambient temperature of 0°F, multiply load value by the correction factor corresponding to the steam pressure.

CONVERSION TABLES

LIQUID WEIGHTS and MEASURES

To Convert	To	Multiply By
Gallons	Liters	3.7853
Gallons	Cu. Inches	231
Gallons	Cu. Feet	0.1337
Gallons	Cu. Meters	0.00379
Gallons	Lbs. of Water	8.339
Liters	Gallons	0.26418
Liters	Cu. Inches	61.025
Liters	Cu. Feet	0.0353
Liters	Cu. Meters	0.001
Liters	Lbs. of Water	2.202
Cu. Inches	Gallons	0.00433
Cu. Inches	Liters	0.01639
Cu. Inches	Cu. Feet	0.00058
Cu. Inches	Cu. Meters	0.000016
Cu. Inches	Lbs. of Water	0.0362
Cu. Feet	Gallons	7.48052
Cu. Feet	Liters	28.316
Cu. Feet	Cu. Inches	1728
Cu. Feet	Cu. Meters	0.0283
Cu. .Feet	Lbs. of Water	62.371
Cu. Meters	Gallons	264.17
Cu. Meters	Liters	999.972
Cu. Meters	Cu. Inches	61023.74
Cu. Meters	Cu. Feet	35.3145
Cu. Meters.	Lbs. of Water	2202.61
Lbs. of Water	Gallons	0.11992
Lbs. of Water	Liters	0.45419
Lbs. of Water	Cu. Inches	27.643
Lbs. of Water	Cu. Feet	0.01603
Lbs. of Water	Cu. Meters	0.000454
LINEAL MEASURES		
Inches	mm	25.4
Inches	cm	2.54
Inches	Meters	0.0254
Feet	cm	30.48
Feet	Meters	0.3048
mm	Inches	0.03937
mm	Feet	0.00328
cm	Inches	0.3937
cm	Feet	0.03281
Meters	Feet	3.28
AREA		
Sq. Inches	Sq. Feet	0.006944
Sq. Inches	Sq. cm	6.4516
Sq. Feet	Sq. Inches	144
Sq. Feet	Sq. cm	929.03
Sq. Feet	Sq. Meters	0.0929
Sq. cm	Sq. Inches	0.155
Sq. cm	Sq. Feet	0.00108
Sq. cm	Sq. Meters	0.0001
Sq. Meter	Sq. Inches	1550
Sq. Meter	Sq. Feet	10.76

CONVERSIONS of PRESSURE AND HEAD

To Convert	To	Multiply By
Lbs .per Sq .In.	Lbs. per Sq. Ft.	144
Lbs. per Sq. In.	Atmospheres	0.06805
Lbs. per Sq. In.	Ins. of Water	27.728
Lbs. per Sq. In.	Ft. of Water	2.3106
Lbs. per Sq. In.	Ins. of Mercury	2.03602
Lbs. per Sq. In.	mm of Mercury	51.715
Lbs. per Sq. In.	Bar	0.06895
Lbs. per Sq. In.	kg per Sq. cm	0.070307
Lbs. per Sq. In.	kg per Sq. M	703.070
Lbs. per Sq. Ft.	Lbs. per Sq. In.	0.0069445
Lbs. per Sq. Ft.	Atmospheres	0.000473
Lbs. per Sq. Ft.	Ins. of Water	0.1926
Lbs. per Sq. Ft.	Ft. of Water	0.01605
Lbs. per Sq. Ft.	Ins. of Mercury	0.014139
Lbs. per Sq. Ft.	mm of Mercury	0.35913
Lbs. per Sq. Ft.	Bar	0.000479
Lbs. per Sq. Ft.	kg per Sq. cm	0.000488
Lbs. per Sq. Ft.	kg per Sq. M	4.88241
Atmospheres	Lbs. per Sq. In.	14.696
Atmospheres	Lbs. per Sq. Ft.	2116.22
Atmospheres	Ins. of Water	407.484
Atmospheres	Ft. of Water	33.957
Atmospheres	Ins. of Mercury	29.921
Atmospheres	mm of Mercury	760
Atmospheres	Bar	1.01325
Atmospheres	kg per Sq. cm	1.0332
Atmospheres	kg per Sq. M	10332.27
Ins. of Water	Lbs. per Sq. In.	0.03609
Ins. of Water	Lbs. per Sq. Ft.	5.1972
Ins. of Water	Atmospheres	0.002454
Ins.of Water	Ft. of Water	0.08333
Ins. of Water	Ins. of Mercury	0.07343
Ins. of Water	mm of Mercury	1.8651
Ins. of Water	Bar	0.00249
Ins. of Water	kg per Sq. cm	0.00253
Ins. of Water	kg per Sq. M	25.375
Ft. of Water	Lbs. per Sq. In.	0.432781
Ft. of Water	Lbs. per Sq. Ft.	63.3205
Ft. of Water	Atmospheres	0.029449
Ft. of Water	Ins. of Water	12
Ft. of Water	Ins. of Mercury	0.88115
Ft. of Water	mm of Mercury	22.3813
Ft. of Water	Bar	0.029839
Ft. of Water	kg per Sq. cm	0.03043
Ft. of Water	kg per Sq. M	304.275
Ins. of Mercury	Lbs. per Sq. In.	0.491154
Ins. of Mercury	Lbs. per Sq. Ft.	70.7262
Ins. of Mercury	Atmospheres	0.033421
Ins. of Mercury	Ins. of Water	13.6185
Ins. of Mercury	Ft. of Water	1.1349
Ins. of Mercury	mm of Mercury	25.40005
Ins. of Mercury	Bar	0.033864
Ins. of Mercury	kg per Sq. cm	0.03453
Ins. of Mercury	kg per Sq. M	345.316
mm of Mercury	Lbs. per Sq. In.	0.019337
mm of Mercury	Lbs. per Sq. Ft.	2.7845
mm of Mercury	Atmospheres	0.001316
mm of Mercury	Ins. of Water	0.53616
mm of Mercury	Ft. of Water	0.04468
mm of Mercury	Ins. of Mercury	0.03937
mm of Mercury	Bar	0.00133
mm of Mercury	kg per Sq. cm	0.00136
mm of Mercury	kg per Sq. M	13.59509
kg per Sq. cm	Lbs. per Sq. In.	14.2233
kg per Sq. cm	Lbs. per Sq. Ft.	2048.155
kg per Sq. cm	Atmospheres	0.96784
kg per Sq. cm	Ins. of Water	394.38
kg per Sq. cm	Ft. of Water	32.865
kg per Sq. cm	Ins. of Mercury	28.959
kg per Sq. cm	mm of Mercury	735.559
kg per Sq. cm	Bar	0.98067
kg per Sq. cm	kg per Sq. M	10000

Note: All weights and measures of water are based on temperature of 60°F.
Note: Temperature of Water and Mercury is 68°F and 32°F respectively.

TEMPERATURE

To convert Fahrenheit to Celsius: $\frac{°F-32}{1.8}$

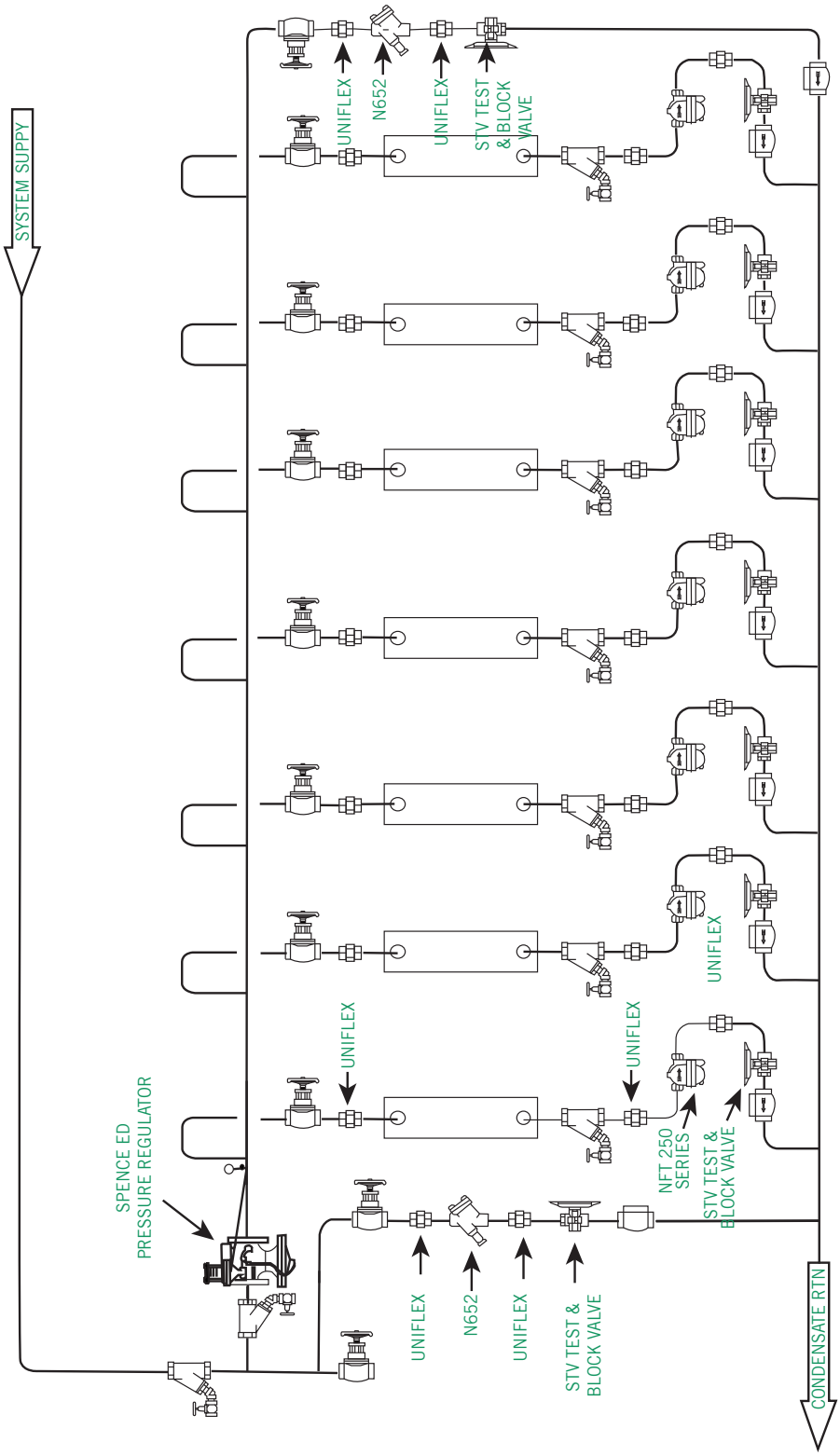
To convert Celsius to Fahrenheit: (1.8 x °C) + 32

