Steam Traps
Thermodynamic Steam Trap

TD600
Thermodynamic

Model	**TD600, TD600L**
Sizes	**3/8", 1/2", 3/4", 1"**
Connections	**NPT**
Body Material	**Stainless Steel 420F**
Options	**Insulation Cap**
PMO Max. Operating Pressure	**600 PSIG**
TMO Max. Operating Temperature	**800°F**
PMA Max. Allowable Pressure	**600 PSIG up to 800°F**
TMA Max. Allowable Temperature	**800°F @ 600 PSIG**

Typical Applications

DRIP, TRACING: TD600 model steam traps are most commonly used in drip applications, such as draining condensate from steam mains and steam supply lines. They can also be used for steam tracing applications. These traps are suitable for outdoor applications that are subject to freezing as well as superheated steam conditions. They are compact and rugged with only a single moving part. If a trap with an integral strainer is desired, the TD600S is recommended. If a fully in-line repairable design is required, the TD700S or the UTD450 with Universal Quick-Change connector is recommended.

How It Works

The disc is the only moving part inside a thermodynamic trap. When steam enters the trap, it creates an internal pressure above the disc that instantly forces the disc to close tightly on the seat, preventing the steam from escaping. The internal steam pressure (holding the disc and seat shut) eventually drops, and the trap re-opens. When condensate enters the trap, it pushes the disc upwards, allowing the condensate to freely discharge. If steam is present, the trap instantly shuts.

Features

- High pressure applications up to 600 PSIG
- Hardened stainless steel seat and disc for extended service life even at high pressure
- Single trap will operate over the entire pressure range of 3.5-600 PSIG (recommended above 30 PSIG)
- Suitable for superheated steam
- Freeze-proof when trap is piped in a vertical orientation for complete drainage of condensate
- Three-hole balanced discharge extends life of the seat area
- Trap will function in any orientation (horizontal preferred)

Sample Specification

The steam trap shall be a thermodynamic disc type with all stainless steel construction. Integral seat design and disc to be hardened for long service life. Unit shall be capable of installation in any orientation and self-draining when mounted vertically.

Installation and Maintenance

The TD600 can be installed in any orientation; however, horizontal with cap facing upward is preferred for longest service life. The one piece body-seat design is extremely simple and economical; however, this configuration is generally considered not fully repairable since the seat cannot be repaired if damaged or worn. Welding of trap body directly into pipeline is not recommended since excessive heat may cause distortion of the seat area. The TD600 does not contain an integral strainer and separate strainer should therefore be installed to protect from dirt and pipe scale. If a fully in-line repairable design or a trap that can be welded into pipeline is desired, the TD700S, TD900S or the UTD450 with Universal Quick-Change connector is recommended.

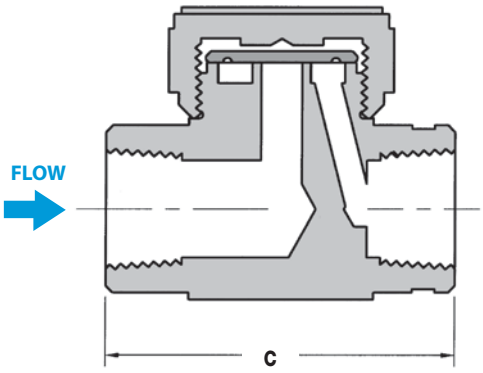
Helpful Selection Information

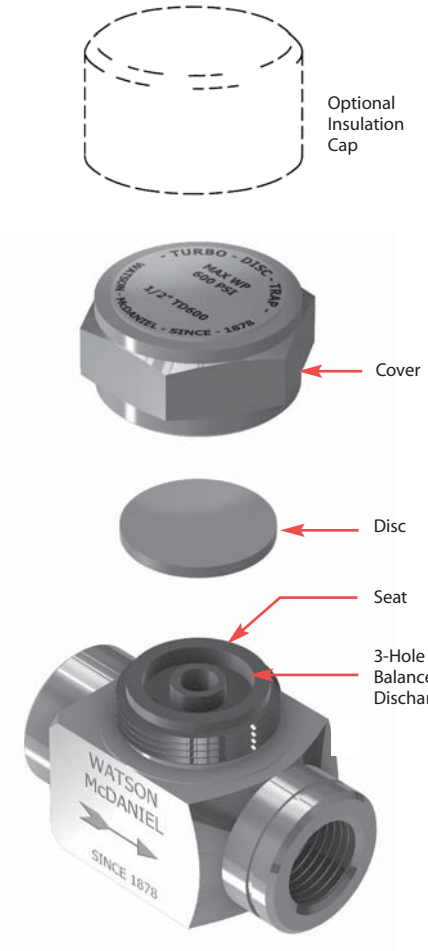
The TD600**L** has reduced size discharge orifice holes which are preferable in terms of performance, longevity, and efficiency; particularly on pressures over 150 psi. For most drip applications the 1/2" TD600**L** should have sufficient capacity. For higher load drip applications or if a 3/4" pipe connection is required, use 3/4" TD600**L** for best results. Choosing a model with a condensate handling capacity in the range of the specific application will prolong trap life.

L = Reduced Size Discharge Orifice holes which are preferable in terms of performance, longevity, and efficiency; particularly on pressures over 150 psi.

Options

An insulation cap is available to reduce cycle rates and steam loss in rain, snow, or cold environments.





DIMENSIONS & WEIGHTS – *inches*

Size	Model Code	Connection	A	B	C	Weight (lbs)
3/8"	TD600-11-N	NPT	1.37	1.69	2.00	0.75
1/2"	TD600-12-N	NPT	1.50	2.00	2.69	1.25
3/4"	TD600-13-N	NPT	1.75	2.38	2.81	2.00
1"	TD600-14-N	NPT	2.12	2.81	3.81	3.00
1/2"	TD600L-12-N	NPT	1.50	1.81	2.71	1.00
3/4"	TD600L-13-N	NPT	1.50	2.25	2.75	1.75

How to Size / Order

Select working pressure; follow column down to correct capacity (lbs/hr) block. Example:

Application: 500 lbs/hr at 100 PSIG working inlet pressure
Size/Model: 3/4" **TD600L-13-N**

MATERIALS

Body	Stainless Steel, AISI 420F
Disc	Stainless Steel, AISI 420
Cover	Stainless Steel, AISI 416
Insulation Cap	Stainless Steel, AISI 304

CAPACITIES – *Condensate (lbs/hr)*

Size	Model Code	Steam Inlet Pressure (PSIG)																				
		3.5	5	10	15	20	25	30	40	50	75	100	150	200	250	300	350	400	450	500	550	600
1/2"	TD600L-12-N	180	185	190	195	200	215	220	230	250	310	375	500	620	710	800	825	900	1070	1120	1185	1290
3/4"	TD600L-13-N	300	315	350	380	415	440	470	515	580	710	825	1020	1165	1300	1440	1565	1670	1775	1880	1960	2060
3/8"	TD600-11-N	180	185	190	195	200	215	220	230	250	310	375	500	620	710	800	825	900	1070	1120	1185	1290
1/2"	TD600-12-N	300	315	350	380	415	440	470	515	580	710	825	1020	1165	1300	1440	1565	1670	1775	1880	1960	2060
3/4"	TD600-13-N	415	430	475	520	565	610	650	720	825	1020	1185	1480	1710	1950	2110	2265	2490	2625	2780	2985	3140
1"	TD600-14-N	650	680	740	815	885	940	1000	1080	1225	1500	1800	2215	2625	2935	3300	3600	3875	4120	4350	4560	4840

Notes: *1) Maximum back pressure not to exceed 80% of inlet pressure (measured in absolute pressure) or trap may not close.*
2) For optimum performance, recommended for operating pressure above 30 PSIG.

Steam Traps
Thermodynamic Steam Trap

TD600S
Thermodynamic

Model	**TD600S, TD600LS**
Sizes	**1/2", 3/4", 1"**
Connections	**NPT**
Body Material	**Stainless Steel 420F**
Options	**Blowdown Valve, Insulation Cap**
PMO Max. Operating Pressure	**600 PSIG**
TMO Max. Operating Temperature	**750°F**
PMA Max. Allowable Pressure	**915 PSIG up to 250°F**
TMA Max. Allowable Temperature	**610°F @ 750 PSIG**

TD600S
Strainer

TD600SB
Strainer &
Blowdown Valve

Typical Applications

DRIP, TRACING: TD600S model steam traps with integral strainer are most commonly used in drip applications, such as draining condensate from steam mains and steam supply lines. They can also be used for steam tracing applications. These traps are suitable for outdoor applications that are subject to freezing as well as superheated steam conditions. They are compact and rugged with only a single moving part. Integral strainer protects against dirt and scale. If a fully in-line repairable design is required, the TD700S or the UTD450 with Universal Quick-Change Connector is recommended.

How It Works

The disc is the only moving part inside a thermodynamic trap. When steam enters the trap, it creates an internal pressure above the disc that instantly forces the disc to close tightly on the seat, preventing the steam from escaping. The internal steam pressure (holding the disc and seat shut) eventually drops, and the trap re-opens. When condensate enters the trap, it pushes the disc upwards, allowing the condensate to freely discharge. If steam is present, the trap instantly shuts.

Features

- Integral strainer with optional blowdown valve to protect trap from contamination
- High pressure applications up to 600 PSIG
- Hardened stainless steel seat and disc for extended service life even at high pressure
- Single trap will operate over the entire pressure range of 3.5-600 PSIG (recommended above 30 PSIG)
- Suitable for superheated steam
- Freeze-proof when trap is piped in a vertical orientation for complete drainage of condensate
- Three-hole balanced discharge extends life of the seat area
- Trap will function in any orientation (horizontal preferred)

Sample Specification

The steam trap shall be all stainless steel thermodynamic type with hardened integral seat and disc with integral strainer and blowdown valve.

Installation and Maintenance

The TD600S can be installed in any orientation; however, horizontal with cap facing upward is preferred for longest service life. The one piece body-seat design is extremely simple and economical; however, this configuration is generally considered not fully repairable since the seat cannot be replaced if damaged or worn. Welding of trap body directly into pipeline is not recommended since excessive heat can cause distortion of the seat area. All models of the TD600S contain an integral strainer for protection against dirt and scale. If a fully in-line repairable design or a trap that can be welded into pipeline is desired, the TD700S, TD900S or the UTD450 with Universal Quick-Change connectors is recommended.

Helpful Selection Information

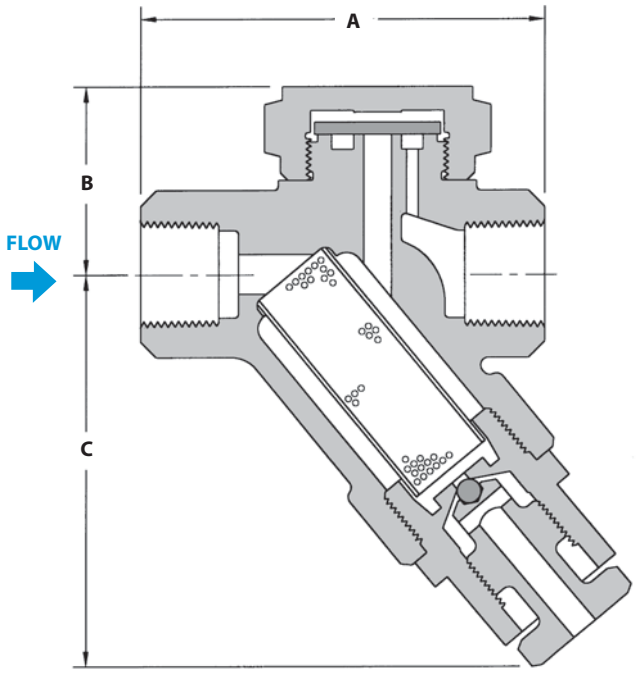
The TD600**L**S has reduced size discharge orifice holes which are preferable in terms of performance, longevity, and efficiency; particularly on pressures over 150 psi. For most drip applications the 1/2" TD600**L**S should have sufficient capacity. For higher load drip applications or if a 3/4" pipe connection is required, use 3/4" TD600**L**S for best results. Choosing a model with a condensate handling capacity in the range of the specific application will prolong trap life.

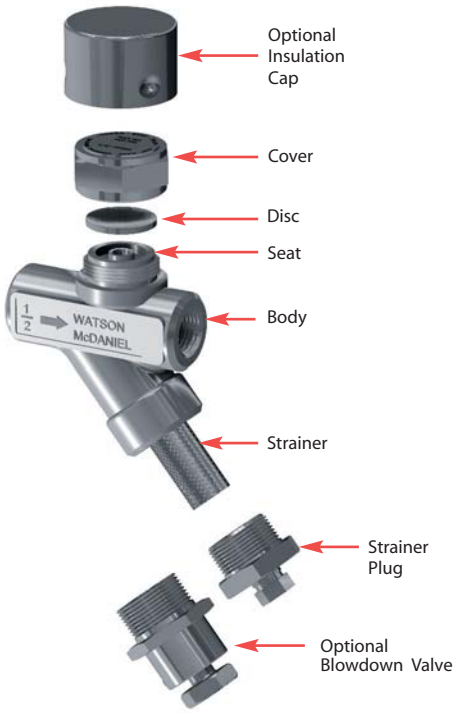
L = Reduced Size Discharge Orifice holes which are preferable in terms of performance, longevity, and efficiency; particularly on pressures over 150 psi.

Options

An insulation cap is available to reduce cycle rates and steam loss in rain, snow, or cold environments. Blowdown valve, used for flushing dirt and scale from strainer.

TD600S
Thermodynamic





DIMENSIONS & WEIGHTS – *inches*

Size	Model	Conn.	A	B	C	Weight (lbs)
Series TD600S (Strainer)						
1/2"	TD600S-12-N	NPT	3.16	1.50	2.53	2
1/2"	TD600LS-12-N	NPT	3.16	1.44	2.53	1.5
3/4"	TD600S-13-N	NPT	3.56	1.62	2.53	2.5
3/4"	TD600LS-13-N	NPT	3.56	1.56	2.53	2.4
1"	TD600LS-13-N	NPT	3.75	1.44	2.53	2.5
Series TD600SB (Strainer & Blowdown Valve)						
1/2"	TD600SB-12-N	NPT	3.16	1.50	3.5	2.3
1/2"	TD600LSB-12-N	NPT	3.16	1.44	3.5	2.0
3/4"	TD600SB-13-N	NPT	3.56	1.62	3.5	2.8
3/4"	TD600LSB-13-N	NPT	3.56	1.56	3.5	2.7
1"	TD600LSB-14-N	NPT	3.72	1.44	3.5	2.7

MATERIALS

Body	Stainless Steel, AISI 420F
Disc	Stainless Steel, AISI 420
Cover	Stainless Steel, AISI 416
Insulation Cap	Stainless Steel, AISI 304
Strainer Screen	Stainless Steel, AISI 304
Blowdown Valve	Stainless Steel, AISI 303

How to Size / Order

Select working pressure; follow column down to correct capacity (lbs/hr) block. Example:

Application: 500 lbs/hr at 100 PSIG working inlet pressure
Size/Model: 3/4" **TD600LS-13-N**

CAPACITIES – *Condensate (lbs/hr)*

Size	Model	Steam Inlet Pressure (PSIG) 3.5	5	10	15	20	25	30	40	50	75	100	150	200	250	300	400	450	500	550	600
1/2" 1"	TD600LS-12-N TD600LS-14-N	180	185	190	195	200	215	220	230	250	310	375	500	620	710	800	900	1070	1120	1185	1290
3/4"	TD600LS-13-N	300	315	350	380	415	440	470	515	580	710	825	1020	1165	1300	1440	1670	1775	1880	1960	2060
1/2"	TD600S-12-N	300	315	350	380	415	440	470	515	580	710	825	1020	1165	1300	1440	1670	1775	1880	1960	2060
3/4"	TD600S-13-N	415	430	475	520	565	610	650	720	825	1020	1185	1480	1710	1950	2110	2265	2625	2780	2985	3140

Note: *Maximum back pressure not to exceed 80% of inlet pressure (measured in absolute pressure) or trap may not close.*
Note: *For optimum performance, recommended for operating pressure above 30 PSIG.*

Steam Traps
Thermodynamic Steam Trap (Repairable)

TD700S
Thermodynamic

Model	**TD700S, TD700HS**
Sizes	**1/2", 3/4", 1"**
Connections	**NPT, SW, FLG**
Body Material	**Chrome-Moly Alloy Steel**
Options	**Blowdown Valve, Insulation Cap**
PMO Max. Operating Pressure	**600 PSIG**
TMO Max. Operating Temperature	**800°F**
PMA Max. Allowable Pressure	**600 PSIG up to 800°F**
TMA Max. Allowable Temperature	**800°F @ 600 PSIG**

TD700S is a Direct Replacement for Yarway Model 721

TD700S
Strainer

TD700SB
Strainer &
Blowdown Valve

Typical Applications

DRIP, TRACING: **TD700S** model steam traps are fully in-line repairable and most commonly used in drip applications, such as draining condensate from steam mains and steam supply lines. They can also be used for steam tracing applications. These traps are suitable for outdoor applications that are subject to freezing as well as superheated steam conditions. They feature a "Quick-Replace" capsule that contains the trap's complete internal working mechanism, which is easily replaced while the trap body remains in-line. All models contain an integral strainer for protection against dirt and scale.