VELOCITY

1 Ft per Sec. = 0.3048 M Per Sec.
1 M per Sec. = 3.2808 Ft. per Sec.

APPLICATION GUIDE

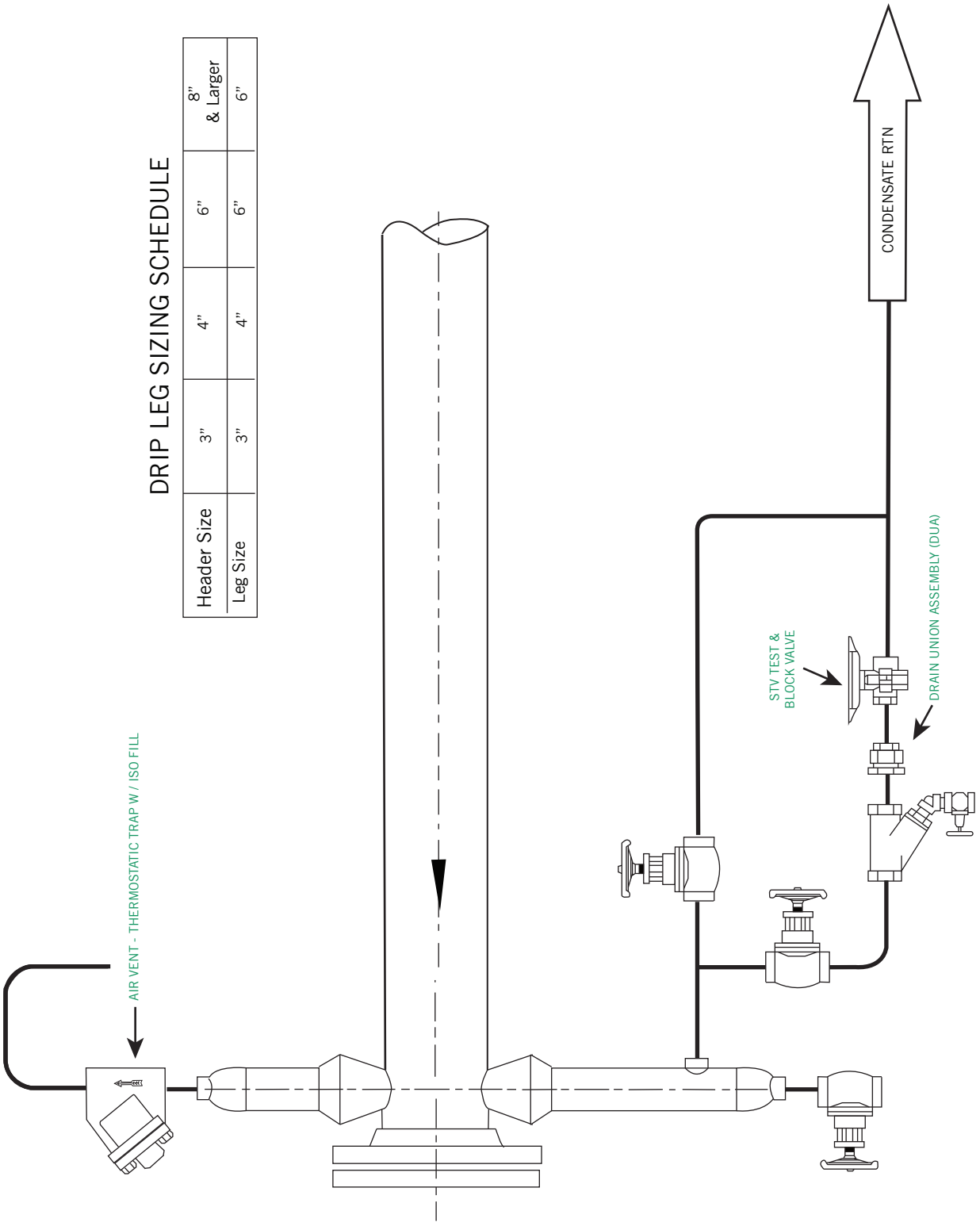
OVEN HEATING COILS



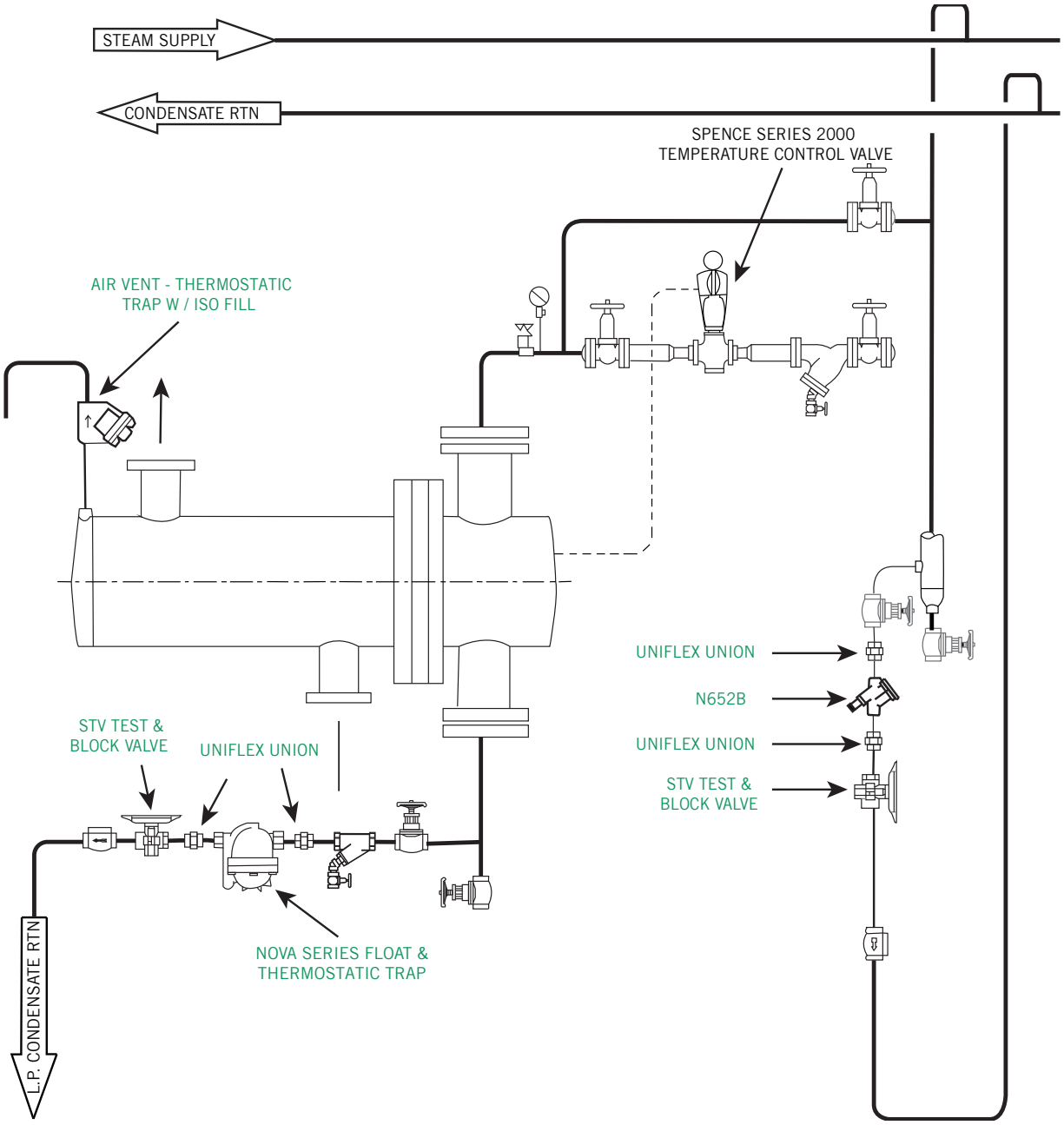
DRIP LEG/END OF MAIN LEG

DRIP LEG SIZING SCHEDULE

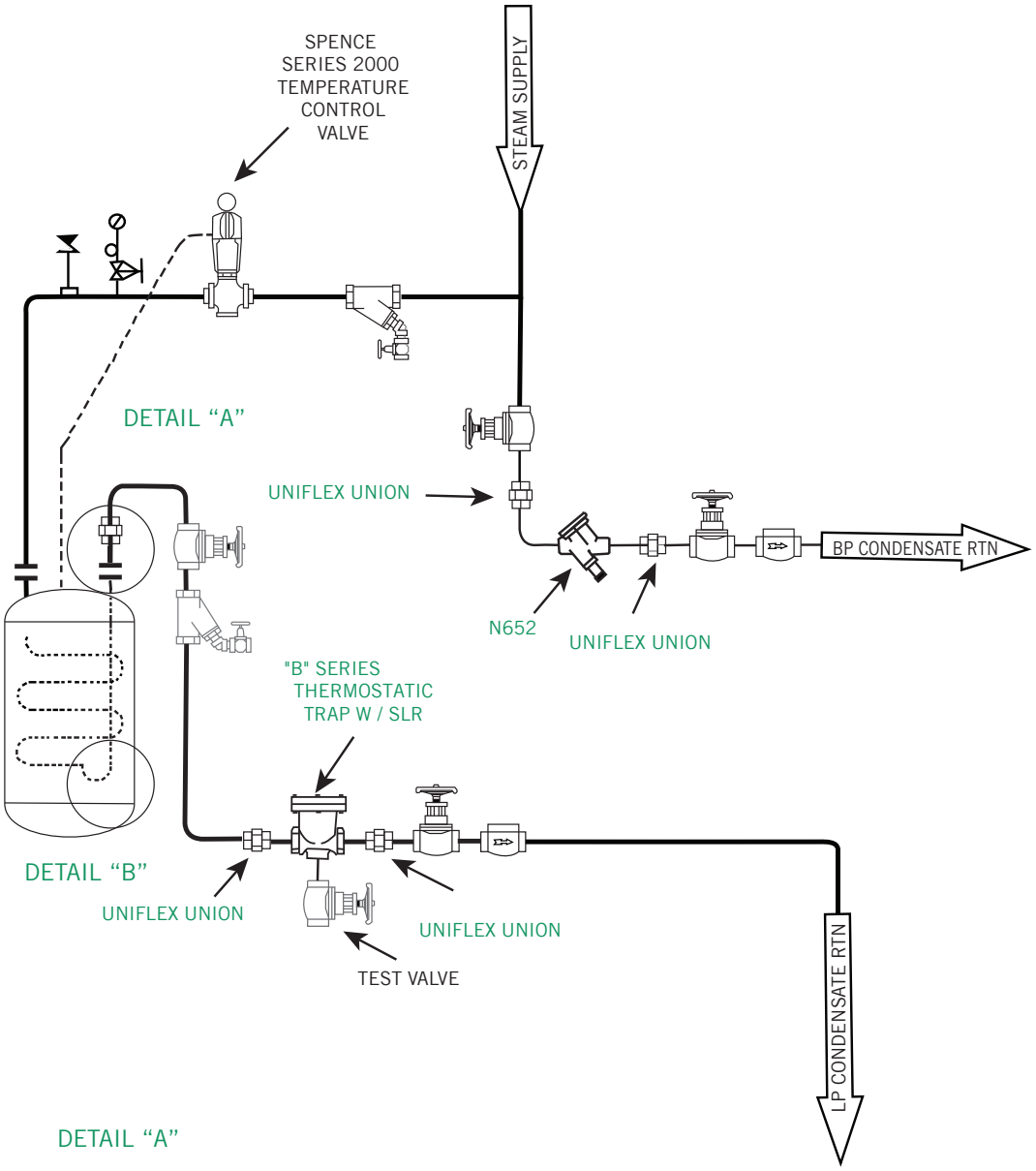
Header Size	3"	4"	6"	8" & Larger
Leg Size	3"	4"	6"	6"