How It Works

The disc is the only moving part inside a thermodynamic trap. When steam enters the trap, it creates an internal pressure above the disc that instantly forces the disc to close tightly on the seat, preventing the steam from escaping. The internal steam pressure (holding the disc and seat shut) eventually drops, and the trap re-opens. When condensate enters the trap, it pushes the disc upwards, allowing the condensate to freely discharge. If steam is present, the trap instantly shuts.

Features

- "Quick-Replace" capsule design for easy in-line repair
- Integral strainer with optional blowdown valve to protect trap from contamination
- High pressure applications up to 600 PSIG
- Hardened stainless steel seat and disc for extended service life even at high pressure
- Single trap will operate over the entire pressure range 4-600 PSIG (recommended above 30 PSI)
- Suitable for superheated steam
- Freeze-proof when trap is piped in a vertical orientation for complete drainage of condensate
- Non-integral seat and chrome-moly body allow for trap to be welded in-line
- Trap will function in any orientation (horizontal preferred)

Sample Specification

The steam trap shall be a thermodynamic style in a chrome-moly alloy steel body with an integral strainer and optional blowdown valve. Unit shall have an all stainless steel in-line removable seat and disc capsule assembly. Trap shall be capable of installation in any orientation and self-draining when mounted vertically.

Installation and Maintenance

The TD700S can be installed in any orientation; however, horizontal with cap facing upward is preferred for longest service life. For maintenance, ALL internal components are easily removed and completely changed using a replacement kit. All models of the TD700S contain an integral strainer for protection against dirt and scale. Available in NPT, Socket-Weld and Flange connections.

Helpful Selection Information

The TD700HS is a high pressure version of the standard TD700S model. While both the TD700S and TD700HS will operate with pressures up to 600 PSIG, the TD700HS has a slightly smaller discharge orifice and is recommended for system pressures over 300 PSIG because of increased efficiency and performance. The TD700S is available in NPT, socket weld, and flange connections from 1/2" through 1". Replacement capsules are available, see Parts & Kits Section.

Options

Blowdown valve, used for flushing dirt and scale from strainer.

Customized Flanged Connections:

TD700HS

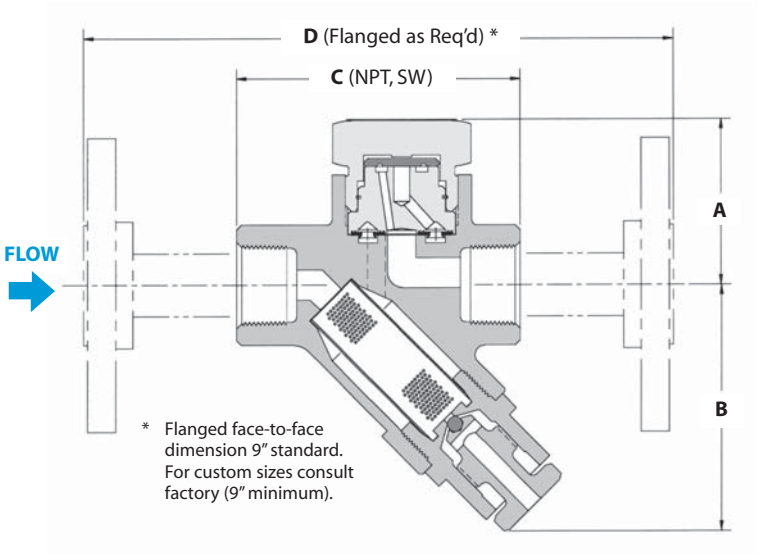
The **TD700HS** is the high pressure version of the TD700S.

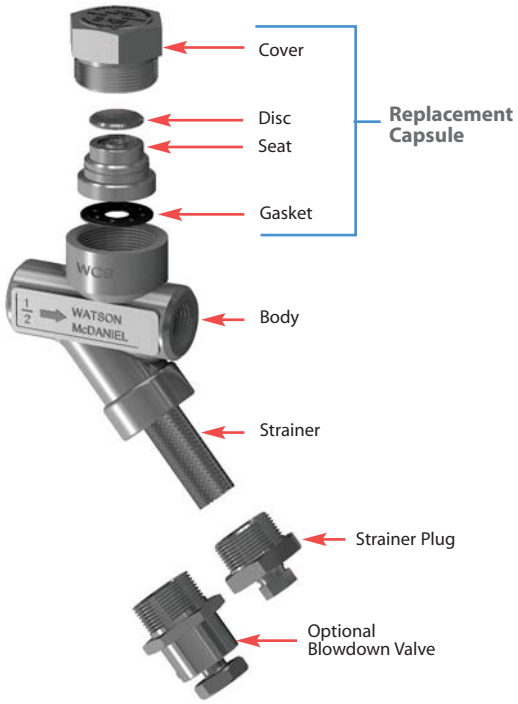
The standard model **TD700S** will operate over the entire pressure range, however, the **TD700HS** will operate more efficiently and have a longer service life for pressures over 300 PSIG.

TD700S	Standard pressure capsule	4-300 PSIG
TD700HS	High pressure capsule	150-600 PSIG

Option: **TD700SB** = Blowdown Valve

Thermodynamic Steam Trap (Repairable)





DIMENSIONS & WEIGHTS – *inches*

Size/Model	Connection	A	B	C	Weight (lbs)
Series TD700S & TD700HS (Strainer)					
1/2"	NPT, SW	2.04	2.50	3.16	2.0
3/4"	NPT, SW	2.04	2.50	3.55	2.0
1"	NPT, SW	2.04	2.50	6.31	2.0
Series TD700SB & TD700HSB (Strainer & Blowdown Valve)					
1/2"	NPT, SW	2.04	3.06	3.16	2.25
3/4"	NPT, SW	2.04	3.06	3.55	2.25
1"	NPT, SW	2.04	3.06	6.31	2.25

MATERIALS

Body	Chrome Moly ASTM A-217, GR WC9
Seat	Stainless Steel, 420F
Seat Gasket	316SS/Grafoil
Cover	Stainless Steel, 416
Disc	Stainless Steel, 420
Retaining Ring	Stainless Steel Spring Wire
Screen	Stainless Steel, 304
Strainer Plug, Pipe Plug	Stainless Steel, 303
Blowdown Valve	Stainless Steel
Flanges	Carbon Steel

How to Size / Order

Select working pressure; follow column down to correct capacity (lbs/hr) block. Example:

Application: 275 lbs/hr at 100 PSIG working inlet pressure

Size/Model: **TD700S**, specify pipe size and connections (NPT, SW, FLG)

CAPACITIES – *Condensate (lbs/hr)*

Size	Conn.	Model Code	Steam Inlet Pressure (PSIG) 4	5	6	7	8	9	10	20	30	40	50	60	80	100	150	300	400	500	600
1/2"	NPT	TD700S-12-N	95	105	115	120	125	130	140	180	220	250	265	280	320	350	405	550	600	650	700
	SW	TD700S-12-SW																			
3/4"	NPT	TD700S-13-N	95	105	115	120	125	130	140	180	220	250	265	280	320	350	405	550	600	650	700
	SW	TD700S-13-SW																			
1"	NPT	TD700S-14-N	95	105	115	120	125	130	140	180	220	250	265	280	320	350	405	550	600	650	700
	SW	TD700S-14-SW																			
1/2"	NPT	TD700HS-12-N															250	330	380	410	450
	SW	TD700HS-12-SW																			
3/4"	NPT	TD700HS-13-N															250	330	380	410	450
	SW	TD700HS-13-SW																			
1"	NPT	TD700HS-14-N															250	330	380	410	450
	SW	TD700HS-14-SW																			

Notes: *1) Maximum back pressure not to exceed 80% of inlet pressure (measured in absolute pressure) or trap may not close.*
2) For optimum performance, recommended for operating pressure above 30 PSIG.

Steam Traps
Thermodynamic Steam Trap (Repairable)

TD900S
Thermodynamic

Model	**TD900S, TD900LS**
Sizes	**1/2", 3/4", 1"**
Connections	**NPT, SW, 600# FLG**
Body Material	**Low Carbon Chrome-Moly**
Options	**Insulation Cap**
PMO Max. Operating Pressure	**900 PSIG**
TMO Max. Operating Temperature	**842ºF**
PMA Max. Allowable Pressure	**1500 PSIG @ 100ºF**
TMA Max. Allowable Temperature	**842ºF @ 981 PSIG**

Typical Applications

DRIP: TD900S model steam traps, capable of handling pressures up to 900 PSIG, are used in drip applications such as draining condensate from steam mains and steam supply lines. The complete internal working mechanism can be replaced while the trap body remains connected in-line. All models contain an integral strainer for protection against dirt and scale. These traps are suitable for outdoor applications that are subject to freezing as well as superheated steam conditions.

How It Works

The disc is the only moving part inside a thermodynamic trap. When steam enters the trap, it creates an internal pressure above the disc that instantly forces the disc to close tightly on the seat, preventing the steam from escaping. The internal steam pressure (holding the disc and seat shut) eventually drops, and the trap re-opens. When condensate enters the trap, it pushes the disc upwards, allowing the condensate to freely discharge. If steam is present, the trap instantly shuts.

Features

- "Quick-Change" seat and disc for easy in-line repair
- High pressure applications up to 900 PSIG
- Integral strainer to protect trap from contamination
- Hardened stainless steel seat and disc for extended service life even at extremely high pressures
- Single trap model will operate over the entire pressure range (20-900 PSIG)
- Suitable for superheated steam
- Freeze-proof when trap is piped in a vertical orientation for complete drainage of condensate
- Trap will function in any orientation (horizontal preferred)

Sample Specification

The steam trap shall be a thermodynamic style with body material in chrome-moly alloy steel. Available in size 1/2", 3/4" and 1" Class 600 socket weld ends or flanges. Unit shall have hardened stainless steel seat and disc with a removable stainless steel strainer.

Installation and Maintenance

The TD900S can be installed in any orientation; however, horizontal with cap facing upward is preferred for longest service life. For maintenance, ALL internal components are easily removed and completely changed using a replacement kit. All models contain an integral strainer for protection against dirt and scale. Available in NPT, Socket-Weld and Flange connections.

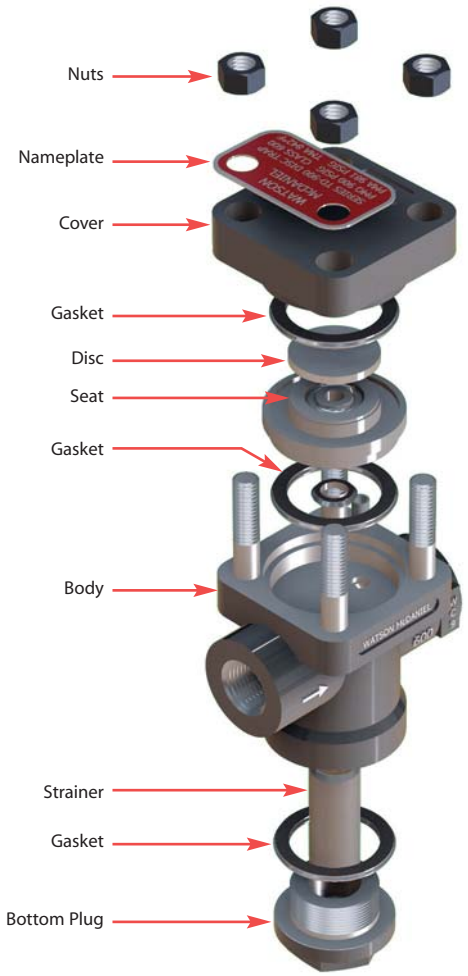
Helpful Selection Information

The TD900LS is a reduced capacity version of the standard TD900S model. The TD900S is available in NPT, Socket Weld,and Flange connections from 1/2" thru 1".

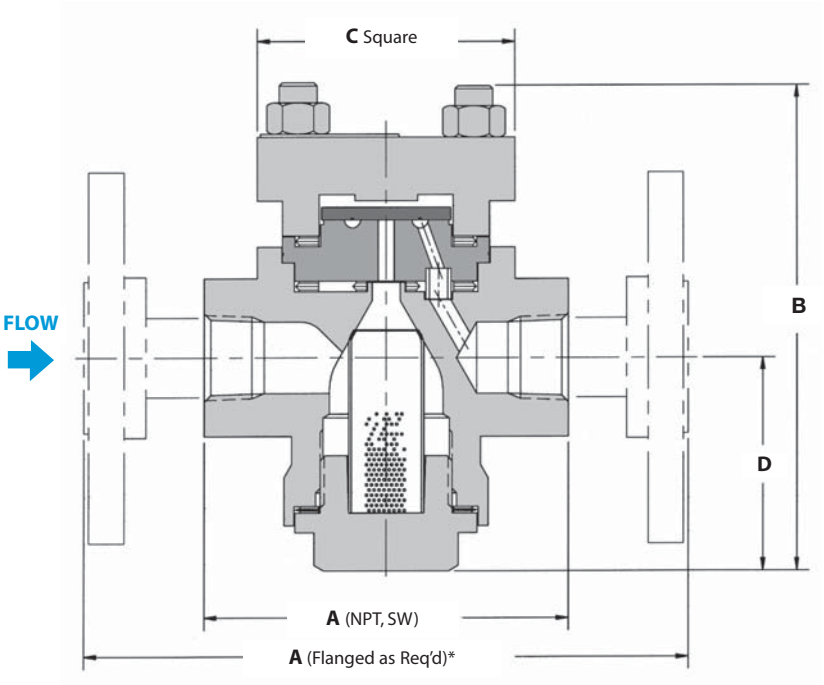
Options

Customized Flanged Connections: Specify size and face-to-face dimensions.

Thermodynamic Steam Trap (Repairable)



Complete internal working mechanism can be replaced while trap body remains connected in-line



* Flanged face-to-face dimension 9" standard.
For custom sizes consult factory (9" minimum).

DIMENSIONS & WEIGHTS – *inches*

Size	Model	Connection	A	B	C	D	Weight (lbs)
1/2"	TD900S/TD900LS	NPT, SW	3.6	4.8	2.6	2.1	4.5
		*600# FLG	9.0	4.8	2.6	2.1	9.0
3/4"	TD900S/TD900LS	NPT, SW	3.6	4.8	2.6	2.1	4.5
		*600# FLG	9.0	4.8	2.6	2.1	11.0
1"	TD900S/TD900LS	NPT, SW	6.5	4.8	2.6	2.1	4.5
		*600# FLG	9.0	4.8	2.6	2.1	11.0

MATERIALS

Body	Alloy Steel, GR WC9
Seat	Stainless Steel, AISI 420
Cover	Alloy Steel, GR WC9
Strainer Cap	Alloy Steel, GR WC9
Strainer	Stainless Steel, AISI 300
Disc	Stainless Steel, AISI 420
Gasket	Stainless Steel, AISI 304
Studs	SA-193, GR B7
Nuts	SA-194, GR 2H

CAPACITIES – *Condensate (lbs/hr)*

Size	Model Code (NPT)	Model Code (SW)	Steam Inlet Pressure (PSIG) 20	50	100	150	200	300	400	500	600	700	800	900
1/2"	TD900S-12-N	TD900S-12-SW	243	411	555	641	700	781	835	874	905	930	951	968
3/4"	TD900S-13-N	TD900S-13-SW												
1"	TD900S-14-N	TD900S-14-SW												
1/2"	TD900LS-12-N	TD900LS-12-SW				181	210	253	290	325	360	381	405	429
3/4"	TD900LS-13-N	TD900LS-13-SW												
1"	TD900LS-14-N	TD900LS-14-SW												

Notes: **WD900S:** *1) Minimum recommended working pressure: 20 PSIG.*
2) Maximum back pressure not to exceed 80% of inlet pressure (measured in absolute pressure) or trap may not close.
WD900LS: *1) Minimum recommended working pressure: 150 PSIG.*
2) Maximum back pressure not to exceed 50% of inlet pressure (measured in absolute pressure) or trap may not close.

Steam Traps
High-Pressure Thermodynamic Steam Trap

TD3600
Thermodynamic

Model	**TD3600**
Sizes	1/2", 3/4", 1"
Connections	BW, SW, 600# FLG, 1500# FLG
Body Material	Forged Alloy Steel
PMO Max. Operating Pressure	**3600 PSIG**
TMO Max. Operating Temperature	975 °F @ 3600 psi 1025 °F @ 2220 psi
PMA Max. Allowable Pressure	2220 PSIG @ 1025 °F 3600 PSIG @ 975 °F
TMA Max. Allowable Temperature	1025 °F @ 2220 PSIG

Note: Connections may limit Pressure & Temperature ratings.

Typical Applications

DRIP: TD3600 model steam traps are designed to handle the drainage of condensate from extremely high pressure systems, and are commonly used as drip traps on high-pressure steam mains and steam supply lines. These traps are suitable for outdoor applications that are subject to freezing as well as superheated steam conditions. The complete internal working mechanism can be completely replaced while the trap body remains in line.

How it Works

The disc is the only moving part inside a thermodynamic trap. When steam enters the trap, it creates an internal pressure above the disc that instantly forces the disc to close tightly on the seat, preventing the steam from escaping. The internal steam pressure (holding the disc and seat shut) eventually drops, and the trap re-opens. When condensate enters the trap, it pushes the disc upwards, allowing the condensate to freely discharge. If steam is present, the trap instantly shuts.

Features

- "Quick-Change" seat and disc for easy in-line repair
- High pressure applications up to 3600 PSIG
- Integral strainer to protect trap from contamination
- Hardened stainless steel seat and disc for extended service life even at extremely high pressures
- Steam trap model will operate over the entire pressure range (100-3600 PSIG)
- Suitable for superheated steam
- Freeze-proof when trap is piped in a vertical orientation for complete drainage of condensate
- Trap will function in any orientation (horizontal preferred)

Sample Specification

The steam trap shall be a thermodynamic style with body material in forged alloy steel. Available in size 1/2", 3/4" and 1" Socket Weld, Butt Weld ends or ANSI 600# &1500# RF flanged connections. Unit shall have hardened repairable stainless steel seat and disc with a removable stainless steel sintered strainer.

Installation and Maintenance

The TD3600 can be installed in any orientation; however, with cap facing upward is preferred for longest service life. For maintenance, ALL internal components are easily removed and completely changed using a replacement kit. The TD3600 contains an integral high pressure sintered strainer for protection against dirt and scale.

Helpful Selection Information

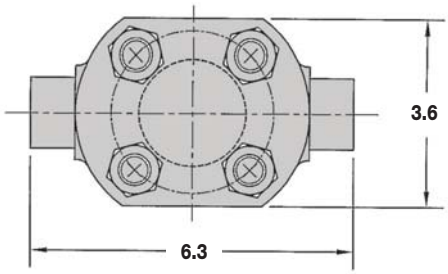
This trap was designed for handling the drainage of condensate from EXTREMELY HIGH PRESSURE systems, with a maximum operating pressure of 3600 PSIG. The TD3600 is available in Socket Weld, Butt Weld and Flange connections from 1/2" through 1".

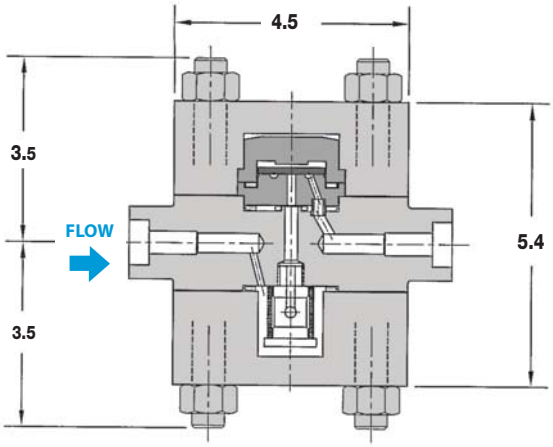
Options

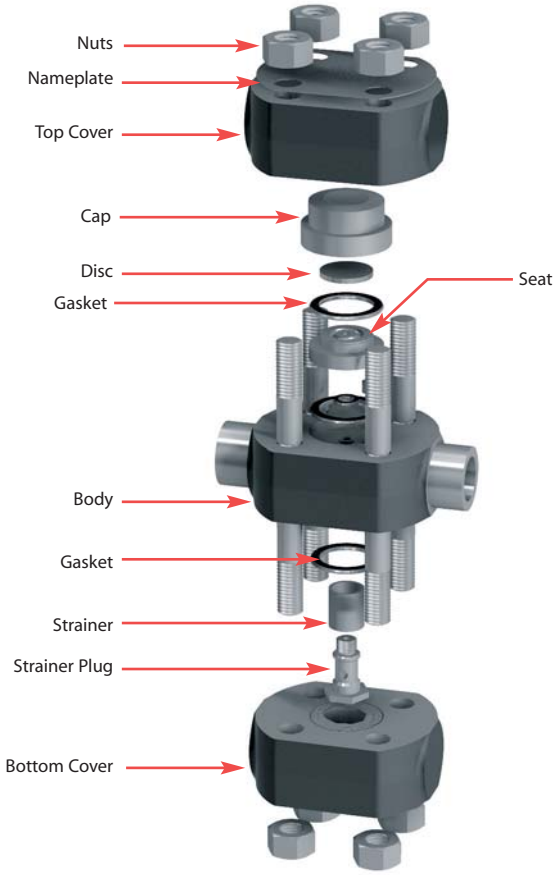
Customized Flanged Connections:
Specify size and face-to-face dimensions.

DIMENSIONS – *inches*

Weight: 25 lbs.







MATERIALS

Body	Forged Alloy Steel, ASTM 182 F22
Seat	Stainless Steel, AISI 420
Cover, top & bottom	Forged Alloy Steel, ASTM 182 F22
Strainer	Sintered Stainless Steel, AISI 300
Disc	Stainless Steel, AISI 420
Gasket	Stainless Steel, AISI 304
Studs	SA-193, GR B16
Nuts	SA-194, GR 4

How to Size / Order

Select working pressure; follow column down to correct capacity (lbs/hr) block. Example:

Application: 380 lbs/hr at 1000 PSIG working inlet pressure

Size/Model: **TD3600**, Specify pipe size and connections (BW, SW, 600# FLG, 1500# FLG)

CAPACITIES – *Condensate (lbs/hr)*

Size	Conn.	Model Code	Steam Inlet Pressure (PSIG) 100	500	1000	1250	1750	2000	2250	2500	2750	3000	3250	3500	3600
1/2"	SW	TD3600-12-SW													
3/4"	SW	TD3600-13-SW	165	290	380	400	435	470	500	525	550	575	595	610	625
1"	SW	TD3600-14-SW													

Note: *Maximum back pressure not to exceed 50% of inlet pressure (measured in absolute pressure) or trap may not close. Add note about other connections.*

Thermostatic Traps Steam Traps

Industrial type Thermostatic traps are used on drip, process and tracing applications, and use an extremely rugged welded stainless steel bellows. They have excellent air venting capability with a capacity and pressure range for a wide variety of applications. Physical size of a thermostatic trap is considerably smaller than F&T or IB style traps of similar capacity making installation and repair considerably easier. For Example: A Thermostatic trap weighing only 4 pounds is able to replace an F&T trap or an IB trap weighing over 40 pounds. In contrast to an F&T or an IB trap, a single model of a thermostatic trap works over the entire pressure range (from 0-650 PSIG) simplifying model selection. In addition, Thermostatic traps are self-draining eliminating issues with freezing in cold climates. With several repairable and non-repairable models available, thermostatic traps offer many advantages and should be considered.

WT1000

WT2000


WT2500


WT3000

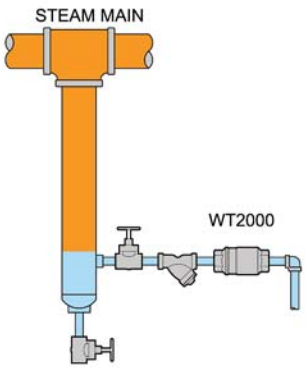

WT4000


WT5000

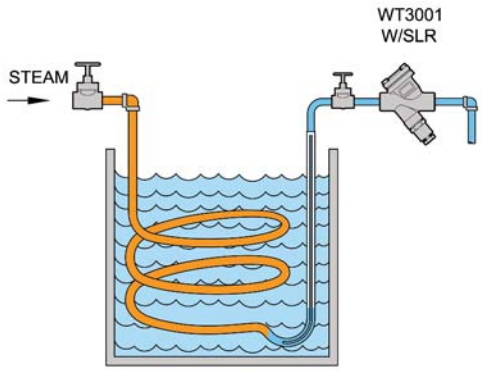

TA/TS

Thermostatic					
Model	Body Material	PMO (PSIG)	Sizes	Connections	Page No.
WT1000	Stainless Steel	**300**	1/2", 3/4"	NPT	**52**
WT2000	Stainless Steel	**650**	1/2", 3/4"	NPT	**52**
WT3000	Stainless Steel	**650**	1/2", 3/4"	NPT, SW, FLG	**54**
WT4000	Stainless Steel	**300**	3/4", 1"	NPT, SW, FLG	**56**
WT5000	Stainless Steel	**650**	3/8" – 1"	NPT, SW	**58**
TA/TS	Brass	**25/125**	1/2", 3/4"	NPT	**60**
WT2500	Cast Iron	**250**	1/2", 3/4"	NPT	**62**

Typical Applications for Thermostatic Steam Traps

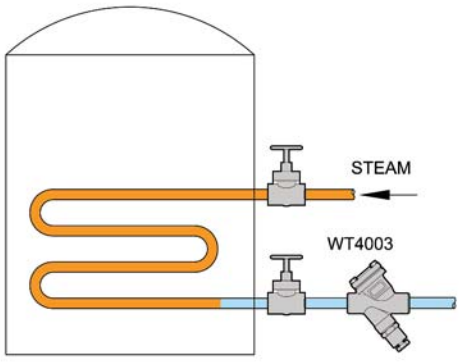


Steam Main Drip



Plating Tank (Batch Process)

With steam trap positioned above condensate collection point using the Steam Lock Release option (SLR)



Outdoor Storage Tank (Batch Process)

THERMOSTATIC STEAM TRAPS

Operation:

The bellows type thermostatic trap contains a fluid-filled thermal element (bellows). The operation of this thermal element is governed by the volumetric thermal expansion of the fluid inside the bellows as it changes states. There is no adjustment required for this trap as the fluid inside the bellows is chosen for its quick response to the change in temperature between steam and condensate at various pressures. The operation of the bellows follows the steam saturation curve, always discharging condensate a few degrees cooler than the steam temperature.

During start-up, when the system is cold, the bellows is retracted and the valve plug is lifted off the seat allowing air and condensate to be discharged from the system. As hot steam approaches the thermal element in the trap, the fluid inside the bellows vaporizes and expands, closing the valve tightly. As long as steam is present, the valve will remain closed. Only when subcooled condensate or air is present will the valve open.

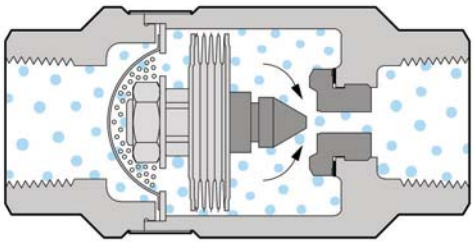
Watson McDaniel thermal element traps offer wide operating pressure ranges, rugged welded stainless steel bellows, and various orifice sizes, making them a great choice for a majority of applications.

Sub-cool:

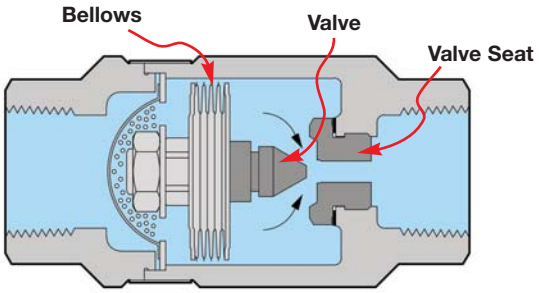
The sub-cooling of condensate prior to discharge can have certain beneficial effects. In the majority of tracing applications, the sub-cooling of condensate is highly desirable because of the additional energy that is extracted from the Hot condensate. If the trap did not sub-cool condensate, this energy would be wasted.

In Batch style process applications such as jacketed kettles, plating tanks and heating of outdoor storage tanks, the sub-cooling of condensate is generally not a factor to consider since the amount of condensate back-up requires less than 1% of the heat transfer surface area and is therefore considered negligible. So a heat exchanger with 50 square feet of surface area requires only ½ a square foot of surface area to sub-cool the condensate. In a Continuous process application that exhibit rapid changes in steam pressures, steam traps requiring sub-cool could lead to additional condensate back up. This scenario is typical in instantaneous hot water heaters using a shell & tube heat exchanger with temperature control valves. The steam pressure in the heat exchanger can drop extremely fast when the water demand changes. In this case, additional sub-cooling of the condensate is required before it will discharge. In some cases, this may be acceptable, but in general, only F&T traps are recommended for process with rapid changes in steam pressures since they always discharge condensate immediately as it is formed. In addition, traps that sub-cool condensate have a softer discharge since less flash steam is generated in the return line.

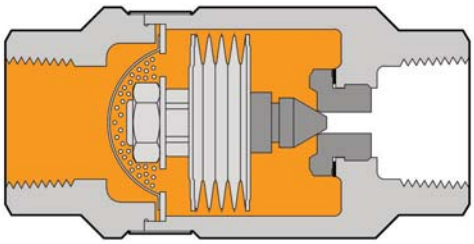
A) AIR When air, which is cooler than steam, is present, the bellows is retracted and the seat is open, allowing large quantities of air to be discharged.

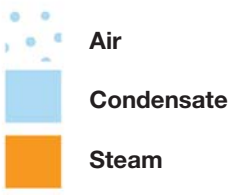


B) CONDENSATE When condensate, which is cooler than steam, is present, the bellows retracts and the seat opens, allowing condensate to be discharged.



C) STEAM When steam reaches the trap, the bellows expands, closing off the seat and preventing the steam from escaping.



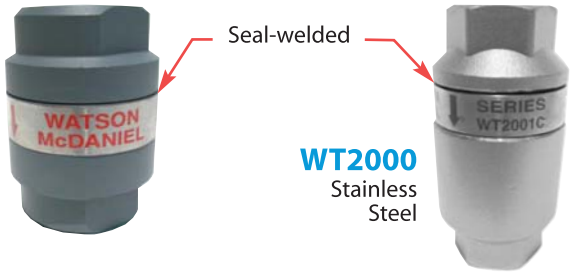


Non-Repairable (Seal-welded Stainless Steel Body)

The **WT1000** & **WT2000** Thermostatic Steam Traps have Stainless Steel, seal-welded bodies and are Non-repairable.

The **WT1000** is specifically intended for Drip and Tracing Applications.

The **WT2000** is substantially larger in capacity than the WT1000. It can be used for Batch Type Process Applications as well as for Drip and Tracing. Also used as an Air Vent; Model AV2000.



WT1000 Stainless Steel

WT2000 Stainless Steel

Repairable (4-Bolt Cover)

The **WT3000** & **WT4000** Thermostatic Steam Traps have cast Stainless Steel bodies and are fully-repairable.

The **WT3000** has an identical capacity to the WT2000; commonly used for Process Applications but can also be used for drip and tracing if a repairable design is desired.

The **WT4000** has substantially higher capacity than the WT3000; used for larger Process Applications.

WT3000 Stainless Steel

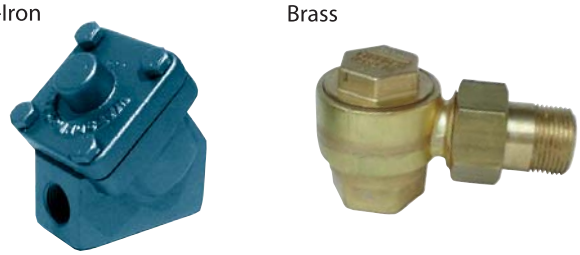
WT4000 Stainless Steel

The **WT2500**, with a cast iron body, is an economical alternative to the WT3000 and is identical in capacity; however, its limited to 250 PSIG. It is likewise fully-repairable and can be used where cast iron is acceptable.

The **TA/TS Series** are referred to as Thermostatic Radiator Traps. They have brass bodies and are fully-repairable; predominantly used in the HVAC industry for steam traps and air vents.

WT2500 Cast-Iron

TA & TS Brass



Temperature Adjustable Bi-Metal

The **WT5000** Bi-Metal Steam Trap has a Stainless Steel body, is fully-repairable and intended for Steam Tracing Applications.

Its unique feature is a temperature-adjustable Bi-Metal element which allows for precise control of condensate discharge temperature (temperature adjustment can be made in the field). This is a desirable feature for tracing, so that condensate discharge temperature can be controlled to suit a particular application.

WT5000 Bi-Metal

Thermostatic Steam Trap (Non-Repairable)

Model	**WT1000 (Non-Repairable)**
Sizes	**1/2", 3/4"**
Connections	**NPT**
Body Material	**Stainless Steel**
PMO Max. Operating Pressure	**300 PSIG**
TMO Max. Operating Temperature	**Saturated Steam Temperature**
PMA Max. Allowable Pressure	**1032 PSIG @ 100°F**
TMA Max. Allowable Temperature	**750°F @ 800 PSIG**

Typical Applications

DRIP, TRACING: The **WT1000** is a low capacity thermostatic trap ideally sized for steam tracing. Thermostatic traps are small, light weight and have excellent air discharging capabilities. Discharging air at start-up allows steam to quickly enter the system. Trap body is permanently seal welded together and therefore non-repairable. Contains an extremely strong and rugged precision welded Stainless Steel thermal element. Its small discharge orifice, which makes it an optimal size trap for both drip and tracing applications, is susceptible to clogging depending on system conditions, therefore, a separate strainer should be installed.

How It Works

This thermostatic trap contains a welded stainless steel thermal element that expands when heated and contracts when cooled to 5°F below saturated steam temperature. When air or sub-cooled condensate are present, the trap is in the open discharge position. When steam reaches the trap, the element expands and closes off tightly.