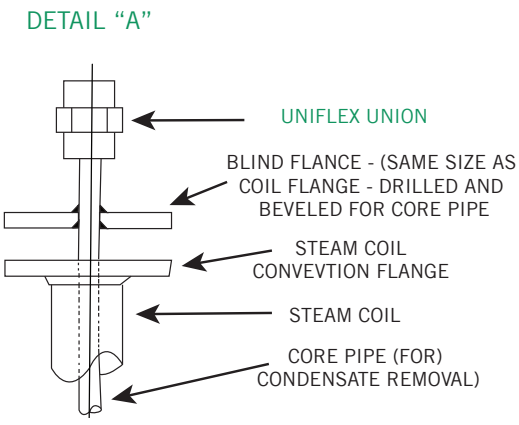


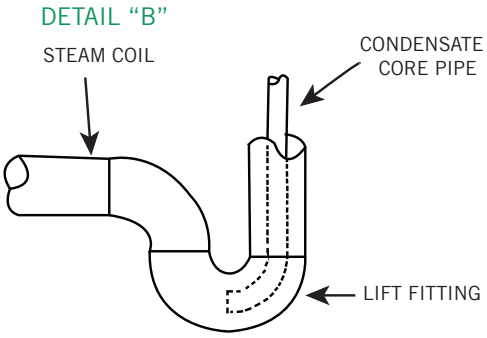
SHELL & TUBE HEAT EXCHANGER



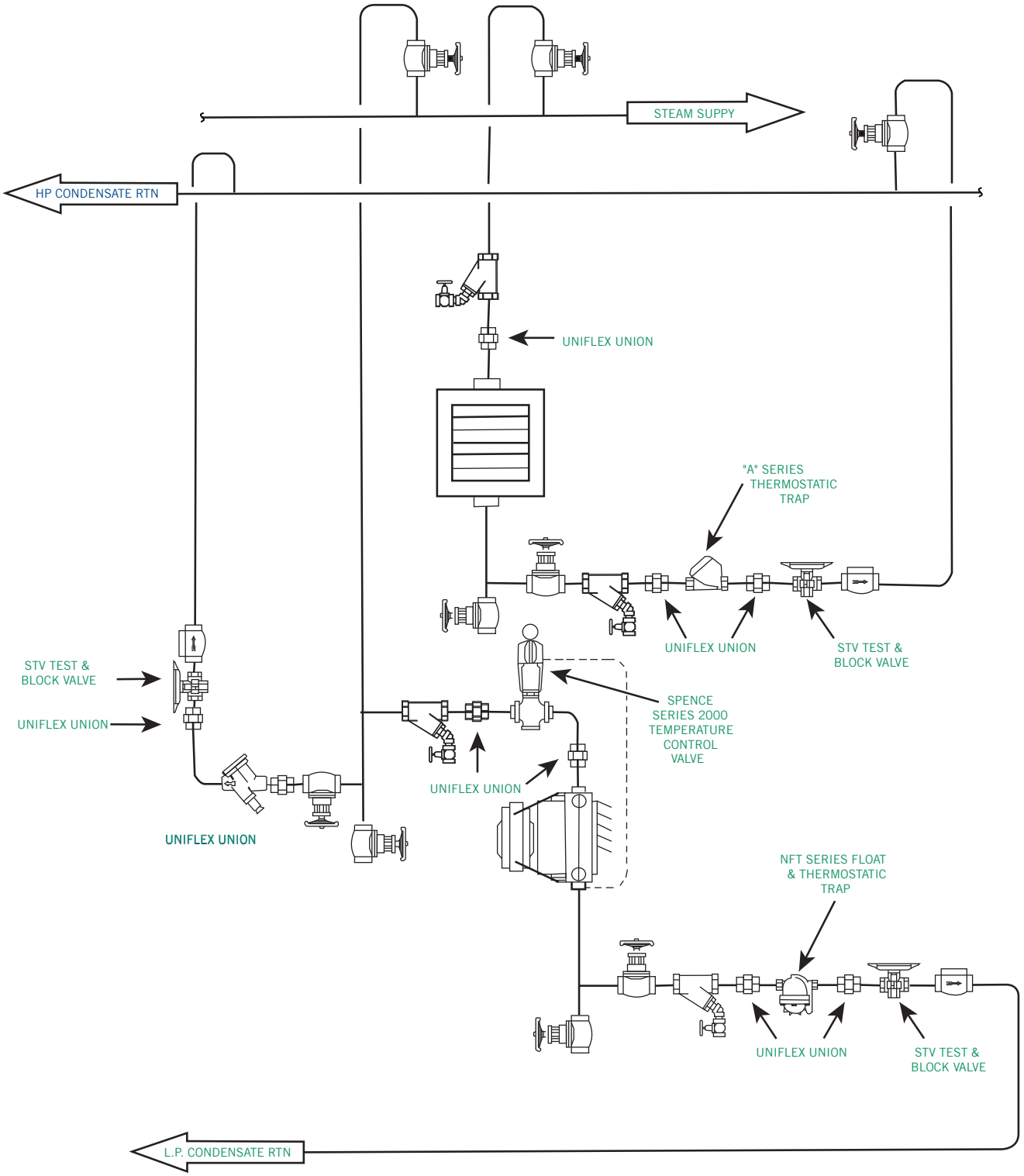
VESSEL WITH STEAM COIL OUTLET AT TOP



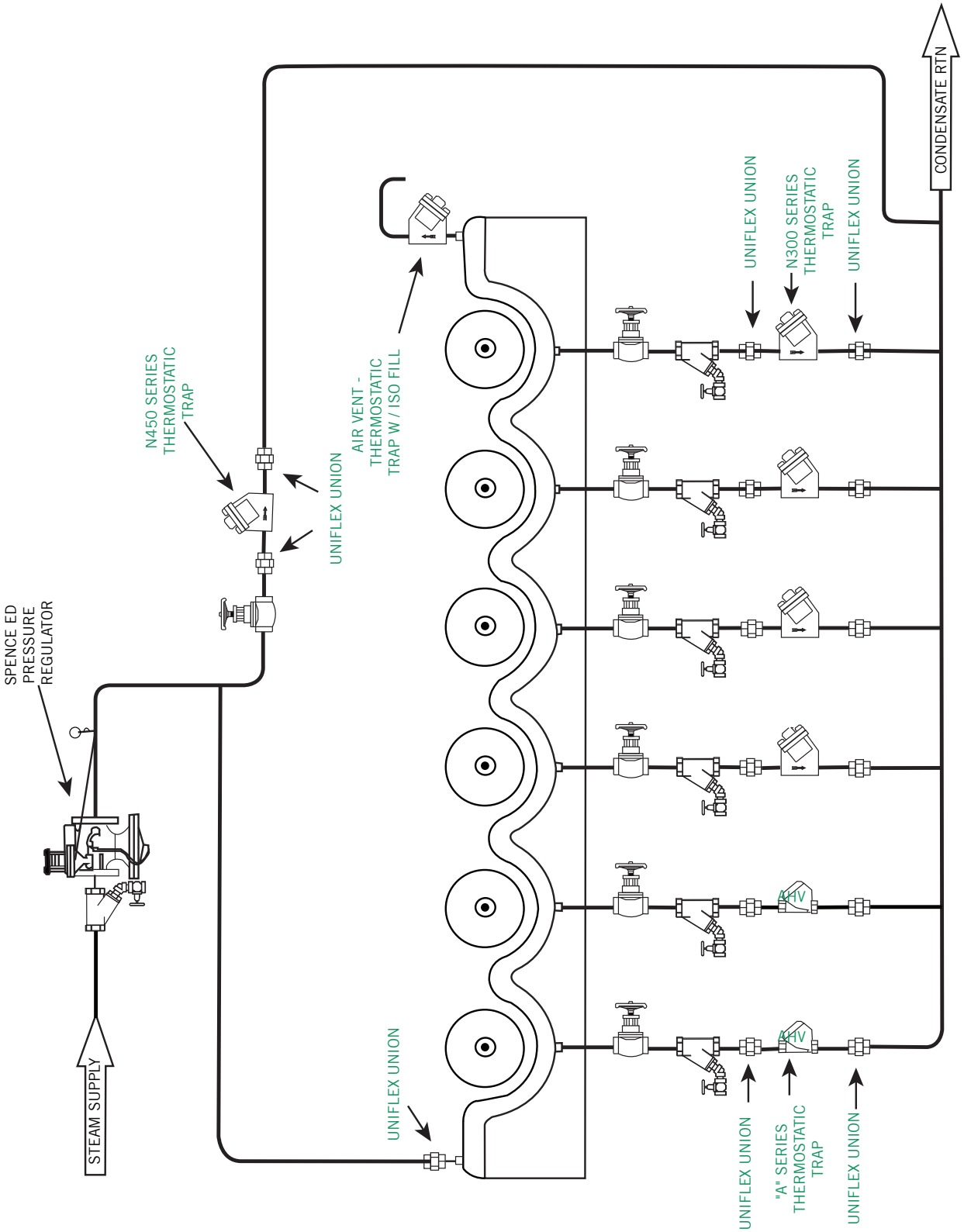




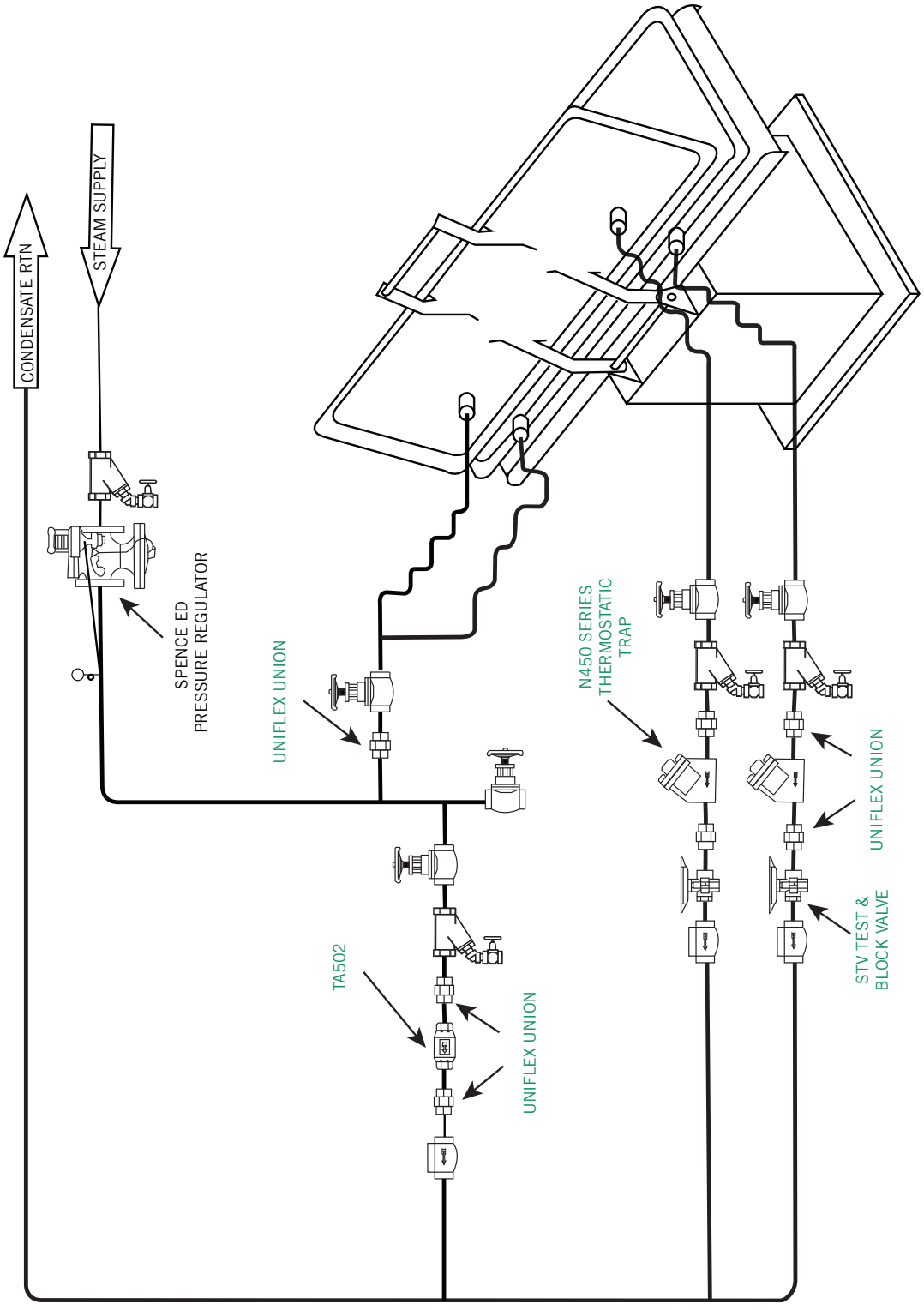
UNIT HEATER


STEAM SUPPY
HP CONDENSATE RTN
UNIFLEX UNION
"A" SERIES
THERMOSTATIC
TRAP
UNIFLEX UNION
STV TEST &
BLOCK VALVE
STV TEST &
BLOCK VALVE
UNIFLEX UNION
SPENCE
SERIES 2000
TEMPERATURE
CONTROL
VALVE
UNIFLEX UNION
UNIFLEX UNION
NFT SERIES FLOAT
& THERMOSTATIC
TRAP
UNIFLEX UNION
STV TEST &
BLOCK VALVE
L.P. CONDENSATE RTN