Features

- Excellent at discharging air which allows steam to enter system quickly; extremely important during start-up
- Welded stainless steel thermal element resists shock from water hammer
- Freeze-proof when trap is installed in a vertical orientation allowing for complete condensate drainage
- Stainless steel Barstock body
- In the unlikely event of bellows failure; trap discharge remains open

Installation & Maintenance

Trap can be installed in any orientation. The WT1000 steam trap body is seal-welded and therefore non-repairable. If a new trap is required, remove from line and replace. This product cannot be welded in-line or failure of the thermal element due to excess heat may occur. Available in NPT threaded connections only.

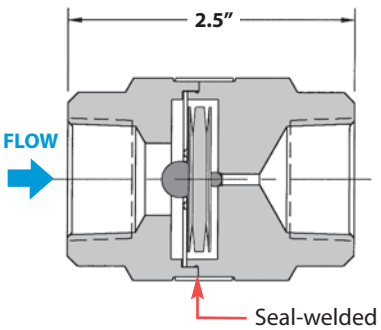
Sample Specification

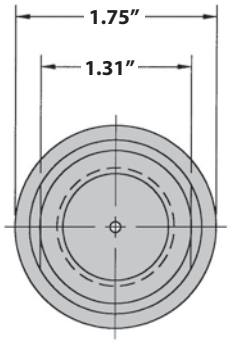
The steam trap shall be of thermostatic type with stainless steel body and stainless steel thermal element.

MATERIALS

Trap Housing	Stainless Steel, AISI 304L
Thermal Element	Stainless Steel, 300 Series
Valve	Stainless Steel, AISI 440C

DIMENSIONS – *inches*





Weight: 1.25 lbs.

CAPACITIES – *Condensate (lbs/hr)*

Size	Model Code	Steam Inlet Pressure (PSIG) 5	10	20	50	100	125	150	200	250	300
1/2"	WT1000-12-N	95	140	195	305	435	485	530	610	685	750
3/4"	WT1000-13-N										

Steam Traps
Thermostatic Steam Trap
(Non-Repairable)

WT2000
Thermostatic

Model	**WT2000 (Non-Repairable)**
Sizes	**1/2", 3/4"**
Connections	**NPT**
Body Material	**Stainless Steel**
PMO Max. Operating Pressure	**650 PSIG**
TMO Max. Operating Temperature	**Saturated Steam Temp.**
PMA Max. Allowable Pressure	**1032 PSIG @ 100°F**
TMA Max. Allowable Temperature	**750°F @ 800 PSIG**

Typical Applications

DRIP, TRACING, PROCESS: The **WT2000** is a general purpose medium-capacity thermostatic trap that can be used for steam tracing, as a drip trap on steam mains and steam supply lines, as well as for process applications. They are also commonly used as an Air Vent on heat exchangers or at the ends of steam mains. Thermostatic traps are small, light weight, operate over a wide pressure range, and have excellent air handling capabilities. Discharging air at start-up allows steam to quickly enter the system. All stainless steel construction and integral strainer, make the WT2000 an excellent choice for a variety of applications. Trap body is permanently seal welded together and therefore non-repairable. Contains an extremely strong and rugged precision welded Stainless Steel thermal element which is highly resistant to waterhammer.

How It Works

This thermostatic trap contains a welded stainless steel thermal element that expands when heated and contracts when cooled to 5°F below saturated steam temperature. When air or sub-cooled condensate are present, the trap is in the open discharge position. When steam reaches the trap, the element expands and closes off tightly.

Features

- Thermostatic traps are excellent at discharging air, which allows steam to enter quickly; extremely important during start-up
- Integral strainer to protect trap from contamination
- Welded stainless steel thermal element resists shock from waterhammer
- Freeze-proof when trap is installed in a vertical orientation allowing for complete condensate drainage
- Body is produced from stainless steel investment casting
- Hardened stainless steel seat for extended service life
- Will operate at steam pressures up to 650 PSIG

Sample Specification

Steam trap shall be of thermostatic type with stainless steel body, thermal element, internal screen, and hardened valve and seat.

Installation and Maintenance

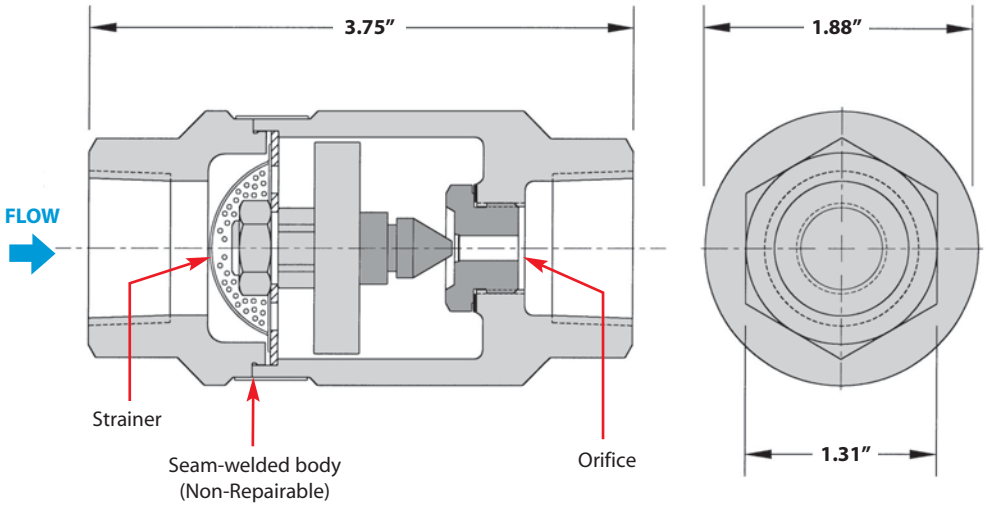
Trap can be installed in any position. The WT2000 steam trap body is seal-welded and therefore non-repairable. If a new trap is required, remove from line and replace. Cannot be welded in-line or failure of the thermal element may occur. Available in NPT threaded connections only.

Helpful Selection Information

Two orifice sizes are available: The 3/16" orifice should be used on all drip and tracing applications as well as small process applications with lower condensate loads. The 5/16" orifice is available to be used on process applications if additional capacity is required.

Options

- Special Bellows Option; available upon request:
  - Fail-closed Bellows (standard bellows fails in open position)
  - 43°F Sub-cool Bellows (Note: Standard bellows are designed for approximately 5°F sub-cool temperature)
- **SLR** = Steam lock release
- Standard models contain a non-cleanable strainer screen. Also available without screen where it is desireable to flush dirt and scale thru the trap. Recommend WT2003 with larger orifice if used without strainer.



Weight: 1.5 lbs.

MATERIALS

Trap Housing	Stainless Steel, ASTM A351-CF3
Thermal Element	Stainless Steel
Valve & Seat	Stainless Steel, AISI 416
Strainer Screen	Stainless Steel

How to Size / Order

Select working pressure; follow column down to correct capacity (lbs/hr) block. Example:

Application: 1827 lbs/hr at 100 PSIG working inlet pressure

Size/Model: **WT2001-12-N**, 1/2″ NPT, 3/16″ orifice

CAPACITIES – *Condensate (lbs/hr)*

Size	Model Code	Orifice Size	Steam Inlet Pressure (PSIG) 5	10	20	50	100	125	150	200	250	300	350	400	500	600	650
1/2″	WT2001-12-N	3/16″	441	625	882	1391	1827	1969	2095	2305	2483	2636	2777	2903	3129	3323	3413
3/4″	WT2001-13-N																
1/2″	WT2003-12-N	5/16″	903	1271	1811	2861	3754	4043	4300	4730	5093	5413	5702	5959	6421	6820	7004
3/4″	WT2003-13-N																

Note: 3/16″ orifice should be used on all drip and tracing applications.

Back Pressure as Percentage of Inlet Pressure	10	20	25	30	40	50	60	70	80	90
Percentage Decrease in Trap Capacity	0	0	0	2	5	12	20	30	40	55

Steam Traps
Thermostatic Steam Trap
(Repairable)

Model	**WT3000 (Repairable)**
Sizes	1/2", 3/4"
Connections	NPT, SW, FLG
Body Material	Stainless Steel
Options	Strainer, Blowdown Valve
PMO Max. Operating Pressure	650 PSIG
TMO Max. Operating Temperature	Saturated Steam Temp.
PMA Max. Allowable Pressure	906 PSIG @ 100°F
TMA Max. Allowable Temperature	750°F @ 725 PSIG

Typical Applications

DRIP, TRACING, PROCESS: The **WT3000** is a general purpose medium capacity thermostatic trap that can be used for steam tracing; as a drip trap on steam mains and steam supply lines; as well as for process applications. All internal working components can be replaced while the trap body remains in-line. Thermostatic traps are small, light weight, operate over a wide pressure range, and have excellent air handling capabilities. Discharging air at start-up allows steam to quickly enter the system. All stainless steel construction and integral strainer option make the WT3000 an excellent choice for a variety of applications. Contains an extremely strong and rugged precision welded Stainless Steel thermal element which is highly resistant to waterhammer.

How It Works

This thermostatic trap contains a welded stainless steel thermal element that expands when heated and contracts when cooled to 5°F below saturated steam temperature. When air or sub-cooled condensate are present, the trap is in the open discharge position. When steam reaches the trap, the element expands and closes off tightly.

Features

- The thermal element and seat can be easily removed and replaced in minutes with the trap body still in-line
- Operates at steam pressures up to 650 PSIG
- Thermostatic traps are excellent at discharging air, which allows steam to enter quickly; extremely important during start-up
- Welded stainless steel thermal element resists shock from waterhammer
- Freeze-proof when trap is installed in a vertical orientation allowing for complete condensate drainage
- Body is produced from stainless steel investment casting
- Hardened stainless steel seat for extended service life
- Available with integral strainer and blowdown valve

Sample Specification

The steam trap shall be of a thermostatic type with stainless steel body, thermal element and internal strainer. Trap must be in-line repairable with a bolt-on type cover that is sealed with a spiral wound Stainless Steel AISI 316 gasket. Seat and valve to be hardened stainless steel.

Installation and Maintenance

Trap can be installed in any orientation. All internal working components are extremely easy to replace and can be performed while the trap body remains connected in-line. Repair kit includes ALL parts to fully rebuild the steam trap including thermal element, seat and gasket. The WT3000S model comes with an optional strainer. WT3000SB comes with optional blowdown valve for flushing dirt and scale from strainer.

Helpful Selection Information

Two orifice sizes are available: The 3/16" orifice should be used on all drip and tracing applications as well as small process applications with lower condensate loads. The 5/16" orifice is available to be used on process applications if additional capacity is required.

Options

Strainer, blowdown valve, steam lock release and special bellows available.

S = Strainer (**WT3001S**)

SB = Strainer and blowdown valve (**WT3001SB**)

SLR = Steam lock release

Special Bellows Option; available upon request:

- Fail-closed Bellows (standard bellows fails in open position)
- 43°F Sub-cool Bellows (Note: Standard bellows are designed for approximately 5°F sub-cool temperature)

How to Size / Order

Refer to the Capacity Chart to determine which model, the WT3001 or WT3003 is required to satisfy the condensate load based on steam inlet pressure.

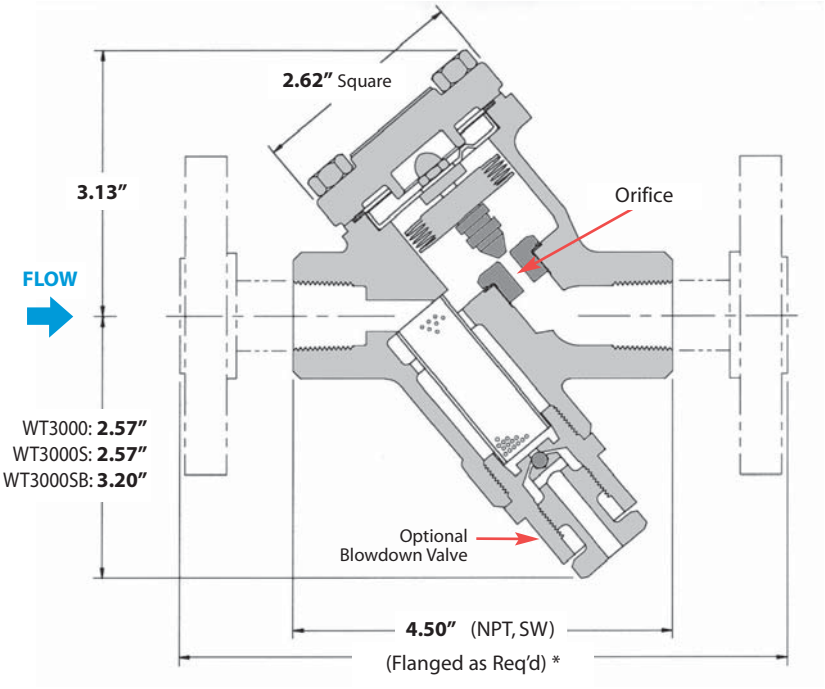
Example:

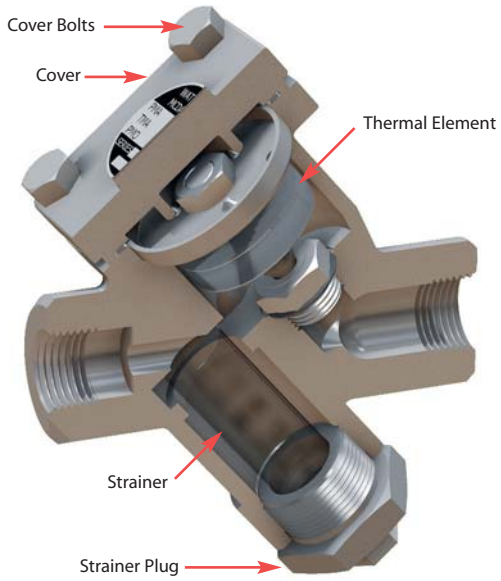
Application: 3754 lbs/hr at 100 PSIG steam inlet pressure
Size/Model: **WT3003S**, 5/16" orifice with strainer,
Specify size & connections (NPT, SW, FLG)

Example Model Codes:

WT3003S-13-N 3/4" NPT with strainer, and 5/16" orifice.

WT3001SB-12-N 1/2" NPT with strainer and blowdown valve, 3/16" orifice





Weight: 4.5 lbs.

* Flanged face-to-face dimension 9" standard.
For custom sizes consult factory (9" minimum).

Size/Connection*	Model **Code**	Orifice Size	Description
1/2" NPT	**WT3001-12-N**	3/16"	No Strainer
3/4" NPT	**WT3001-13-N**	3/16"	No Strainer
1/2" NPT	**WT3001S-12-N**	3/16"	Strainer
3/4" NPT	**WT3001S-13-N**	3/16"	Strainer
1/2" NPT	**WT3001SB-12-N**	3/16"	Strainer & Blowdown
3/4" NPT	**WT3001SB-13-N**	3/16"	Strainer & Blowdown
1/2" NPT	**WT3003-12-N**	5/16"	No Strainer
3/4" NPT	**WT3003-13-N**	5/16"	No Strainer
1/2" NPT	**WT3003S-12-N**	5/16"	Strainer
3/4" NPT	**WT3003S-13-N**	5/16"	Strainer
1/2" NPT	**WT3003SB-12-N**	5/16"	Strainer & Blowdown
3/4" NPT	**WT3003SB-13-N**	5/16"	Strainer & Blowdown

** For Socket Weld Connection change **N** to **SW***

MATERIALS

Cover & Body	Stainless Steel, AISI 316L
Thermal Element	Stainless Steel, AISI 300
Valve & Seat	Stainless Steel, AISI 416
Cover Gasket	Stainless Steel, AISI 316
Seat Gasket	Stainless Steel, AISI 316
Cover Bolts	Steel, ASTM A193 GR B7 Nickel Plated
Strainer*	0.046 Perforated Stainless Steel AISI 304
Blowdown Valve*	Stainless Steel AISI 303

** Strainer and blowdown valve are optional*

CAPACITIES – *Condensate (lbs/hr)*

Model	Orifice Size	Steam Inlet Pressure (PSIG) 5	10	20	50	100	125	150	200	250	300	350	400	500	600	650
WT3001	**3/16"**	441	625	882	1391	1827	1969	2095	2305	2483	2636	2777	2903	3129	3323	3413
WT3003	**5/16"**	903	1271	1811	2861	3754	4043	4300	4730	5093	5413	5702	5959	6421	6820	7004

Back Pressure as Percentage of Inlet Pressure	10	20	25	30	40	50	60	70	80	90
Percentage Decrease in Trap Capacity	0	0	0	2	5	12	20	30	40	55

Steam Traps
Thermostatic Steam Trap
(Repairable)

WT4000
Thermostatic

Model	**WT4000 (Repairable)**
Sizes	**3/4", 1"**
Connections	**NPT, SW, FLG**
Body Material	**Stainless Steel**
Options	**Strainer, Blowdown Valve**
PMO Max. Operating Pressure	**300 PSIG**
TMO Max. Operating Temperature	**Saturated Steam Temperature**
PMA Max. Allowable Pressure	**906 PSIG @ 100°F**
TMA Max. Allowable Temperature	**750°F @ 725 PSIG**

Typical Applications

PROCESS: The **WT4000** is a high capacity version of the WT3000, for removing condensate and air from larger process applications. This steam trap is fully repairable while the body remains in-line. Like all thermostatic traps, they are small, light weight, operate over a wide pressure range, and have excellent air handling capabilities. Discharging air at start-up allows steam to quickly enter the system. All stainless steel construction and integral strainer option make the WT4000 an excellent choice for most process applications. Contains an extremely strong and rugged precision welded Stainless Steel thermal element which is highly resistant to waterhammer.

How It Works

This thermostatic trap contains a welded stainless steel thermal element that expands when heated and contracts when cooled to 5°F below saturated steam temperature. When air or sub-cooled condensate are present, the trap is in the open discharge position. When steam reaches the trap, the element expands and closes off tightly.

Features

- The thermal element and seat can be easily removed and replaced in minutes with the trap body still in-line
- Operates at steam pressures up to 300 PSIG
- Thermostatic traps are excellent at discharging air, which allows steam to enter quickly; extremely important during start-up
- Welded stainless steel thermal element resists shock from waterhammer
- Freeze-proof when the trap is installed in a vertical orientation allowing for complete condensate drainage
- Body is produced from stainless steel investment casting
- Hardened stainless steel seat for extended service life
- Available with integral strainer and blowdown valve

Sample Specification

The steam trap shall be of thermostatic type with stainless steel body, thermal element, and internal strainer. Trap must be in-line repairable with a bolt-on type cover that is sealed with a spiral wound Stainless Steel AISI 316 gasket. Seat and valve to be hardened stainless steel.

Installation and Maintenance

Trap can be installed in any orientation. All internal working components are extremely easy to replace and can be performed while the trap body remains connected in-line. Repair kit includes ALL parts to fully rebuild the steam trap including thermal element, seat and gasket. The WT4000 does not contain a strainer. The WT4000S contains a strainer. WT4000SB contains a blowdown valve for flushing dirt and scale from strainer.

Helpful Selection Information

Two orifice sizes are available: 7/16" standard capacity and 5/16" reduced capacity. Select these models for steam systems with maximum working pressure of 300 PSIG.

Options

Strainer, blowdown valve, and steam lock release.

S = Strainer (**WT4001S**)

SB = Strainer and blowdown valve (**WT4001SB**)

SLR = Steam lock release

Customized flanged connections: Specify size, face-to-face dimensions.

How to Size / Order

Refer to the Capacity Chart to determine which model, the WT4001 or WT4003 is required to satisfy the condensate load based on steam inlet pressure.

Example:

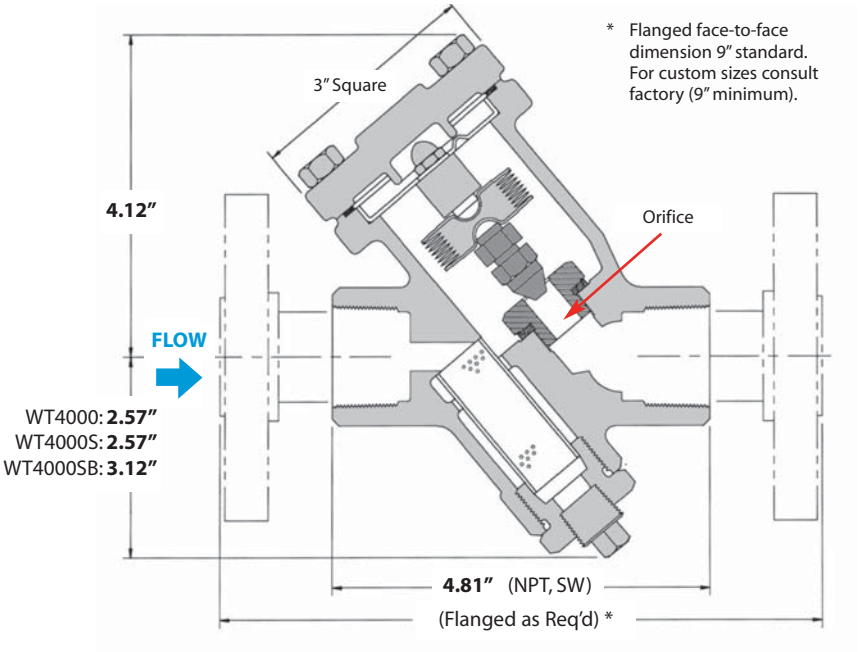
Application: 5610 lbs/hr at 100 PSIG steam inlet pressure

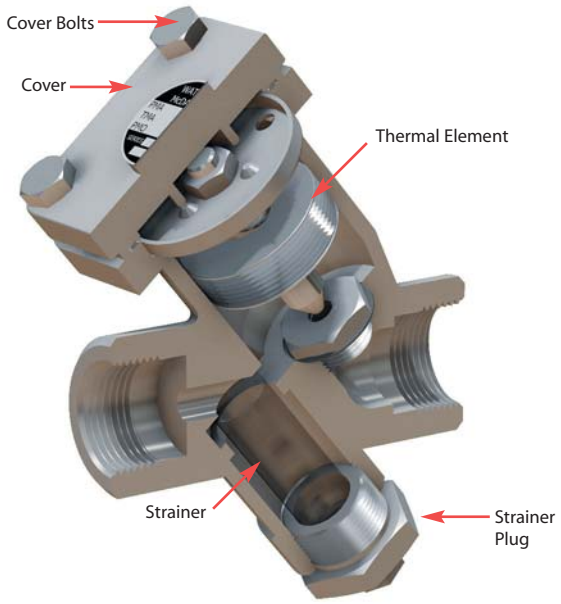
Size/Model: **WT4001S**, 5/16" orifice, and strainer
Specify size & connections (NPT, SW, FLG)

Example Model Codes:

WT4001S-13-N 3/4" NPT with strainer, and 5/16" orifice

WT4003SB-14-N 1" NPT with strainer and blowdown valve, 7/16" orifice





Weight: 4.5 lbs.

Size/Connection*	Model Code	Orifice Size	Description
3/4" NPT	**WT4001-13-N**	5/16"	No Strainer
1" NPT	**WT4001-14-N**	5/16"	No Strainer
3/4" NPT	**WT4001S-13-N**	5/16"	Strainer
1" NPT	**WT4001S-14-N**	5/16"	Strainer
3/4" NPT	**WT4001SB-13-N**	5/16"	Strainer & Blowdown
1" NPT	**WT4001SB-14-N**	5/16"	Strainer & Blowdown
3/4" NPT	**WT4003-13-N**	7/16"	No Strainer
1" NPT	**WT4003-14-N**	7/16"	No Strainer
3/4" NPT	**WT4003S-13-N**	7/16"	Strainer
1" NPT	**WT4003S-14-N**	7/16"	Strainer
3/4" NPT	**WT4003SB-13-N**	7/16"	Strainer & Blowdown
1" NPT	**WT4003SB-14-N**	7/16"	Strainer & Blowdown

** For Socket Weld Connection change **N** to **SW***

MATERIALS	
Body	Stainless Steel, AISI 316L
Cover	Stainless Steel, AISI 316L
Cover Gasket	Spiral Wound Stainless Steel, AISI 316
Cover Bolts	Steel, ASTM A193 GR B7 Nickel Plated
Thermal Element	Stainless Steel, AISI 302
Valve & Seat	Hardened Stainless Steel, AISI 416
Seat Gasket	Stainless Steel, AISI 316
Strainer*	0.046 Perforated Stainless Steel AISI 304
Blowdown Valve*	Stainless Steel AISI 300

** Strainer and blowdown valve are optional*

CAPACITIES – *Condensate (lbs/hr)*

Model	Orifice Size	Steam Inlet Pressure (PSIG) 1	2	5	10	20	50	100	125	150	200	250	300
WT4001	**5/16"**	605	855	1350	1910	2705	4275	5610	6045	6425	7070	7615	8095
WT4003	**7/16"**	940	1325	2095	2960	4190	6620	8695	9365	9950	10955	11800	12540

Back Pressure as Percentage of Inlet Pressure	10	20	25	30	40	50	60	70	80	90
Percentage Decrease in Trap Capacity	0	0	0	2	5	12	20	30	40	55

Steam Traps
Bi-Metal Adjustable Discharge Temperature
(Repairable)

WT5000
Bi-Metal

Model	**WT5000 (Bi-Metal)**
Sizes	**3/8", 1/2", 3/4, 1"**
Connections	**NPT, SW**
Body Material	**Stainless Steel**
PMO Max. Operating Pressure	**650 PSIG**
TMO Max. Operating Temperature	**662°F**
PMA Max. Allowable Pressure	**900 PSIG**
TMA Max. Allowable Temperature	**800°F**

Typical Applications

TRACING: The **WT5000** is specifically designed for steam tracing applications where accurate and adjustable control of condensate discharge temperature is desired. Can be used where a temperature sensitive medium is being transferred in piping system or held in a storage vessel and standard steam tracing methods may not be adequate to maintain specific product temperatures. Having the ability to adjust the condensate discharge temperature would allow for accurate temperature control of the product being traced. The significant feature of the WT5000 is that the condensate discharge temperature is easily field-adjustable.

How It Works

Bi-metallic plates of dissimilar metals which are connected to the valve seat assembly respond to temperature variations. At relatively cool conditions, the trap is open for the discharge of condensate. When the temperature of the condensate is equal to or higher than the set temperature, the metals react and expand, closing the trap. External field-adjustability of the bi-metal element allows control of the condensate discharge temperature.

The condensate temperature can be field adjusted as follows:

To **INCREASE** the temperature, turn the adjuster screw:
→ **COUNTERCLOCKWISE**

To **DECREASE** the temperature, turn the adjuster screw:
→ **CLOCKWISE**

Note: The lower the set temperature, the more condensate will back-up in front of the trap inlet connection. Therefore, consideration should be given to providing adequate piping to accommodate any such back-up.

Features

- Excellent for various steam tracing and small process applications using the additional energy (sensible heat) of the hot condensate
- Field-adjustable bi-metal element allows control of condensate discharge temperature
- Internal screen and seat/plug design help prevent pipe scale and debris from accumulating on seating surfaces to provide trouble-free operation
- In-line repairable

Sample Specification

The steam trap shall be a bi-metal type with stainless steel body, seat, valve plug and bimetallic element. Bi-metal element shall be externally adjustable for control of condensate discharge temperature. Trap must be in-line repairable with a replaceable bi-metal element, valve plug and seat.

Installation and Maintenance

Trap can be installed in any orientation. The body is made from stainless steel and is fully repairable while the steam trap remains in-line. If the trap fails, remove the cover and replace the internal working components. Repair kit includes bimetallic element (including valve stem and plug), seat and gasket.

Helpful Selection Information

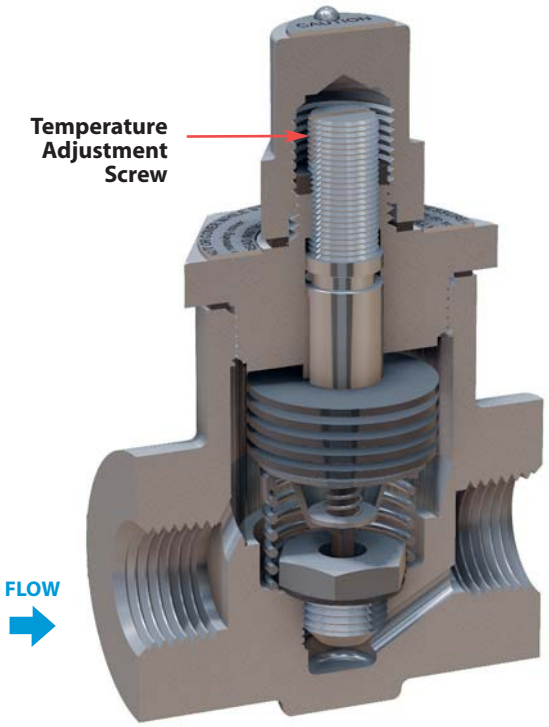
Available in 3/8" through 1" NPT and socket weld connections. Select this model for steam systems with maximum working pressure of 650 PSIG.

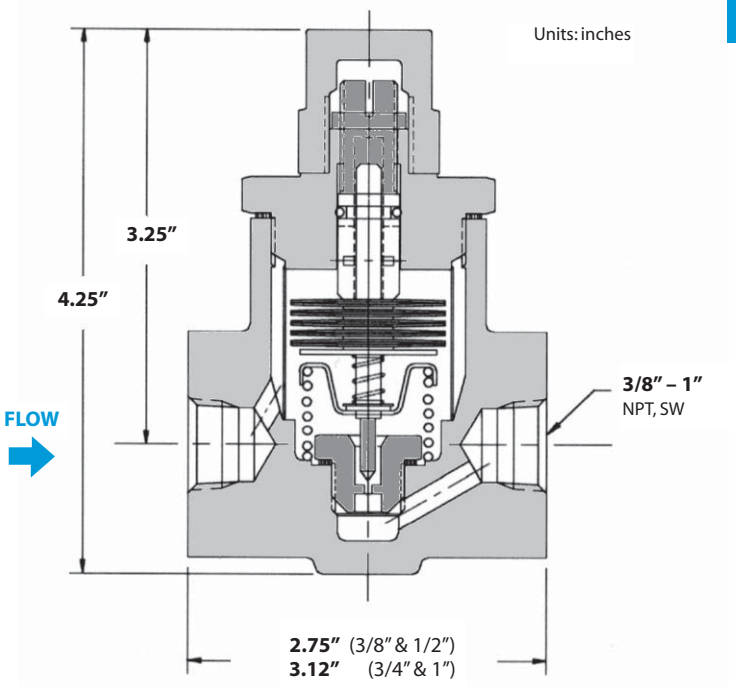
Size/Connection	Model Code	Weight lbs	Cross Reference TLV
3/8" NPT	**WT5000-11-N**	3.0	LEX3N-TZ
1/2" NPT	**WT5000-12-N**		
3/4" NPT	**WT5000-13-N**		
1" NPT	**WT5000-14-N**		
3/8" SW	**WT5000-11-SW**	3.0	LEX3N-TZ
1/2" SW	**WT5000-12-SW**		
3/4" SW	**WT5000-13-SW**		
1" SW	**WT5000-14-SW**		

MATERIALS	
Body and Cover	304 Stainless Steel
Bimetal Element	GB14
Valve Seat	420 Stainless Steel
Valve Stem	420 Stainless Steel

Bi-Metal Adjustable Discharge Temperature

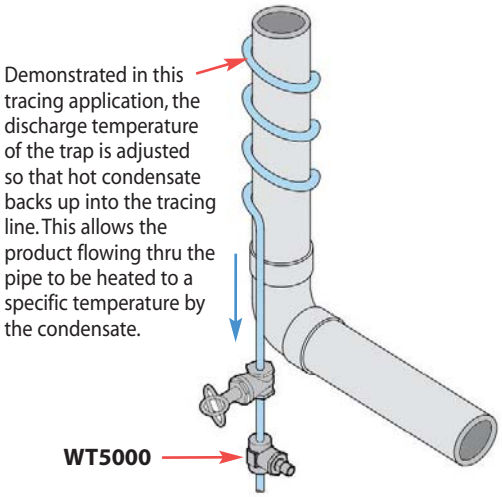
(Repairable)





Notes:

1) Capacities in chart are based on discharging condensate to atmospheric pressure (0 PSIG).
2) **Initial Opening Temperature = T** is the temperature at which the trap just begins to open. A negligable amount of condensate flow takes place at this temperature. It is adjustable between 120˚F and 390˚F.
3) **Initial Opening Temperature** must be at least 27 degrees below the saturated steam temperature to prevent possible steam loss.
4) When the condensate cools below the initial opening temperature, the Bi-metal mechanism opens further, increasing trap capacity. Trap capacity can be adjusted up to the max value given in the chart.
5) For instructions on setting the trap discharge temperature and capacity, refer to the Watson McDaniel Installation and Maintenance Guide.
6) *Example:* A WT5000 trap with 125 PSIG Steam Inlet Pressure can be set to an Initial Opening Temperature between 120˚F and 326˚F. It can pass up to 413 lbs/hr when the temperature of the condensate is 80˚F below the initial opening temperature (T–80˚F).