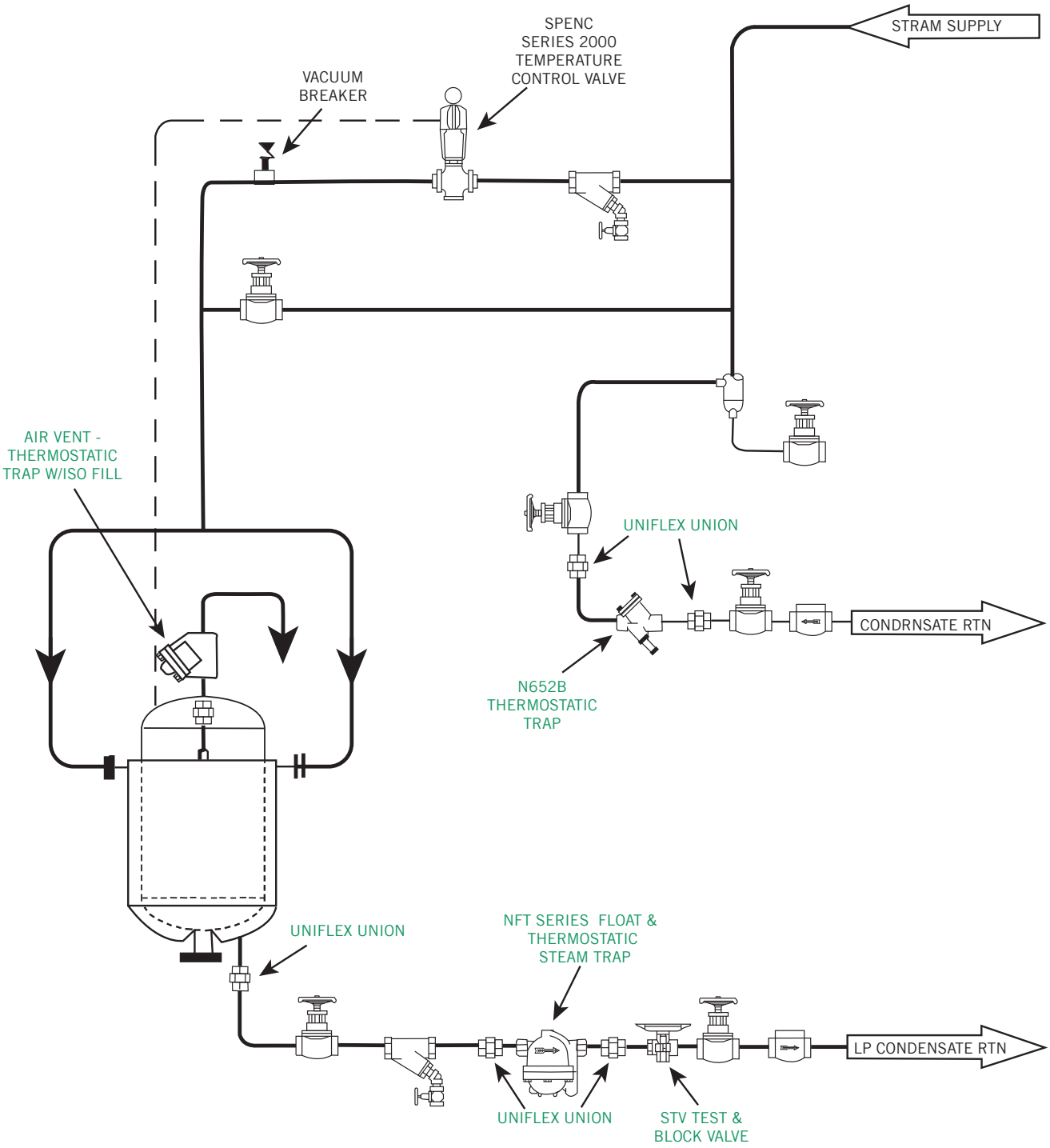
FLAT WORK IRONER



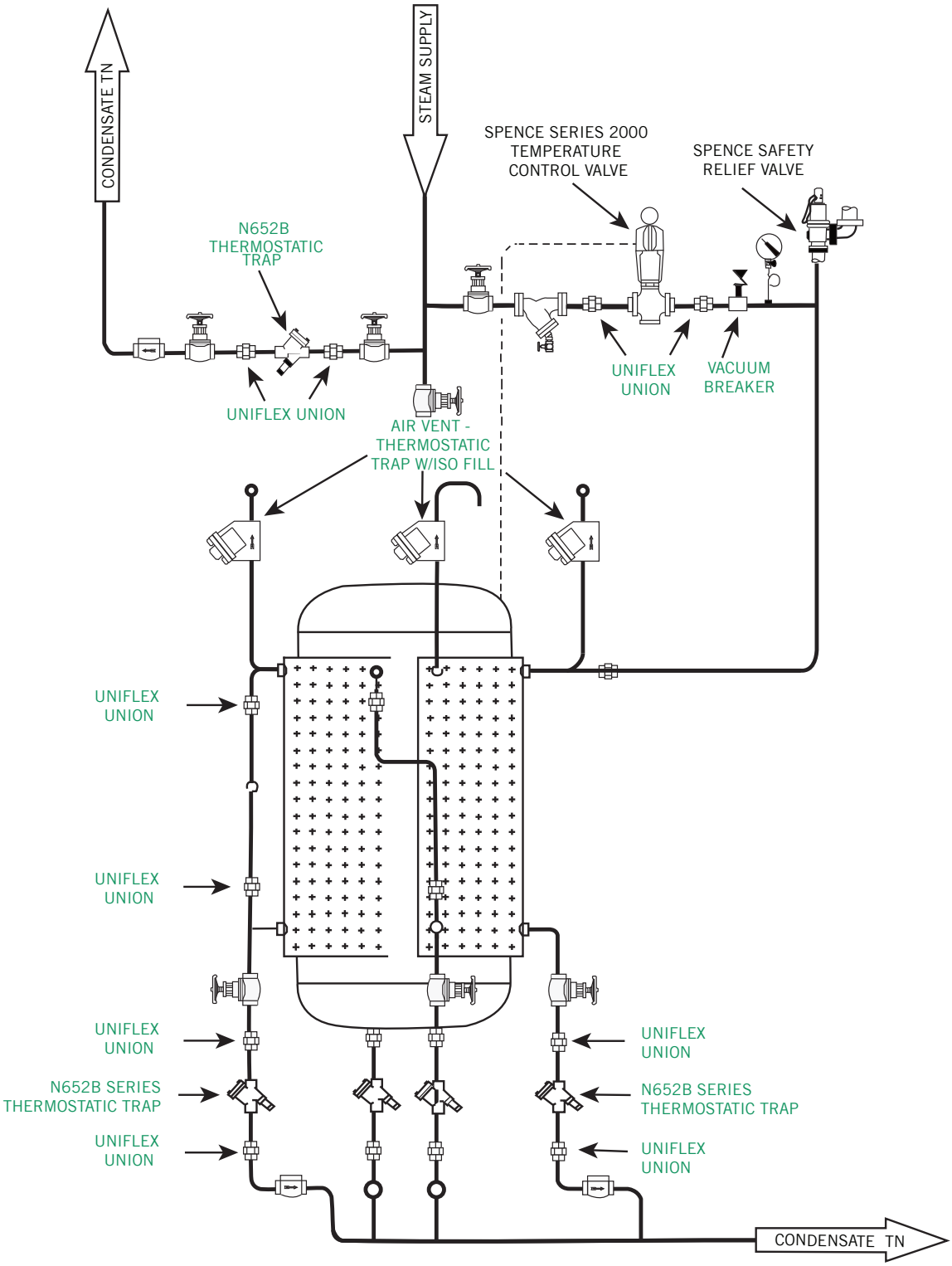
STEAM PRESS


CONDENSATE RTN
STEAM SUPPLY
SPENCE ED
PRESSURE REGULATOR
UNIFLEX UNION
TA502
UNIFLEX UNION
N450 SERIES
THERMOSTATIC
TRAP
UNIFLEX UNION
STV TEST &
BLOCK VALVE