T = Initial Opening Temperature of the Trap can be set from 120˚F to 390˚F

Trap Capacities at Various Inlet Pressures – *Lbs/hr @ T, T-20˚F, T-40˚F, T-60˚F, T-80˚F*

T can range from 120˚F to 390˚F.
T range for Steam Inlet Pressure of 15 PSIG is 120 to 223˚F

Condensate Discharge Temperature	Steam Inlet Pressure (PSIG) 15	30	50	100	125	150	200	250	300	350	400	450	500	600	650
	Saturated Steam Temperature (˚F) (based on given steam inlet pressure) 250	274	298	338	353	366	388	406	422	436	448	460	470	489	497
	Maximum Initial Opening Temperature must be at least 27 degrees below saturated steam temperature. (390˚F max) 223	247	271	311	326	339	361	379	390	→					390
T = Initial Opening Temp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T–20˚F 20˚below Initial Opening Temperature	56	70	102	144	161	177	204	228	250	270	289	306	323	354	368
T–40˚F 40˚below Initial Opening Temperature	116	164	212	300	336	368	425	475	520	562	600	637	671	735	756
T–60˚F 60˚below Initial Opening Temperature	134	190	245	346	387	424	490	548	600	648	693	735	775	849	883
T–80˚F 80˚below Initial Opening Temperature	143	202	261	370	413	453	523	584	640	691	739	784	826	905	942

Steam Traps
Thermostatic Steam Trap
(Repairable)

TA25B, TA125
TS25B, TS125

Model	**TA25B, TA125, TS25B, TS125**
Sizes	**1/2", 3/4"**
Connections	**NPT**
Body Material	**Brass**
PMO Max. Operating Pressure	**TA25B, TS25B 25 PSIG** **TA125, TS125 125 PSIG**
TMO Max. Operating Temperature	**Saturated Steam Temperature**
PMA Max. Allowable Pressure	**125 PSIG up to 450°F**
TMA Max. Allowable Temperature	**450°F @125 PSIG**

TA Type • Right-Angle Connection

TS Type • Straight-thru Connection

Typical Applications

TA & TS type steam traps are predominantly used in the HVAC industry. They are referred to as radiator traps because the quick-disconnect right angle connection of the TA Type is found on most steam radiator installations. The TS Type offers a straight-through connection alternative. TA and TS Series radiator traps were designed specifically for removing condensate and air from 2-pipe steam heating systems. Their excellent air-handling capabilities, compact size, and economical cost make them a great choice for air vents on heat exchangers or for steam trap applications on OEM equipment. Contains an extremely strong and rugged precision-welded Stainless Steel thermal element which is highly resistant to waterhammer.

How It Works

This thermostatic trap contains a welded stainless steel thermal element that expands when heated and contracts when cooled. When air and condensate are present the trap is in the open discharge position. When steam reaches the trap the element expands and closes off tightly.

Features

- Excellent air handling capability
- In-line repairable
- Welded stainless steel thermal element
- Stainless seat on TA125 & TS125
- High thermal efficiency

Sample Specification

The steam trap shall be of thermostatic type with brass or bronze body and stainless steel thermal element. Trap must be in-line repairable.

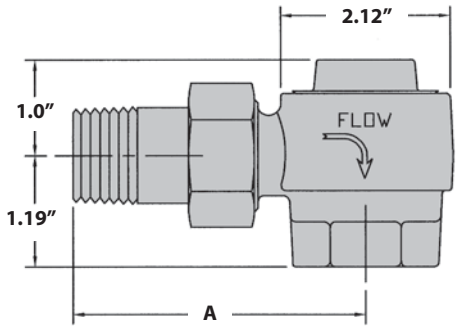
Installation and Maintenance

Trap can be installed in any orientation. The bodies are made from a high-quality brass forging and are easily repairable while the steam trap remains in-line by removing the cap and replacing the seat and thermal element. Repair kit includes thermal element, seat and gasket.

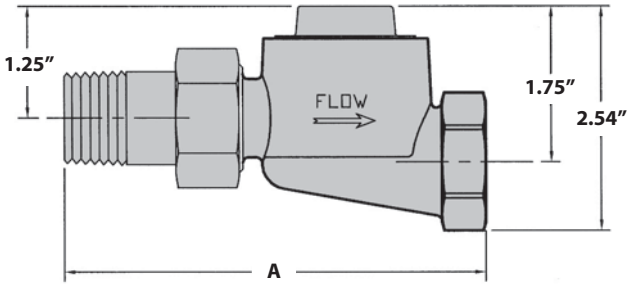
Thermostatic Steam Trap

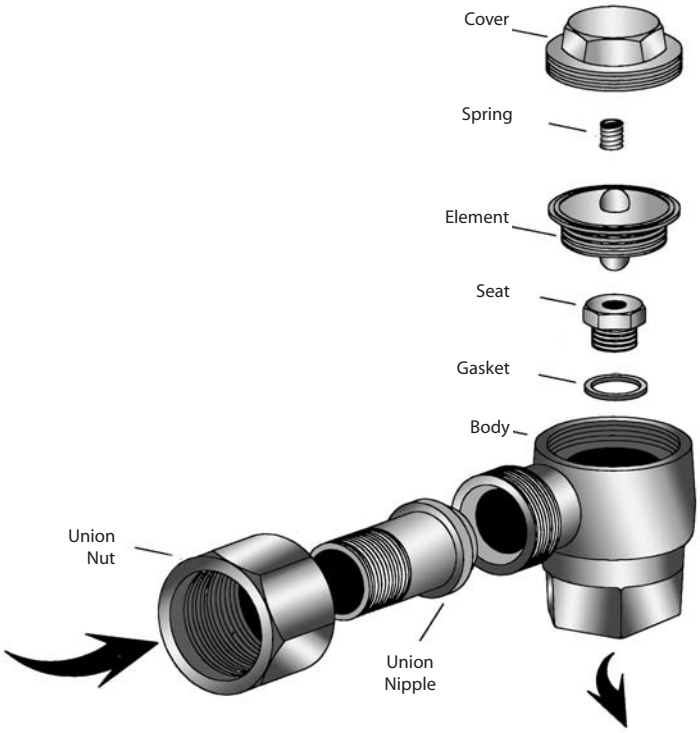
(Repairable)

TA Type • Right-Angle Connection



TS Type • Straight-thru Connection





DIMENSIONS & WEIGHTS — *inches*

Model	Pipe Size	A	Weight (lbs)
TA25B, TA125	1/2″	2.1875	1.5
TA25B, TA125	3/4″	3.062	1.5
TS25B, TS125	1/2″	4.500	1.5
TS25B, TS125	3/4″	4.625	1.5

Note: *Other Union Connections and Lengths are available; consult factory.*

How to Size / Order

Select differential pressure; follow column down to correct capacity (lbs/hr) block. Example:

Application: 2100 lbs/hr at 40 PSI differential pressure

Size/Model: 3/4″ **TA125**

CAPACITIES — *Condensate (lbs/hr)*

Size	Model Code	PMO (PSIG)	Steam Inlet Pressure (PSIG) 15	25	40	65	125
1/2″	TA25B-12-N TS25B-12-N	25	825	1070			
	TA125-12-N TS125-12-N	125	825	1070	1323	1610	1950
3/4″	TA25B-13-N TS25B-13-N	25	1290	1700			
	TA125-13-N TS125-13-N	125	1290	1700	2100	2575	3300

MATERIALS

Body	Forged Brass, CA 377
Element	Welded Stainless Steel, AISI 302
Cover	Forged Brass, CA 377
Spring	Stainless Steel, AISI 304
Seat	TA25B/TS25B: Brass ASTM B-21 TA125/TS125: Stainless Steel, AISI 303
Gasket	Brass, ASTM B-21
Union Nipple	Brass, ASTM B-16
Union Nut	Brass, ASTM B-16

Steam Traps
Thermostatic Steam Trap (Repairable)

WT2500
Thermostatic

Model	**WT2500 (Repairable)**
Sizes	1/2", 3/4"
Connections	NPT
Body Material	Cast Iron
PMO Max. Operating Pressure	**250 PSIG**
TMO Max. Operating Temperature	406°F
PMA Max. Allowable Pressure	250 PSIG up to 450°F
TMA Max. Allowable Temperature	450°F @ 250 PSIG

Typical Applications

DRIP, TRACING, PROCESS: The **WT2500** is a general purpose medium capacity thermostatic trap that can be used for steam tracing; as a drip trap on steam mains and steam supply lines; as well as for process applications. All internal working components can be replaced while the trap body remains in-line. Like all thermostatic traps, they are small, light weight, operate over a wide pressure range, and have excellent air handling capabilities. Discharging air at start-up allows steam to quickly enter the system. The WT2500 is an excellent choice for a variety of applications. Contains an extremely strong and rugged precision welded Stainless Steel thermal element which is highly resistant to waterhammer.

How It Works

The thermostatic trap contains a welded stainless steel thermal element that expands when heated and contracts when cooled. When air and condensate are present, the trap is in the open discharge position. When steam reaches the trap, the element expands and closes off tightly.

Features

- The thermal element and seat can be easily removed and replaced in minutes with the trap body still in-line
- Operates at steam pressures up to 250 PSIG
- Thermostatic traps have excellent air handling capability
- Welded stainless steel thermal element resists shock from water hammer
- Freeze-proof when trap is installed in a vertical orientation allowing for complete condensate drainage
- Hardened stainless steel seat for extended service life

Sample Specification

The steam trap shall be of a thermostatic type with cast iron body and stainless steel thermal element. Trap must be in-line repairable with a bolt-on type cover that is sealed with a spiral wound Stainless Steel AISI 316 gasket. Valve and seat to be hardened stainless steel.

Installation and Maintenance

Trap can be installed in any orientation. All internal working components are extremely easy to replace and can be performed while the trap body remains in line by removing the four-bolt cover. Repair kit includes ALL parts to fully rebuild the steam trap including thermal element, seat and gasket.

Helpful Selection Information

Two orifice sizes are available: The 3/16" orifice should be used on all drip and tracing applications as well as small process applications with lower condensate loads. The 5/16" orifice is available to be used on process applications if additional capacity is required.

Options

SLR = Steam lock release

How to Size / Order

Select working pressure; follow column down to correct capacity (lbs/hr). Example:

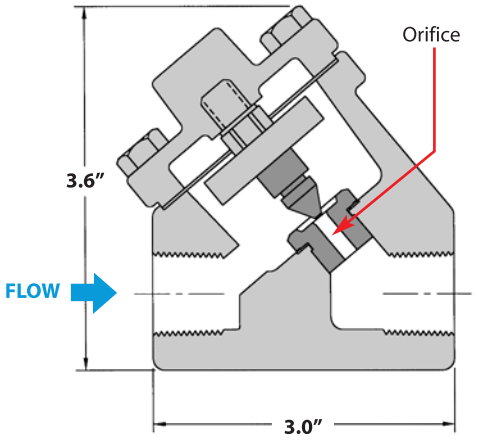
Application: 1827 lbs/hr at 100 PSIG working inlet pressure
Size/Model: **WT2501-12-N**, 1/2" NPT, 3/16" orifice.

MATERIALS

Cover & Body	Cast Iron ASTM A-126 Class B
Thermal Element	Stainless Steel, AISI 302
Valve & Seat	Stainless Steel, AISI 416
Cover Gasket	Garlock

CAPACITIES – *condensate (lbs/hr)*

Size	Model Code	Orifice Size	Steam Inlet Pressure (PSIG) 5	10	20	50	100	125	150	200	250
1/2"	WT2501-12-N	3/16"	441	625	882	1391	1827	1969	2095	2305	2483
3/4"	WT2501-13-N										
1/2"	WT2503-12-N	5/16"	903	1271	1811	2861	3754	4043	4300	4730	5093
3/4"	WT2503-13-N										




Watson McDaniel
POINT DOWN


INLET
WATSON McDANIEL
01944
OUTLET


WATSON McDANIEL Co.

Float & Thermostatic					64-83
Model	Body Material	PMO (PSIG)	Sizes	Connections	Page No.
WFT	Cast Iron	**250**	3/4" – 2"	NPT	**66**
FTT	Ductile Iron	**300**	1/2" – 2"	NPT	**70**
FTE/FTES	Ductile Iron/Cast Steel	**200/300**	1 1/2", 2", 2 1/2"	NPT, SW, FLG	**74**
FT600/FT601	Carbon Steel/Stainless Steel	**450**	3/4" – 4"	NPT, SW, FLG	**76**
FT	Cast Iron	**75**	3/4" – 2"	NPT	**82**

PMO = Maximum Operating Pressure

	Characteristics	Material	Application
WFT 	Parallel Pipe Connection	Cast Iron	Primary Selection for Low to Medium Capacity General Purpose Process Applications Smaller sizes can also be used for Drip Applications
FTT 	In-Line Pipe Connection	Ductile Iron	
FTE & FTES 	Extremely High-Capacity	**FTE**: Ductile Iron **FTES**: Cast Steel	High Capacity Process Applications
FT600 & FT601 	Cast Steel Body	**FT600**: Carbon Steel **FT601**: Stainless Steel	Where Carbon Steel or Stainless Steel bodies are required
FT 	Parallel Pipe Connection (H-pattern)	Cast Iron	General Purpose, Low to Medium Capacity Process Applications up to 75 psig Smaller sizes can also be used for Drip Applications

Introduction

FLOAT & THERMOSTATIC TRAPS

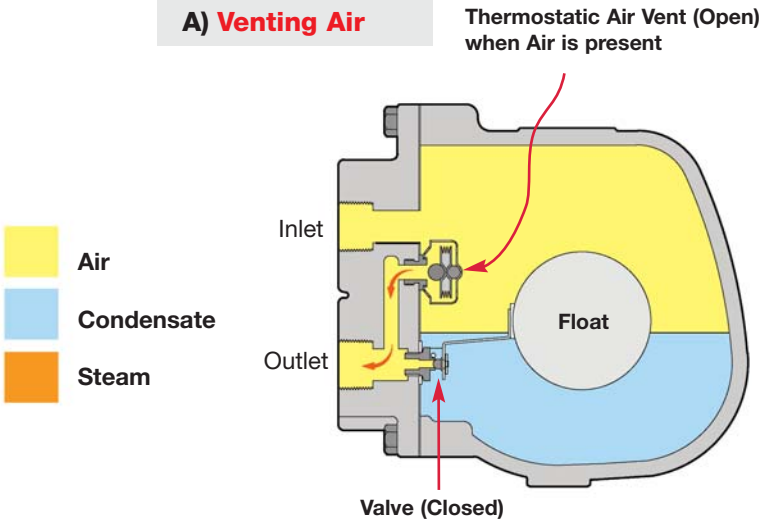
F&T steam traps are the most common trap type used for process applications. They use a float-operated valve mechanism to discharge condensate as it is formed, and an air vent for discharging air at start-up; both very important requirements for process applications. The WFT and FTT-Series with Iron bodies, are suitable for most general purpose process applications up to 250 PSIG. The 3/4" WFT and FTT are often used for drip applications. The FTE-Series has extremely high capacity. The FT600 Series available with Cast Steel or Stainless Steel bodies; often required in Chemical and Petrochemical refineries and other industries.

F&T Traps are classified as mechanical style traps and require the buoyancy of the float, and a lever mechanism to lift the valve disc off the seat orifice. Larger seat orifices and higher steam pressures require additional buoyancy and mechanical force for the trap to open. Select a trap model with an equal or higher PMO rating than the steam pressure, or the trap will not open. F&T traps are not self-draining and are therefore subject to freezing in cold climates. Freeze protection valves are available to fully drain most model F&T traps during shut down periods.

Operation:

At start-up, air and condensate enter the steam trap. The air will be discharged through the open thermostatic air vent (**Figure A**). As the condensate level in the trap rises, it lifts the float which opens the valve to allow the discharge of condensate. When steam enters the trap, the thermostatic element expands and closes the air vent, preventing the steam from escaping (**Figure B**). As the condensate discharges through the seat orifice, the float lowers, and shuts the valve (**Figure C**). The float closes the valve with a level of condensate above the seating orifice to prevent loss of any steam. The float level rises and falls to modulate the seat opening in order to maintain a constant equilibrium between the incoming and discharging condensate. Due to the balance of forces required between the incoming pressure and internal trap components, several orifice sizes are offered to accommodate various differential pressure ranges. These traps can be fitted with a steam lock release (SLR) to be used when the steam trap is physically positioned above the condensate collection point. For superheated steam applications, the thermostatic air vent is replaced with a live orifice air vent.

A) Venting Air

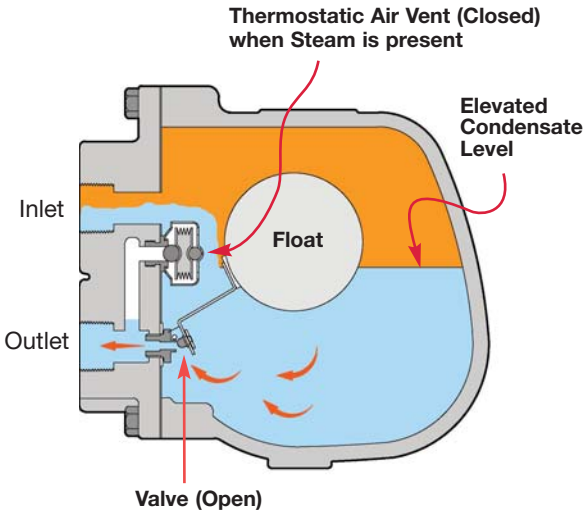


A) When cold air enters the trap during start-up, the thermostatic air vent is open, allowing the discharge of large quantities of air from the system.