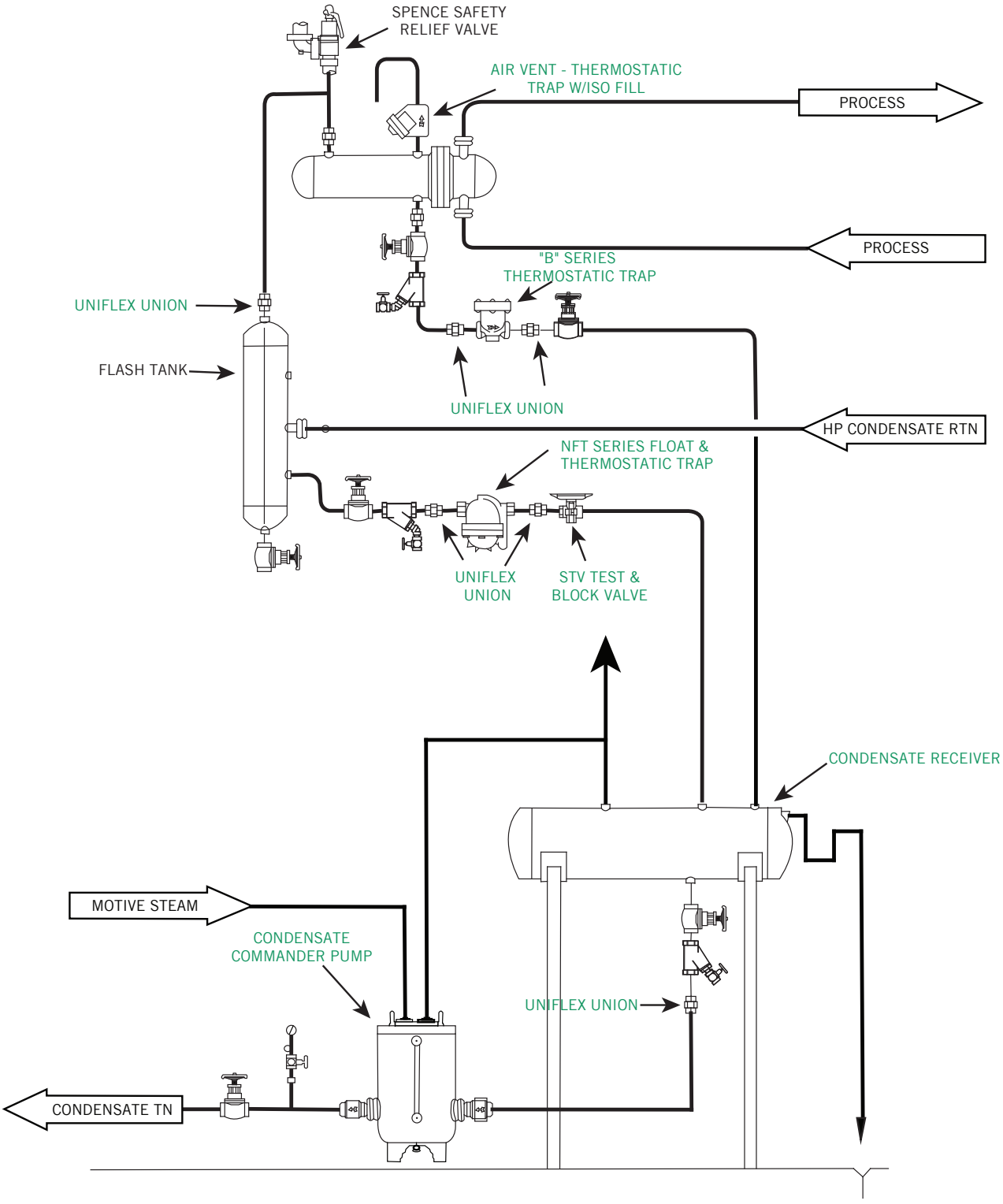
JACKETED PRESSURE VESSEL



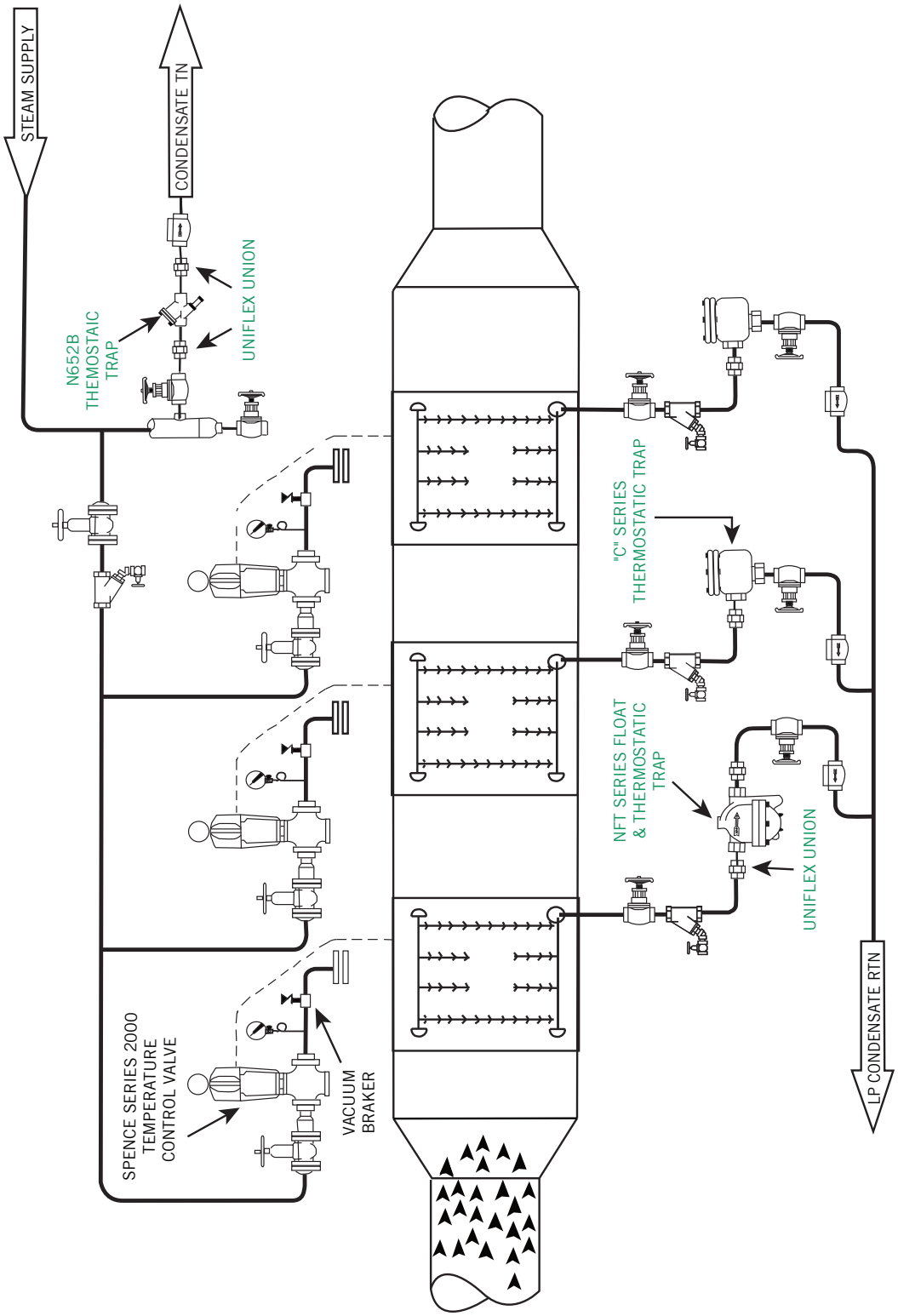
PRESSURE VESSEL WITH DIMPLE JACKET



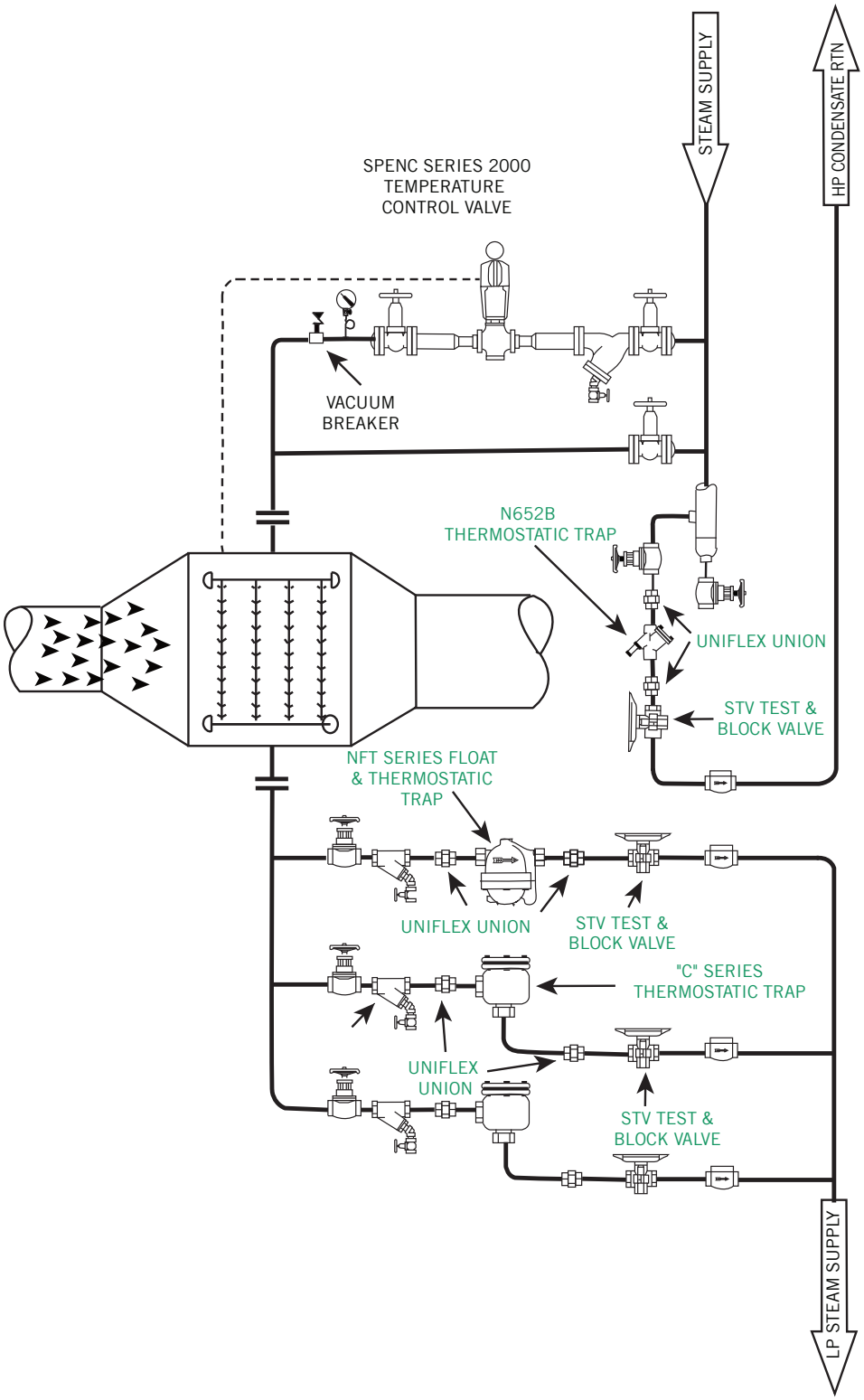
FLASH TANK WITH CONDENSATE BOOSTER PUMP



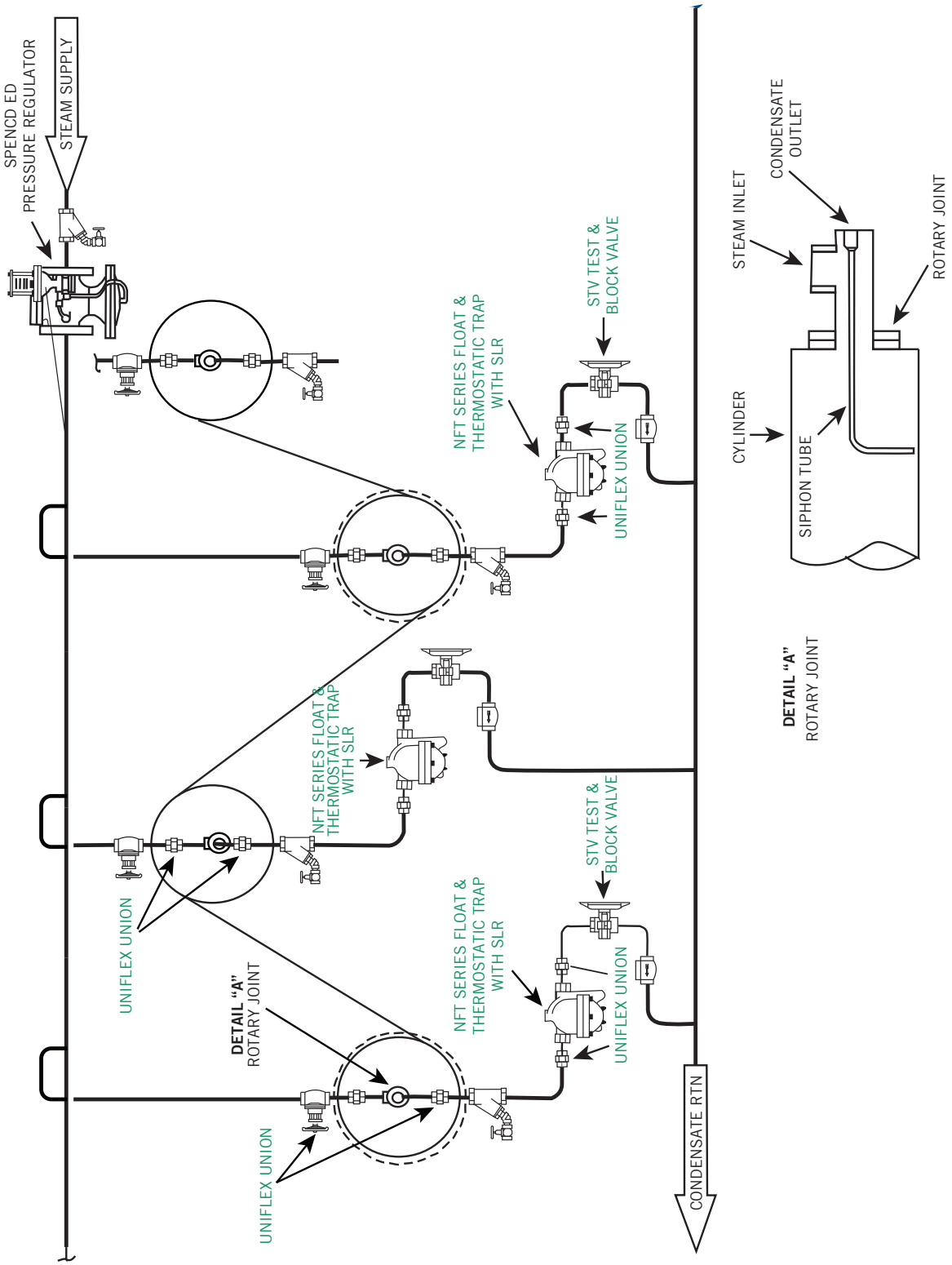
MULTI-COIL AIR HANDLER



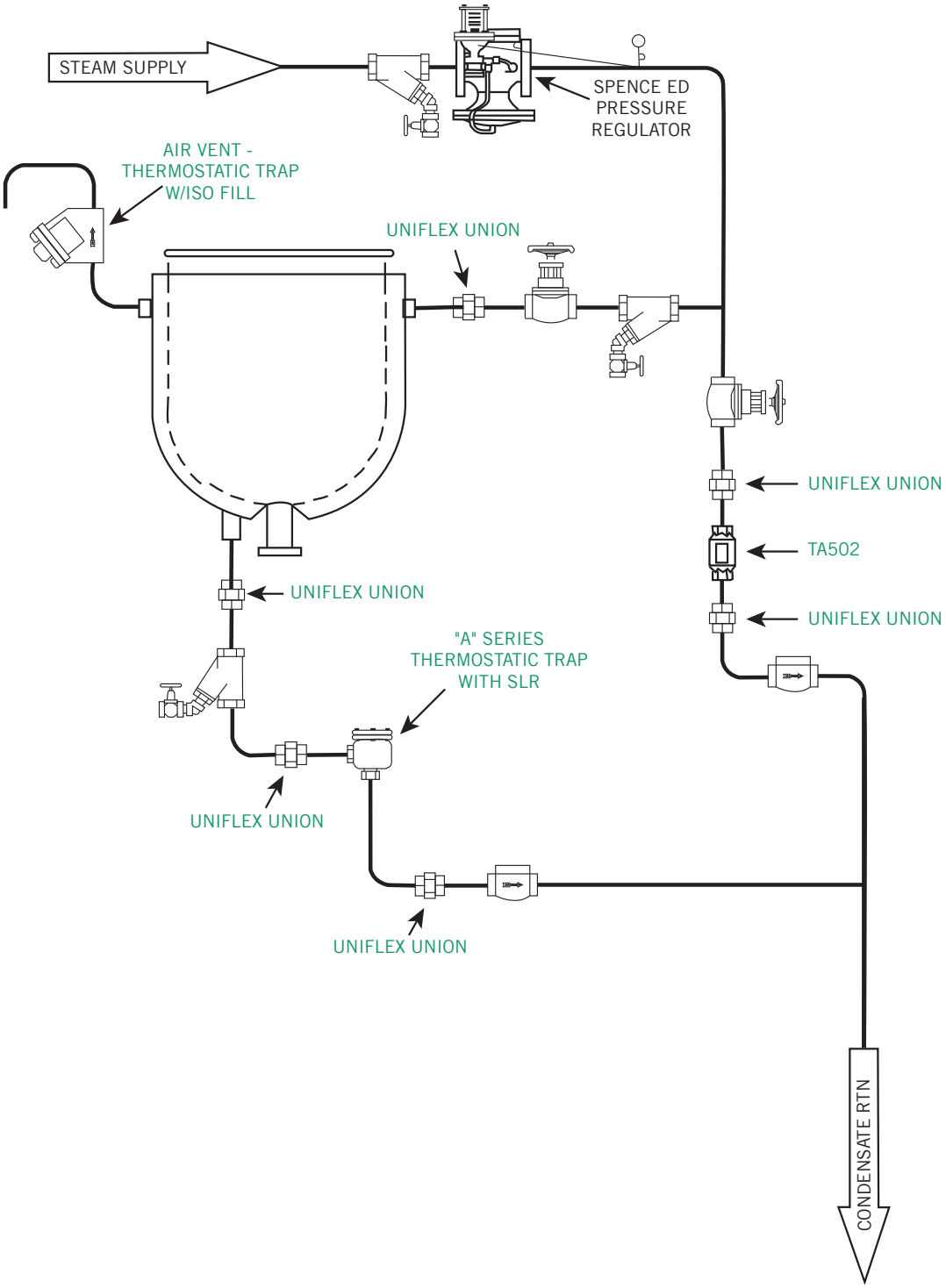
HIGH PRESSURE AIR COIL



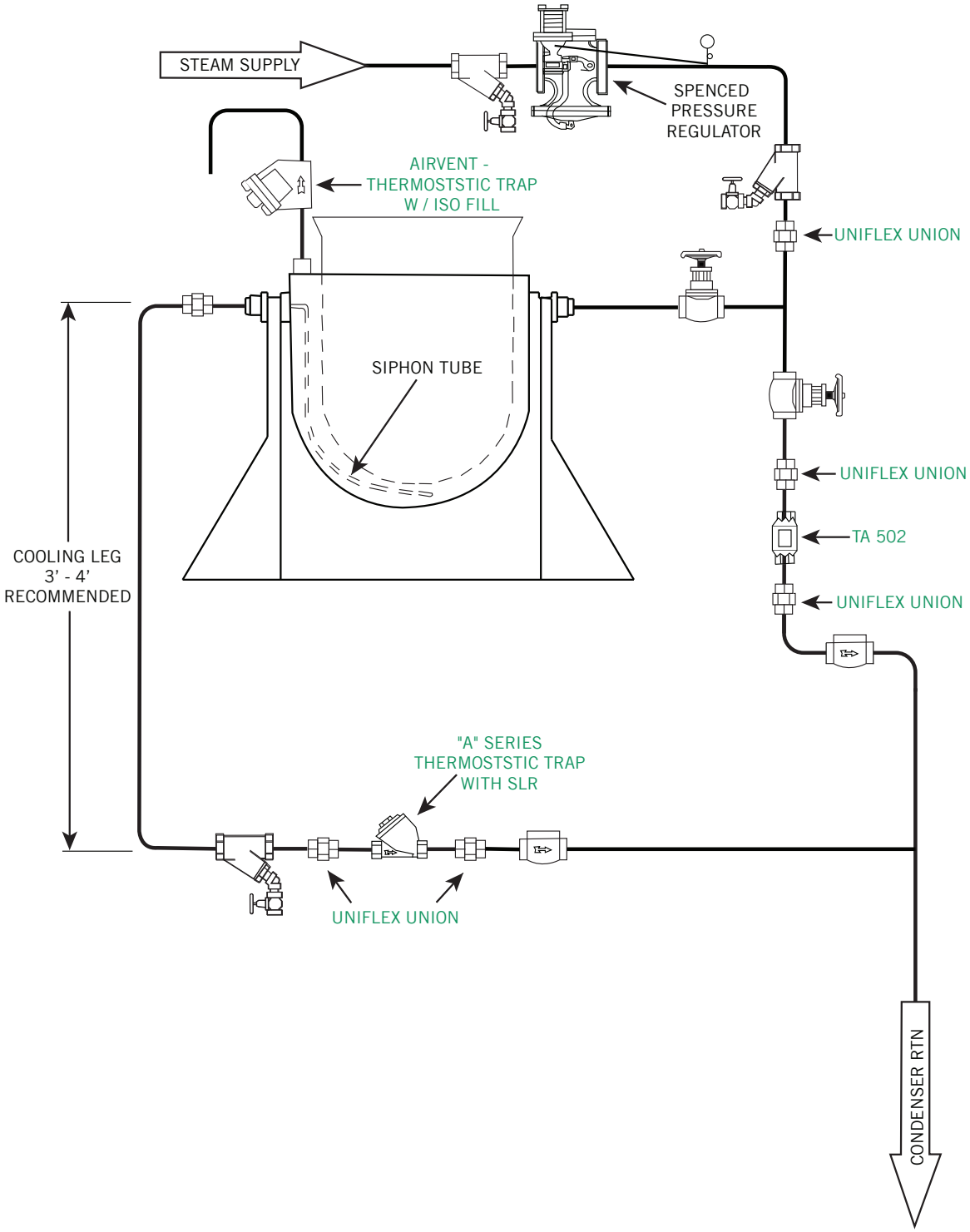
DRY CAN/CALENDER ROLL



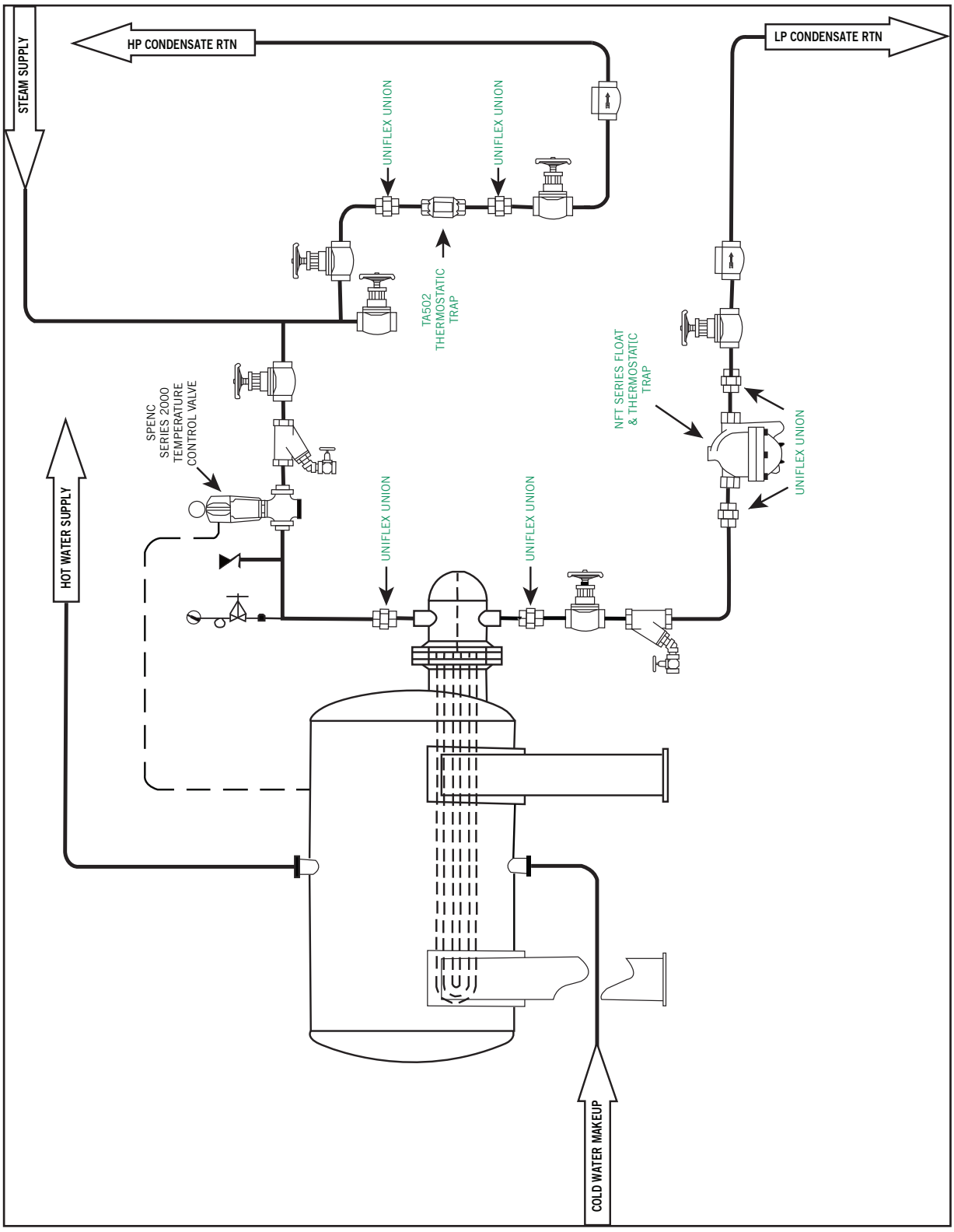
JACKETED KETTLE



TILTING JACKETED KETTLE



DOMESTIC HOT WATER



REFERENCE AND PIPING DESIGN

PIPING & TRAPPING DESIGN GUIDELINES

1. Extra care should be taken for expansion stresses due to the higher coefficient of expansion for stainless steel.
2. Branch connections are to be made from the top of headers with the block valve as close as possible to the header.
3. The recommended types of branch connections are tees and reducing tees.
4. Steam lines should slope down to traps (recommended 1% min.).
5. A dirt leg with trap station is recommended at every change of elevation (no undrainable pockets).
6. Extra care should be taken in pipe supports to eliminate sagging.
7. Instruments in general should be kept to a minimum. However, where required, it is recommended that:
   A) All are installed in tees.
   B) Pressure gauges be installed with diaphragm seals.
   C) Flow meters be installed in the vertical flow-up position to eliminate pockets
   D) Pressure reducing stations be kept to a minimum.
8. Traps should be installed in the vertical flow-down position to eliminate pockets.
9. Trap block valves should be located as close as possible to the user.
10. Condensate lines should be sloped (recommended 1% min.) to the end point. Note that contaminated condensate should always be piped to a process sewer. Uncontaminated condensate (from drip legs) may be recovered, if cost effective, and used elsewhere in the plant (not as Clean Steam make-up).
11. Condensate terminal points should contain an air break (2" or 2 pipe diameters, whichever is greater) between the end of the pipe and the drain, floor or grade.
12. Test connections for traps are recommended-trap efficiency is essential for Clean Steam.

PIPE DATA TABLES

Pipe Size (in.)	Outside Diameter (in.)	Weight Class	Carbon Steel Sched.	Stainless Steel Sched.	Wall Thick-ness (in.)	Inside Diameter (in.)	Circum. (Ext.) (in.)	Circum (Int.) (in.)	Flow Area (sq. in.)	Weight of Pipe (lbs/Ft.)	Weight of Water (lbs/Ft.)	Gallons of Water per Ft.	Section Modulus	Pipe Size (in.)
		—	—	10S	.049	.307		.96	.074	.19	.032	.004	.00437	
⅛	.405	STD	40	40S	.068	.269	1.27	.85	.057	.24	.025	.003	.00523	⅛
		XS	80	80S	.095	.215		.68	.036	.31	.016	.002	.00602	
		—	—	10S	.065	.410		1.29	.132	.33	.057	.007	.01032	
¼	540	STD	40	40S	.088	.364	1.70	1.14	.104	.42	.045	.005	.01227	¼
		XS	80	80S	.119	.302		.95	.072	.54	.031	.004	.01395	
		—	—	10S	.065	.545		1.71	.233	.42	.101	.012	.01736	
⅜	675	STD	40	40S	.091	.493	2.12	1.55	.191	.57	.083	.010	.0216	⅜
		XS	80	80S	.126	.423		1.33	.141	.74	.061	.007	.0255	
		—	—	5S	.065	.710		2.23	.396	.54	.172	.021	.0285	
		—	—	10S	.083	.674		2.12	.357	.67	.155	.019	.0341	
½	840	STD	40	40S	.109	.622	2.64	1.95	.304	.85	.132	.016	.0407	½
		XS	80	80S	.147	.546		1.72	.234	1.09	.102	.012	.0478	
		—	160	—	.187	.466		1.46	.171	1.31	.074	.009	.0527	
		XXS	—	—	.294	.252		.79	.050	1.71	.022	.003	.0577	
		—	—	5S	.065	.920		2.89	.665	.69	.288	.035	.0467	
		—	—	10S	.083	.884		2.78	.614	.86	.266	.032	.0566	
¾	1.050	STD	40	40S	.113	.824	3.30	2.59	.533	1.13	.231	.028	.0706	¾
		XS	80	80S	.154	.742		2.33	.433	1.47	.188	.022	.0853	
		—	160	—	.219	.612		1.92	.296	1.94	.128	.015	.1004	
		XXS	—	—	.308	.434		1.36	.148	2.44	.064	.008	.1103	
		—	—	5S	.065	1.185		3.72	1.103	.87	.478	.057	.0760	
		—	—	10S	.109	1.097		3.45	.945	1.40	.409	.049	.1151	
1	1.315	STD	40	40S	.133	1.049	4.13	3.30	.864	1.68	.375	.045	.1328	1
		XS	80	80S	.179	.957		3.01	.719	2.17	.312	.037	.1606	
		—	160	—	.250	.815		2.56	.522	2.84	.230	.027	.1903	
		XXS	—	—	.358	.599		1.88	.282	3.66	.122	.015	.2136	
		—	—	5S	.065	1.530		4.81	1.839	1.11	.797	.096	.1250	
		—	—	10S	.109	1.442		4.53	1.633	1.81	.708	.085	.1934	
1¼	1.660	STD	40	40S	.140	1.380	5.22	4.34	1.495	2.27	.649	.078	.2346	1¼
		XS	80	80S	.191	1.278		4.02	1.283	3.00	.555	.067	.2913	
		—	160	—	.250	1.160		3.64	1.057	3.76	.458	.055	.3421	
		XXS	—	—	.382	.896		2.81	.630	5.21	.273	.033	.4110	
		—	—	5S	.065	1.770		5.56	2.461	1.28	1.066	.128	.1662	
		—	—	10S	.109	1.682		5.28	2.222	2.09	.963	.115	.2598	
1½	1.900	STD	40	40S	.145	1.610	5.97	5.06	2.036	2.72	.882	.106	.3262	1½
		XS	80	80S	.200	1.500		4.71	1.767	3.63	.765	.092	.4118	
		—	160	—	.281	1.338		4.20	1.406	4.86	.608	.073	.5078	
		XXS	—	—	.400	1.100		3.46	.950	6.41	.420	.049	.5977	
		—	—	5S	.065	2.245		7.05	3.958	1.61	1.72	.206	.2652	
		—	—	10S	.109	2.157		6.78	3.654	2.64	1.58	.190	.4204	
2	2.375	STD	40	40S	.154	2.067	7.46	6.49	3.355	3.65	1.45	.174	.5606	2
		XS	80	80S	.218	1.939		6.09	2.953	5.02	1.28	.153	.7309	
		—	160	—	.344	1.687		5.30	2.241	7.46	.97	.116	.9790	
		XXS	—	—	.436	1.503		4.72	1.774	9.03	.77	.092	1.1040	
		—	—	5S	.083	2.709		8.51	5.764	2.48	2.50	.299	.4939	
		—	—	10S	.120	2.635		8.28	5.453	3.53	2.36	.283	.6868	
2½	2.875	STD	40	40S	.203	2.469	9.03	7.76	4.788	5.79	2.07	.249	1.064	2½
		XS	80	80S	.276	2.323		7.30	4.238	7.66	1.87	.220	1.339	
		—	160	—	.375	2.125		6.68	3.546	10.01	1.54	.184	1.638	
		XXS	—	—	.552	1.771		5.56	2.464	13.69	1.07	.128	1.997	

PIPE DATA TABLES
CONT'D.

Pipe Size (in.)	Outside Diameter (in.)	Weight Class	Carbon Steel Sched.	Stainless Steel Sched.	Wall Thick-ness (in.)	Inside Diameter (in.)	Circum. (Ext.) (in.)	Circum (Int.) (in.)	Flow Area (sq. in.)	Weight of Pipe (lbs/ Ft.)	Weight of Water (lbs/Ft.)	Gallons of Water per Ft.	Section Modulus	Pipe Size (in.)
		—	—	5S	.083	3.334		10.47	8.730	3.03	3.78	.454	.744	
		—	—	10S	.120	3.260		10.24	8.347	4.33	3.62	.434	1.041	
3	3.500	STD	40	40S	.216	3.068	11.00	9.64	7.393	7.58	3.20	.384	1.724	3
		XS	80	80S	.300	2.900		9.11	6.605	10.25	2.86	.343	2.225	
		—	160	—	.438	2.624		8.24	5.408	14.32	2.35	.281	2.876	
		XXS	—	—	.600	2.300		7.23	4.155	18.58	1.80	.216	3.424	
		—	—	5S	.083	4.334		13.62	14.75	3.92	6.39	.766	1.249	
		—	—	10S	.120	4.260		13.38	14.25	5.61	6.18	.740	1.761	
		STD	40	40S	.237	4.026		12.65	12.73	10.79	5.50	.661	3.214	
4	4.500	XS	80	80S	.337	3.826	14.14	12.02	11.50	14.98	4.98	.597	4.271	4
		—	120	—	.438	3.624		11.39	10.31	19.00	4.47	.536	5.178	
		—	160	—	.531	3.438		10.80	9.28	22.51	4.02	.482	5.898	
		XXS	—	—	.674	3.152		9.90	7.80	27.54	3.38	.405	6.791	
		—	—	5S	.109	5.345		16.79	22.44	6.36	9.72	1.17	2.498	
		—	—	10S	.134	5.295		16.63	22.02	7.77	9.54	1.14	3.029	
		STD	40	40S	.258	5.047		15.86	20.01	14.62	8.67	1.04	5.451	
5	5.563	XS	80	80S	.375	4.813	17.48	15.12	18.19	20.78	7.88	.945	7.431	5
		—	120	—	.500	4.563		14.34	16.35	27.04	7.09	.849	9.250	
		—	160	—	.625	4.313		13.55	14.61	32.96	6.33	.759	10.796	
		XXS	—	—	.750	4.063		12.76	12.97	38.55	5.61	.674	12.090	
		—	—	5S	.109	6.407		20.13	32.24	7.60	13.97	1.68	3.576	
		—	—	10S	.134	6.357		19.97	31.74	9.29	13.75	1.65	4.346	
		STD	40	40S	.280	6.065		19.05	28.89	18.97	12.51	1.50	8.496	
6	6.625	XS	80	80S	.432	5.761	20.81	18.10	26.07	28.57	11.29	1.35	12.22	6
		—	120	—	.562	5.501		17.28	23.77	36.39	10.30	1.24	14.98	
		—	160	—	.719	5.187		16.30	21.15	45.35	9.16	1.10	17.81	
		XXS	—	—	.864	4.897		15.38	18.84	53.16	8.16	.978	20.02	
		—	—	5S	.109	8.407		26.41	55.51	9.93	24.06	2.88	6.131	
		—	—	10S	.148	8.329		26.17	54.48	13.40	23.61	2.83	8.212	
		—	20	—	.250	8.125		25.53	51.85	22.36	22.47	2.69	13.39	
		—	30	—	.277	8.071		25.36	51.16	24.70	22.17	2.66	14.69	
		STD	40	40S	.322	7.981		25.07	50.03	28.55	21.70	2.60	16.81	
		—	60	—	.406	7.813		24.55	47.94	35.64	20.77	2.49	20.58	
8	8.625	XS	80	80S	.500	7.625	27.10	23.95	45.66	43.39	19.78	2.37	24.51	8
		—	100	—	.594	7.437		23.36	43.46	50.95	18.83	2.26	28.14	
		—	120	—	.719	7.187		22.58	40.59	60.71	17.59	2.11	32.58	
		—	140	—	.812	7.001		21.99	38.50	67.76	16.68	2.00	35.65	
		XXS	—	—	.875	6.875		21.60	37.12	72.42	16.10	1.93	37.56	
		—	160	—	.906	6.813		21.40	36.46	74.69	15.80	1.89	38.48	
		—	—	5S	.134	10.482		32.93	86.29	15.19	37.39	4.48	11.71	
		—	—	10S	.165	10.420		32.74	85.28	18.65	36.95	4.43	14.30	
		—	20	—	.250	10.250		32.20	82.52	28.04	35.76	4.29	21.15	
		—	30	—	.307	10.136		31.84	80.69	34.24	34.96	4.19	25.57	
		STD	40	40S	.365	10.020		31.48	78.86	40.48	34.20	4.10	29.90	
10	10.750	XS	60	80S	.500	9.750	33.77	30.63	74.66	54.74	32.35	3.88	39.43	10
		—	80	—	.594	9.562		30.04	71.84	64.43	31.13	3.73	45.54	
		—	100	—	.719	9.312		29.25	68.13	77.03	29.53	3.54	53.22	
		—	120	—	.844	9.062		28.47	64.53	89.29	27.96	3.35	60.32	
		XXS	140	—	1.000	8.750		27.49	60.13	104.13	26.06	3.12	68.43	
		—	160	—	1.125	8.500		26.70	56.75	115.64	24.59	2.95	74.29	

PIPE DATA TABLES
CONT'D.