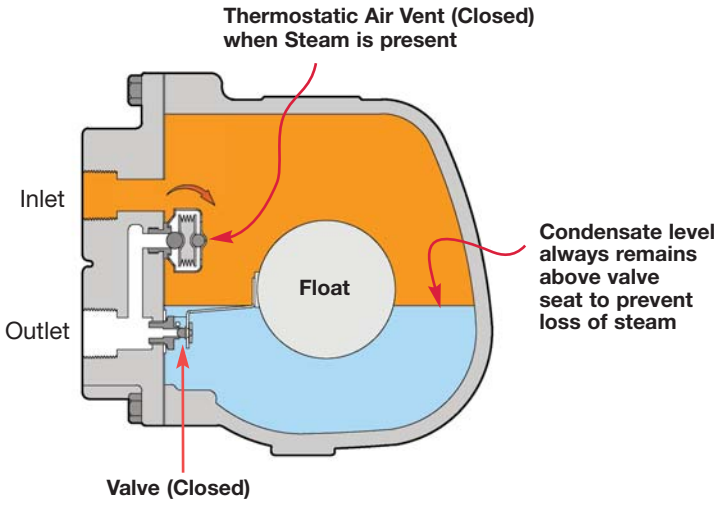
B) When condensate enters the trap, the float lifts which opens the valve, allowing condensate to discharge.

C) When steam is present, and no condensate is entering the trap, the valve and thermostatic air vent remain closed, trapping steam in the system.

B) Discharging Condensate



C) Closed (Trapping Steam)



Steam Traps
Float & Thermostatic Steam Trap

WFT Series
Float & Thermostatic

Model	**WFT**
Sizes	**3/4", 1", 1 1/4", 1 1/2", 2"**
Connections	**NPT**
Body Material	**Cast Iron**
PMO Max. Operating Pressure	**250 PSIG**
TMO Max. Operating Temperature	**Saturated Steam Temperature**
PMA Max. Allowable Pressure	**250 PSIG up to 450°F**
TMA Max. Allowable Temperature	**450°F @ 250 PSIG**

Typical Applications

PROCESS, DRIP: **WFT Series** with parallel port connections were specifically designed for removing condensate and air from HVAC and industrial process applications such as unit heaters, pressing machines, heat exchangers and coils. They contain a high-quality welded stainless steel thermostatic air vent and stainless steel mechanism. The WFT Series are fully repairable while the trap remains in-line and are available in 3/4" thru 2" NPT connections. For drip applications, such as draining steam mains and steam supply lines, use model 3/4" WFT-125 (WFT-125-13-N).

How It Works

Float and thermostatic traps contain a float-operated valve and seat mechanism with a separate thermostatic element which work together to remove both condensate and air from the steam system. The float, which is attached to a valve, rises and opens the valve when condensate enters the trap, allowing the condensate to discharge. Air is discharged through the thermostatic air vent to the outlet side of the trap. Steam entering the trap causes the thermostatic element to expand, closing the air vent and trapping the steam.

Features

- All stainless steel internals with hardened seat and wear parts
- In-line repairability is simplified by having all internals attached to the cover
- Welded stainless steel thermostatic air vent resists shock from waterhammer. Live orifice air vent is available for superheated applications
- Excellent air handling capability allows air to be discharged rapidly so steam can enter the system quickly during start-up
- F&T traps discharge condensate immediately as it is formed (no condensate will back up into the system)

Sample Specification

The trap shall be of float and thermostatic design with cast iron body and parallel piping configuration. Thermostatic air vent to be welded stainless steel. All internals must be stainless steel with hardened seat area. Trap must be in-line repairable.

Installation and Maintenance

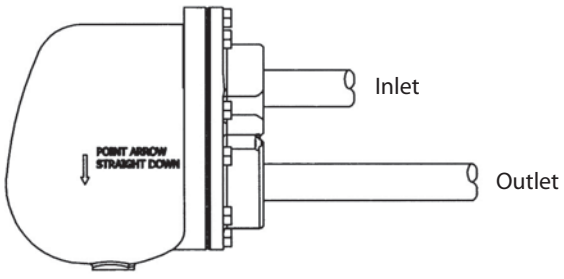
The trap must be installed upright and level for the float mechanism to operate properly. All internal components can be replaced with the trap connected in-line. Repair kits include thermostatic air vent, float, valve seat and disc, and gaskets. The standard thermostatic air vent can be damaged by superheat; therefore, in applications with superheated steam, the thermostatic air vent should be replaced with a special "live orifice" air vent.

Options

- Live orifice air vent for superheated steam applications.
- NPT Connection for freeze protection

MATERIALS	
Body & Cover	Cast Iron
Gasket	Grafoil
Cover Screws	Steel, GR5
Float	Stainless Steel, AISI 304
Internals	Stainless Steel, 300 Series
Thermostat	Stainless Steel
Valve Seat	Stainless Steel, 17-4 PH
Valve Disc	Stainless Steel, AISI 420F

Demonstration of Parallel piping connections:



How to Size / Order

The PMO (maximum operating pressure) rating of model selected must meet or exceed the maximum steam pressure or the trap may not open. For example; the WFT-125 has a PMO of 125 psi. Condensate capacity (lbs/hr) of the trap is based on the differential pressure across the trap. For drip applications, a 3/4" WFT size is generally sufficient to exceed warm-up loads with a 2X safety factor. The condensate loads (lbs/hr) for process applications are normally calculated at the maximum steam pressure; then an appropriate safety margin is applied in order to select a trap with sufficient capacity when operating at lower steam pressures. Reference full explanation of Safety Load Factors in Steam Trap Introduction section.

When a temperature control valve regulates the flow of steam to the process equipment (Heat Exchanger) being drained of condensate, it is recommended to select a trap with a PMO that exceeds the inlet steam pressure to the temperature control valve. This assures that under all operating conditions, the steam pressure will not exceed the PMO of the trap.

For Example: Process application has a maximum steam inlet pressure of 100 psi, a maximum condensate load of 2,500 lbs/hr and is discharging to a condensate return line with a possible back pressure of 25 PSIG. **ΔP** = 100-25 = 75 PSI

To select trap: If the Safety Load Factor is chosen to be 2X max capacity at max differential pressure, then Trap should be selected based on 5,000 lbs/hr (2,500 x 2 = 5,000) at 75 PSI differential pressure with a PMO in excess of 100 PSIG

Selection: WFT-125-17-N, PMO=125 PSIG, 2″ NPT with a condensate capacity of 7,460 lbs/hr at 75 PSI differential pressure.

CAPACITIES — *Condensate (lbs/hr)*

Model Code	PMO (PSIG)	Pipe Size	Orifice Size	ΔP = Differential Pressure (PSI) 1/4	1/2	1	2	5	10	15	20	30	40	50	75	100	125	150	175	200	225	250
WFT-015-13-N	15	3/4″	0.250	390	490	620	780	1050	1320	1500												
WFT-015-14-N	15	1″	0.250	390	490	620	780	1050	1320	1500												
WFT-015-15-N	15	1 1/4″	0.312	610	770	960	1210	1630	2040	2330												
WFT-015-16-N	15	1 1/2″	0.500	1420	1910	2570	3460	5120	6890	8190												
WFT-015-17-N	15	2″	0.625	2260	2950	3860	5040	7170	9360	10930												
WFT-030-13-N	30	3/4″	0.228	330	420	530	670	930	1180	1350	1500	1720										
WFT-030-14-N	30	1″	0.228	330	420	530	670	930	1180	1350	1500	1720										
WFT-030-15-N	30	1 1/4″	0.228	330	420	530	670	930	1180	1350	1500	1720										
WFT-030-16-N	30	1 1/2″	0.390	930	1240	1650	2190	3210	4280	5060	5700	6750										
WFT-030-17-N	30	2″	0.500	1420	1910	2570	3460	5120	6890	8190	9260	11020										
WFT-075-13-N	75	3/4″	0.166	175	225	295	385	545	705	825	920	1075	1200	1305	1525							
WFT-075-14-N	75	1″	0.166	175	225	295	385	545	705	825	920	1075	1200	1305	1525							
WFT-075-15-N	75	1 1/4″	0.312	640	850	1130	1500	2180	2900	3420	3850	4540	5110	5600	6610							
WFT-075-16-N	75	1 1/2″	0.312	640	850	1130	1500	2180	2900	3420	3850	4540	5110	5600	6610							
WFT-075-17-N	75	2″	0.422	1020	1340	1760	2310	3330	4380	5140	5760	6770	7590	8290	9730							
WFT-125-13-N	125	3/4″	0.128	105	135	180	235	340	445	525	585	690	770	845	990	1110	1210					
WFT-125-14-N	125	1″	0.128	105	135	180	235	340	445	525	585	690	770	845	990	1110	1210					
WFT-125-15-N	125	1 1/4″	0.250	410	540	710	930	1340	1770	2070	2320	2730	3050	3340	3920	4390	4790					
WFT-125-16-N	125	1 1/2″	0.250	410	540	710	930	1340	1770	2070	2320	2730	3050	3340	3920	4390	4790					
WFT-125-17-N	125	2″	0.332	720	960	1270	1690	2460	3270	3860	4340	5130	5770	6320	7460	8390	9190					
WFT-175-13-N	175	3/4″	0.166	190	250	320	420	590	770	900	1010	1180	1310	1430	1670	1870	2030	2180	2310			
WFT-175-14-N	175	1″	0.166	190	250	320	420	590	770	900	1010	1180	1310	1430	1670	1870	2030	2180	2310			
WFT-175-15-N	175	1 1/4″	0.250	410	540	710	930	1340	1770	2070	2320	2730	3050	3340	3920	4390	4790	5150	5470			
WFT-175-16-N	175	1 1/2″	0.250	410	540	710	930	1340	1770	2070	2320	2730	3050	3340	3920	4390	4790	5150	5470			
WFT-175-17-N	175	2″	0.281	520	680	900	1180	1700	2230	2620	2930	3440	3860	4210	4950	5540	6050	6510	6920			
WFT-250-13-N	250	3/4″	0.128	115	145	190	245	345	450	520	580	675	755	820	955	1060	1155	1235	1310	1375	1440	1495
WFT-250-14-N	250	1″	0.128	115	145	190	245	345	450	520	580	675	755	820	955	1060	1155	1235	1310	1375	1440	1495
WFT-250-15-N	250	1 1/4″	0.203	270	350	450	590	820	1070	1240	1380	1600	1780	1940	2250	2500	2720	2910	3080	3240	3380	3520
WFT-250-16-N	250	1 1/2″	0.203	270	350	450	590	820	1070	1240	1380	1600	1780	1940	2250	2500	2720	2910	3080	3240	3380	3520
WFT-250-17-N	250	2″	0.250	410	540	710	930	1340	1760	2060	2310	2710	3040	3320	3890	4360	4760	5110	5430	5730	6000	6250

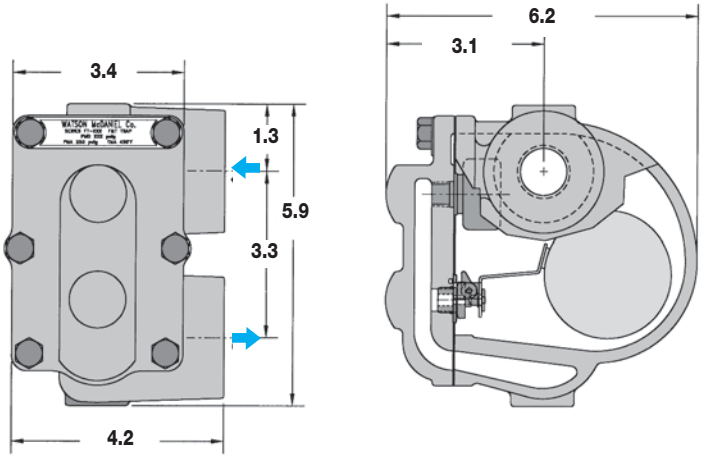
Steam Traps
Float & Thermostatic Steam Trap

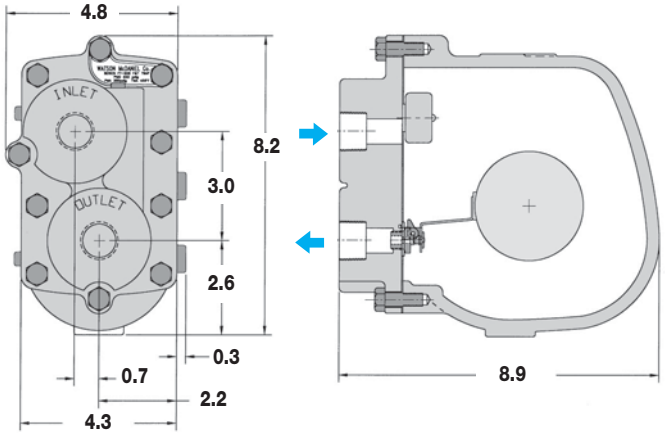
WFT Series
Float & Thermostatic

Dimensions: inches

WFT
3/4" • 1" • 1 1/4"

WFT
3/4" & 1"



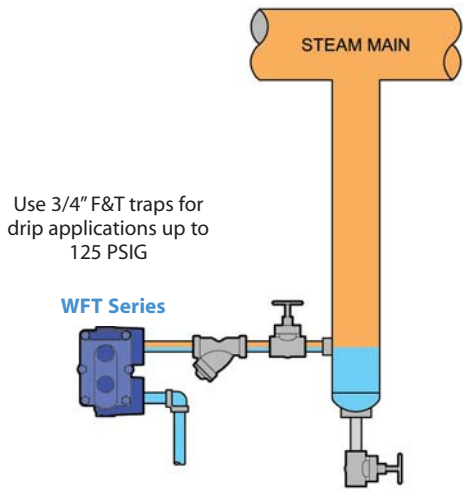


SPECIFICATIONS

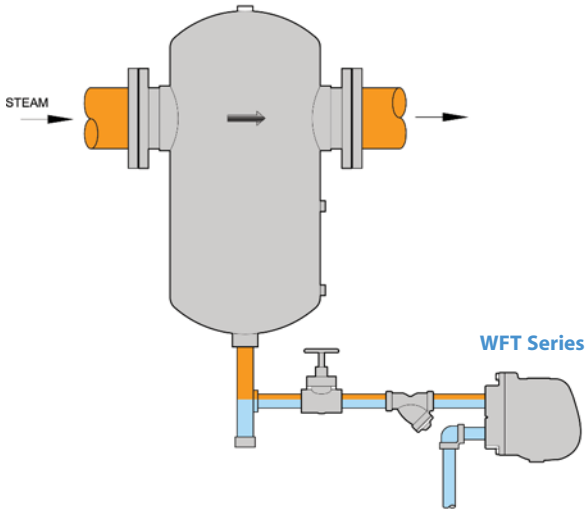
Model	Sizes	Connection	PMO (PSIG)	PMA (PSIG)	Weight (lbs)
WFT-15	3/4", 1", 1 1/4"	NPT	15	125	9
WFT-30	3/4", 1", 1 1/4"	NPT	30	125	9
WFT-75	3/4", 1"	NPT	75	125	9
WFT-125	3/4", 1"	NPT	125	125	9

SPECIFICATIONS

Model	Sizes	Connection	PMO (PSIG)	PMA (PSIG)	Weight (lbs)
WFT-175	3/4", 1"	NPT	175	250	20
WFT-250	3/4", 1"	NPT	250	250	20



Steam Main Drip Application

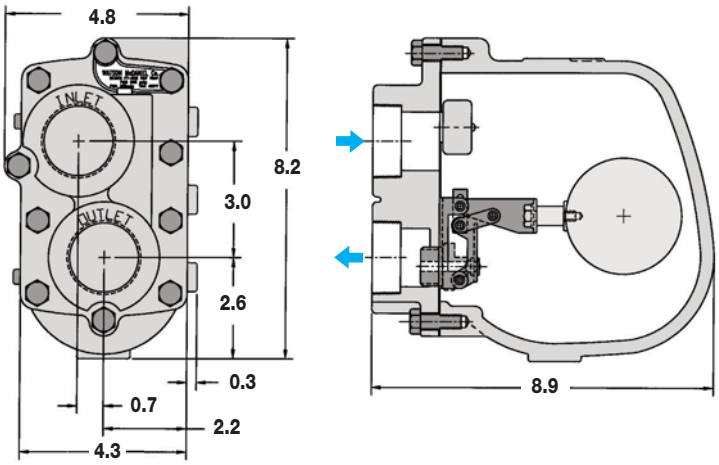


Separator Application

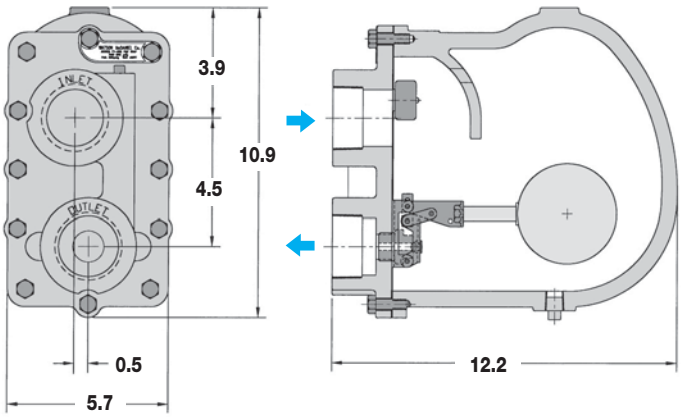
WFT Series
Float & Thermostatic

Dimensions: inches

WFT
$1^1/_4$" & $1^1/_2$"



WFT
2"