Pipe Size (in.)	Outside Diameter (in.)	Weight Class	Carbon Steel Sched.	Stainless Steel Sched.	Wall Thick-ness (in.)	Inside Diameter (in.)	Circum. (Ext.) (in.)	Circum (Int.) (in.)	Flow Area (sq. in.)	Weight of Pipe (lbs/Ft.)	Weight of Water (lbs/Ft.)	Gallons of Water per Ft.	Section Modulus	Pipe Size (in.)
		—	—	5S	.156	12.438		39.08	121.50	20.98	52.65	6.31	19.2	
		—	—	10S	.180	12.390		38.92	120.57	24.17	52.25	6.26	22.0	
		—	20	—	.250	12.250		38.48	117.86	33.38	51.07	6.12	30.2	
		—	30	—	.330	12.090		37.98	114.80	43.77	49.74	5.96	39.0	
		STD	—	40S	.375	12.000		37.70	113.10	49.56	49.00	5.88	43.8	
		—	40	—	.406	11.938		37.50	111.93	53.52	48.50	5.81	47.1	
12	12.750	XS	—	80S	.500	11.750	40.06	36.91	108.43	65.42	46.92	5.63	56.7	12
		—	60	—	.562	11.626		36.52	106.16	73.15	46.00	5.51	62.8	
		—	80	—	.688	11.374		35.73	101.64	88.63	44.04	5.28	74.6	
		—	100	—	.844	11.062		34.75	96.14	107.32	41.66	4.99	88.1	
		XXS	120	—	1.000	10.750		33.77	90.76	125.49	39.33	4.71	100.7	
		—	140	—	1.125	10.500		32.99	86.59	139.67	37.52	4.50	109.9	
		—	160	—	1.312	10.126		31.81	80.53	160.27	34.89	4.18	122.6	
		—	—	5S	.156	13.688		43.00	147.15	23.07	63.77	7.64	23.2	
		—		10S	.188	13.624		42.80	145.78	27.73	63.17	7.57	27.8	
		—	10	—	.250	13.500		42.41	143.14	36.71	62.03	7.44	36.6	
		—	20	—	.312	13.376		42.02	140.52	45.61	60.89	7.30	45.0	
		STD	30	—	.375	13.250		41.63	137.88	54.57	59.75	7.16	53.2	
		—	40	—	.438	13.124		41.23	135.28	63.44	58.64	7.03	61.3	
14	14.000	XS	—	—	.500	13.000	43.98	40.84	132.73	72.09	57.46	6.90	69.1	14
		—	60	—	.594	12.812		40.25	128.96	85.05	55.86	6.70	80.3	
		—	80	—	.750	12.500		39.27	122.72	106.13	53.18	6.37	98.2	
		—	100	—	.938	12.124		38.09	115.49	130.85	50.04	6.00	117.8	
		—	120	—	1.094	11.812		37.11	109.62	150.79	47.45	5.69	132.8	
		—	140	—	1.250	11.500		36.13	103.87	170.28	45.01	5.40	146.8	
		—	160	—	1.406	11.188		35.15	98.31	189.11	42.60	5.11	159.6	
		—	—	5S	.165	15.670		49.23	192.85	27.90	83.57	10.02	32.2	
		—	—	10S	.188	15.624		49.08	191.72	31.75	83.08	9.96	36.5	
		—	10	—	.250	15.500		48.69	188.69	42.05	81.74	9.80	48.0	
		—	20	—	.312	15.376		48.31	185.69	52.27	80.50	9.65	59.2	
		STD	30	—	.375	15.250		47.91	182.65	82.58	79.12	9.49	70.3	
		XS	40	—	.500	15.000		47.12	176.72	82.77	76.58	9.18	91.5	
16	16.00	—	60	—	.656	14.688	50.27	46.14	169.44	107.50	73.42	8.80	116.6	16
		—	80	—	.844	14.312		44.96	160.92	136.61	69.73	8.36	144.5	
		—	100	—	1.031	13.938		43.79	152.58	164.82	66.12	7.93	170.5	
		—	120	—	1.219	13.562		42.61	144.50	192.43	62.62	7.50	194.5	
		—	140	—	1.438	13.124		41.23	135.28	233.64	58.64	7.03	220.0	
		—	160	—	1.594	12.812		40.26	128.96	245.25	55.83	6.70	236.7	
		—	—	5S	.165	17.67		55.51	245.22	31.43	106.26	12.74	40.8	
		—	—	10S	.188	17.62		55.37	243.95	35.76	105.71	12.67	46.4	
		—	10	—	.250	17.50		54.98	240.53	47.39	104.21	12.49	61.1	
		—	20	—	.312	17.38		54.59	237.13	58.94	102.77	12.32	75.5	
		STD	—	—	.375	17.25		54.19	233.71	70.59	101.18	12.14	89.6	
		—	30	—	.438	17.12		53.80	230.30	82.15	99.84	11.96	103.4	
		XS	—	—	.500	17.00		53.41	226.98	93.45	98.27	11.79	117.0	
18	18.00	—	40	—	.562	16.88	56.55	53.02	223.68	104.87	96.93	11.62	130.1	18
		—	60	—	.750	16.50		51.84	213.83	138.17	92.57	11.11	168.3	
		—	80	—	.938	16.12		50.66	204.24	170.92	88.50	10.61	203.8	
		—	100	—	1.156	15.69		49.29	193.30	207.96	83.76	10.04	242.3	
		—	120	—	1.375	15.25		47.91	182.66	244.14	79.07	9.49	277.6	
		—	140	—	1.562	14.88		46.73	173.80	274.22	75.32	9.03	305.5	
		—	160	—	1.781	14.44		45.36	163.72	308.50	70.88	8.50	335.6	

PIPE DATA TABLES
CONT'D.

Pipe Size (in.)	Outside Diameter (in.)	Weight Class	Carbon Steel Sched.	Stainless Steel Sched.	Wall Thick-ness (in.)	Inside Diameter (in.)	Circum. (Ext.) (in.)	Circum (Int.) (in.)	Flow Area (sq. in.)	Weight of Pipe (lbs/Ft.)	Weight of Water (lbs/Ft.)	Gallons of Water per Ft.	Section Modulus	Pipe Size (in.)
		—	—	5S	.188	19.62		61.65	302.46	39.78	131.06	15.71	57.4	
		—	—	10S	.218	19.56		61.46	300.61	46.06	130.27	15.62	66.3	
		—	10	—	.250	19.50		61.26	298.65	52.73	129.42	15.51	75.6	
		—	20	—	.375	19.25		60.48	290.04	78.60	125.67	15.12	111.3	
		STD	30	—	.500	19.00		59.69	283.53	104.13	122.87	14.73	145.7	
20	20.00	XS	40	—	.594	18.81	62.83	59.10	278.00	123.11	120.46	14.44	170.4	20
		—	60	—	.812	18.38		57.73	265.21	166.40	114.92	13.78	225.7	
		—	80	—	1.031	17.94		56.35	252.72	208.87	109.51	13.13	277.1	
		—	100	—	1.281	17.44		54.78	238.83	256.10	103.39	12.41	331.5	
		—	120	—	1.500	17.00		53.41	226.98	296.37	98.35	11.79	375.5	
		—	140	—	1.750	16.50		51.84	213.82	341.09	92.66	11.11	421.7	
		—	160	—	1.969	16.06		50.46	202.67	379.17	87.74	10.53	458.5	
		—	—	5S	.188	21.62		67.93	367.25	43.80	159.14	19.08	69.7	
		—	—	10S	.218	21.56		67.75	365.21	50.71	158.26	18.97	80.4	
		—	10	—	.250	21.50		67.54	363.05	58.07	157.32	18.86	91.8	
		STD	20	—	.375	21.25		66.76	354.66	86.61	153.68	18.42	135.4	
		XS	30	—	.500	21.00		65.97	346.36	114.81	150.09	17.99	117.5	
22	22.00	—	60	—	.875	20.25	69.12	63.62	322.06	197.41	139.56	16.73	295.0	22
		—	80	—	1.125	19.75		62.05	306.35	250.81	132.76	15.91	366.4	
		—	100	—	1.375	19.25		60.48	291.04	302.88	126.12	15.12	432.6	
		—	120	—	1.625	18.75		58.90	276.12	353.61	119.65	14.34	493.8	
		—	140	—	1.875	18.25		57.33	261.59	403.00	113.36	13.59	550.3	
		—	160	—	2.125	17.75		55.76	247.45	451.06	107.23	12.85	602.4	
		—	—	5S	.218	23.56		74.03	436.10	55	188.98	22.65	96.0	
		—	10	10S	.250	23.50		73.83	433.74	63	187.95	22.53	109.6	
		STD	20	—	.375	23.25		73.04	424.56	95	183.95	22.05	161.9	
		XS	—	—	.500	23.00		72.26	415.48	125	179.87	21.58	212.5	
		—	30	—	.562	22.88		71.86	411.00	141	178.09	21.35	237.0	
24	24.00	—	40	—	.688	22.62	75.40	71.08	402.07	171	174.23	20.88	285.1	24
		—	60	—	.969	22.06		69.31	382.35	238	165.52	19.86	387.7	
		—	80	—	1.219	21.56		67.74	365.22	297	158.26	18.97	472.8	
		—	100	—	1.531	20.94		65.78	344.32	367	149.06	17.89	570.8	
		—	120	—	1.812	20.38		64.01	326.08	430	141.17	16.94	652.1	
		—	140	—	2.062	19.88		62.44	310.28	483	134.45	16.12	718.9	
		—	160	—	2.344	19.31		60.67	292.98	542	126.84	15.22	787.9	
		—	—	5S	.250	29.50		92.68	683.49	79	296.18	35.51	172.3	
		—	10	10S	.312	29.38		92.29	677.71	99	293.70	35.21	213.8	
30	30.00	STD	—	—	.375	29.25	94.25	91.89	671.96	119	291.18	34.91	255.3	30
		XS	20	—	.500	29.00		91.11	660.52	158	286.22	34.31	336.1	
		—	30	—	.625	28.75		90.32	649.18	196	281.31	33.72	414.9	

GLOSSARY OF TERMS

Celtron Cartridge - The thermodynamic capsule comprising the operational components of most Spence thermodynamic traps.

Differential Pressure - The pressure upstream of the steam trap less the pressure after the trap is referred to as differential pressure. When sizing Spence traps the capacity charts are based on the differential pressures across the trap.

HC - This is a suffix on some Spence thermostatic traps indicating a high capacity option. Sometimes called OS.

ISO - See Subcooling fill.

L - A suffix on some Spence thermostatic and thermodynamic traps indicating a low capacity option.

OS - See HC

R - A suffix on some Spence thermostatic traps indicating a reduced capacity option.

Saturated Temperature - The temperature at which water boils at a given pressure. Water changes phase into steam along a pressure temperature curve. These pressures and temperatures may be found in the steam tables.

Skirted Seat (SK) - This is an option employing a seat that diffuses the condensate discharge reducing the possibility of internal body erosion. This option, available on the N450 and N650, should be specified when the steam service pressure is in the top third of the trap's pressure rating.

Spiral Wound Gasket - This class of gasket is utilized throughout our higher pressure traps and the Uniflex union. It is characterized by utilizing a metal winding, often stainless steel, sandwiching a filler, often a graphite material. While relatively expensive, the sealing performance of this class of gasket is generally considered superior to most others.

Steam Lock Release (SLR) - This is an orifice from .0225 to .03125 inches dependent on model, added to a steam trap to prevent flash steam locking. This option is recommended when condensate piping must rise over an obstacle before draining to a trap. A typical application would be a coil in a kettle whose outlet must rise over the side before dropping to the steam trap. An alternate usage typically involves thermostatic traps in clean steam or sterilizer applications. The SLR is specified to increase sensitivity and minimize condensate backup.

Sterilizer Trim - This option typically employs an alternate seat. Internal geometries are altered in such a fashion that trap sensitivity is increased. The option takes its name from the service often requiring the most sensitive of thermostatic traps. Sterilizer trim is occasionally combined with high capacity and SLR options thus yielding a super sensitive high capacity steam trap.

Subcool - often associated with the sensitivity of a thermostatic trap this term indicates a temperature below the saturated steam curve. Thermostatic traps actuate at temperatures below saturated. Standard Spence Traps typically actuate in the 8° to 10°F subcool range i.e. they expel condensate 8° to 10°F below saturated steam temperature.

Subcooling Fill - An optional bellows utilizing an alternate fill enabling the trap to release condensate at 30° to 40°F below saturated temperature. This option should be specified when reducing the volume of flash steam created by condensate is desired or when pressures exceeding 500 psi are expected. Also referred to as ISO.

Welded Bellows - Temperature sensitive, fluid filled bellows opens to let condensate and air out and closes to trap steam in. Welded bellows fail open or fail closed in the event of bellows failure. Welded bellows are available in stainless steel and inconel, depending on model.

STEAM TABLE QUICK REFERENCE CHART

PRESS PSIG	TEMP °F	TEMP °C	PRESS PSIG	TEMP °F	TEMP °C	PRESS PSIG	TEMP °F	TEMP °C
0	212	100	85	328	164	290	419	215
1	215	102	90	331	166	300	422	217
3	219	104	95	335	168	320	428	220
5	227	108	100	338	170	340	433	223
8	235	113	110	344	173	360	438	226
10	239	115	120	350	177	380	443	229
15	250	121	130	356	180	400	448	231
20	259	126	140	361	183	420	453	234
25	267	130	150	366	186	440	457	236
30	274	134	160	371	188	460	462	239
35	281	138	170	375	191	480	466	241
40	287	142	180	380	193	500	470	243
45	292	145	190	384	195	520	474	246
50	298	148	200	388	198	540	478	248
55	303	150	215	394	201	560	482	250
60	307	153	230	399	204	580	485	252
65	312	155	245	404	207	600	489	254
70	316	158	250	406	208	620	492	256
75	320	160	260	409	210	640	496	258
80	324	162	275	414	212	660	499	259

All the information in this Spence Designer's Guide can be found on www.SpenceValve.com.

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