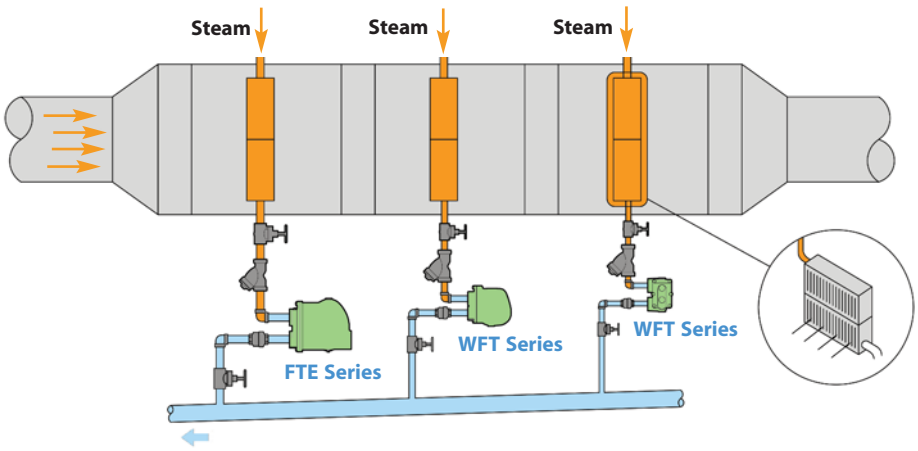
SPECIFICATIONS

Model	Sizes	Connection	PMO (PSIG)	PMA (PSIG)	Weight (lbs)
WFT-15	$1^1/_2$"	NPT	15	250	21
WFT-30	$1^1/_2$"	NPT	30	250	21
WFT-75	$1^1/_4$", $1^1/_2$"	NPT	75	250	21
WFT-125	$1^1/_4$", $1^1/_2$"	NPT	125	250	21
WFT-175	$1^1/_4$", $1^1/_2$"	NPT	175	250	21
WFT-250	$1^1/_4$", $1^1/_2$"	NPT	250	250	21

SPECIFICATIONS

Model	Sizes	Connection	PMO (PSIG)	PMA (PSIG)	Weight (lbs)
WFT-15	2"	NPT	15	250	53
WFT-30	2"	NPT	30	250	53
WFT-75	2"	NPT	75	250	53
WFT-125	2"	NPT	125	250	53
WFT-175	2"	NPT	175	250	53
WFT-250	2"	NPT	250	250	53

Multi-bank Air Heating Coils / Air Handler Unit

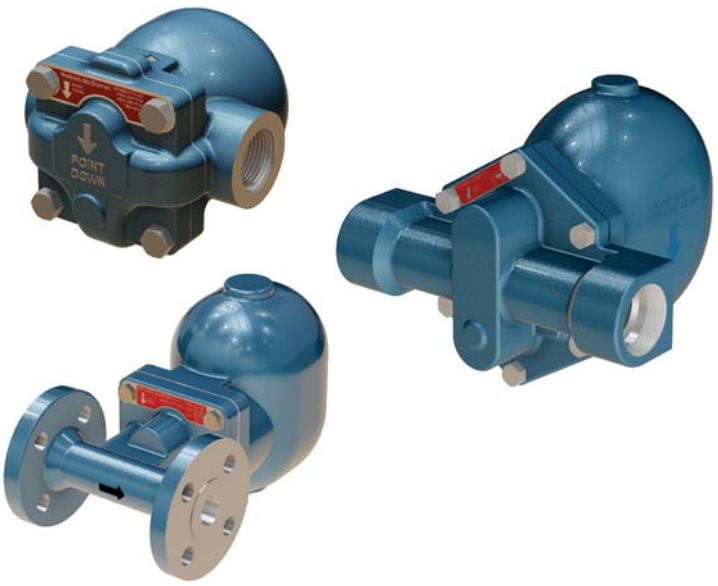


Steam Traps
Float & Thermostatic Steam Trap

FTT Series
Float & Thermostatic

Model	**FTT**
Sizes	**1/2", 3/4", 1", 1 1/2", 2"**
Connections	**NPT, 150# FLG (1" - 2")**
Body Material	**Ductile Iron**
PMO Max. Operating Pressure	**300 PSIG**
TMO Max. Operating Temperature	**Saturated Steam Temperature**
PMA Max. Allowable Pressure	**300 PSIG up to 450°F**
TMA Max. Allowable Temperature	**450°F @ 300 PSIG**

1/2" & 3/4" available in NPT only.



Typical Applications

DRIP, PROCESS: **FTT Series** steam traps with in-line pipe connections are used for the removal of condensate and air in HVAC and industrial process applications such as unit heaters, water heaters, pressing machines, heat exchangers and coils. They contain a high-quality welded stainless steel thermostatic air vent and stainless seat and mechanism. F&T traps have excellent air handling capability, making them a better choice than Inverted Bucket traps for most process applications. For drip applications, such as draining steam mains and steam supply lines, use 1/2" or 3/4" sizes.

How It Works

Float and thermostatic traps contain a float and seat mechanism with a separate thermostatic element which work together to remove both condensate and air from the steam system. The float, which is attached to a valve, rises and opens the valve when condensate enters the trap. This allows the condensate to discharge. Air is discharged through the thermostatic air vent to the outlet side of the trap. Steam entering the trap causes the thermostatic element to expand, closing the air vent and trapping the steam.

Sample Specification

The trap shall be of float and thermostatic design with ductile iron body and in-line piping configuration. Thermostatic air vent to be welded stainless steel. All internals must be stainless steel with hardened seat area. Trap must be in-line repairable.

Options

- Live orifice air vent for superheated steam applications.
- NPT Connection for freeze protection

Installation and Maintenance

The trap must be installed upright and level for the float mechanism to operate properly. All internal components can be replaced with the trap body remaining in-line. Repair kits include thermostatic air vent, float, valve seat and disc, and gaskets. The standard thermostatic air vent can be damaged by superheat; therefore, in applications with superheated steam, the thermostatic air vent should be replaced with a special "live orifice" air vent.

Features

- Ductile Iron has a higher pressure and temperature rating and is more resistant to shock loads than cast Iron
- All stainless steel internals with hardened seat and wear parts
- In-line repairability is simplified by having all internals attached to the cover
- Welded stainless steel thermostatic air vent resists shock from waterhammer. Live orifice air vent is available for superheated applications
- Excellent air handling capability allows air to be discharged rapidly so steam can enter the system quickly during start-up
- F&T traps discharge condensate immediately as it is formed (no condensate will back up into the system)

How to Size / Order

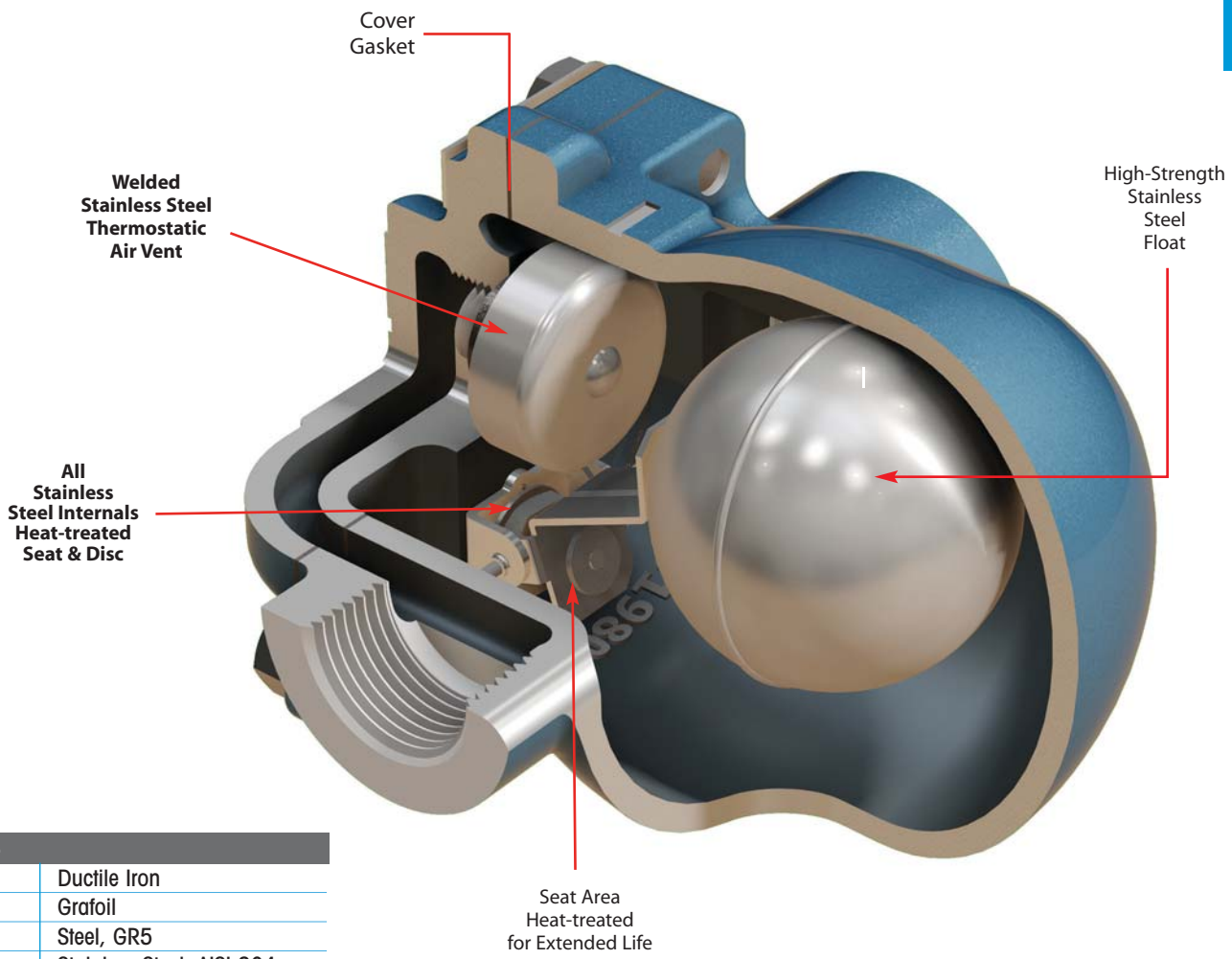
The PMO (maximum operating pressure) rating of model selected must meet or exceed the maximum steam pressure or the trap may not open. For example; the FTT-145 has a PMO of 145 psi. Condensate capacity (lbs/hr) of the trap is based on the differential pressure across the trap. For drip applications, a 1/2" FTT size is generally sufficient to exceed warm-up loads with a 2X safety factor. The condensate loads (lbs/hr) for process applications are normally calculated at the maximum steam pressure; then an appropriate safety margin is applied in order to select the trap with sufficient capacity when operating at lower steam pressures. Reference full explanation of Safety Load Factors in Steam Traps Introduction section.

When a temperature control valve is regulating flow to the process equipment, it is recommended to select a trap with a PMO that will exceed the inlet steam pressure to the control valve.

For Example: Process application has a maximum steam inlet pressure of 100 psi, a maximum condensate load of 2,500 lbs/hr and is discharging to a condensate return line with a possible back pressure of 25 psig. **ΔP** = 100-25 = 75 PSI

To select trap: If the Safety Load Factor is chosen to be 2X max capacity at max differential pressure, then Trap should be selected based on 5,000 lbs/hr (2,500 x 2 = 5,000) at 75 PSI differential pressure with a PMO in excess of 100 PSIG

Selection: **FTT-145-16-N**, PMO=145 PSIG, 1 1/2" NPT with a condensate capacity of 9,600 lbs/hr at 75 PSI differential pressure.



MATERIALS	
Body & Cover	Ductile Iron
Gasket	Grafoil
Cover Screws	Steel, GR5
Float	Stainless Steel, AISI 304
Internals	Stainless Steel
Thermostat	Stainless Steel
Valve Seat	Stainless Steel, 17-4 PH
Valve Disc	Stainless Steel, AISI 420F

Connection Code: **N**=NPT **F150** = 150# FLG
1/2" & 3/4" available in NPT only.
PMO = Max Operating Pressure

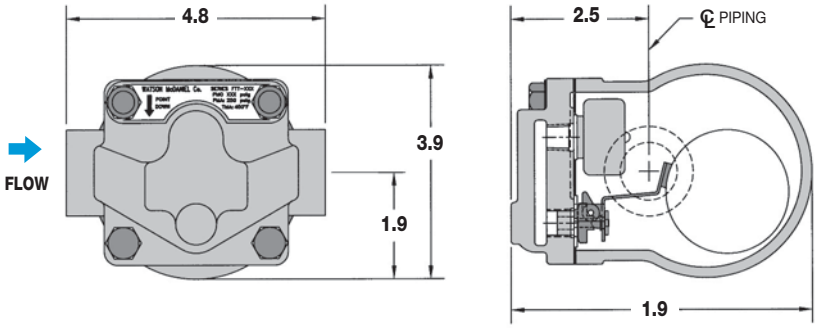
CAPACITIES – *Condensate (lbs/hr)*

Model Code	PMO (PSIG)	Pipe Size	ΔP = Differential Pressure (PSI) 1/4	1/2	1	2	5	10	15	20	30	40	50	65	75	100	125	145	200	225	250	300
FTT-065-12-N	65	1/2"	115	155	205	270	390	520	610	685	810	910	995	1110								
FTT-065-13-N	65	3/4"	115	155	205	270	390	520	610	685	810	910	995	1110								
FTT-065-14-N	65	1"	340	500	775	1100	1700	2400	2800	3250	3925	4200	5000	5825								
FTT-065-16-N	65	1 1/2"	1150	1650	2500	3450	5300	7500	8180	10600	13100	15000	16800	18900								
FTT-065-17-N	65	2"	3470	4820	8500	11950	18700	25200	26900	36000	43000	49600	55500	61300								
FTT-145-12-N	145	1/2"	55	75	100	135	200	270	320	365	435	490	540	600	640	725	795	850				
FTT-145-13-N	145	3/4"	55	75	100	135	200	270	320	365	435	490	540	600	640	725	795	850				
FTT-145-14-N	145	1"	190	275	405	550	840	1200	1380	1600	1850	2200	2450	2750	2920	3400	3700	3900				
FTT-145-16-N	145	1 1/2"	685	970	1275	1750	2740	3750	4490	5100	6250	7200	8000	8900	9600	11250	12000	13300				
FTT-145-17-N	145	2"	1860	2680	3125	4400	6900	9250	13790	14600	16900	19400	21900	25000	26800	31000	34000	37000				
FTT-225-12-N	225	1/2"	40	50	70	95	135	185	220	245	290	330	360	405	430	485	530	565	645	680		
FTT-225-13-N	225	3/4"	40	50	70	95	135	185	220	245	290	330	360	405	430	485	530	565	645	680		
FTT-225-14-N	225	1"	150	200	300	405	600	820	975	1130	1375	1510	1620	1875	2000	2350	2600	2750	3100	3250		
FTT-250-16-N	250	1 1/2"	530	710	825	1130	1760	2500	2950	3375	4125	4740	5250	6000	6400	7300	8000	8650	10200	10800	11300	
FTT-250-17-N	250	2"	695	985	1560	2185	3490	4800	5800	6750	8250	9500	10650	12400	13300	15000	16600	18120	21200	22300	23200	
FTT-300-14-N	300	1"	100	155	220	300	460	630	750	860	1060	1240	1360	1450	1600	1820	2000	2130	2500	2650	2800	3000

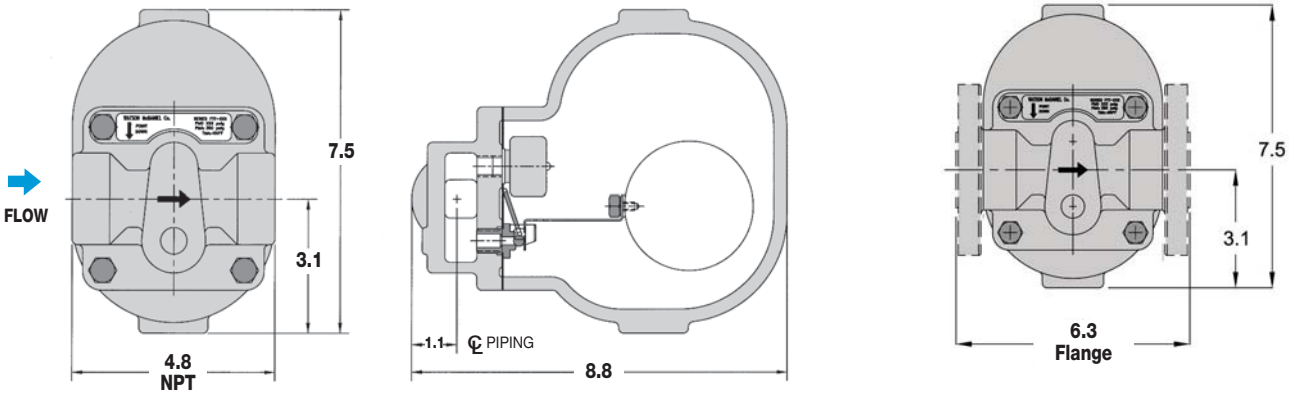
Dimensions: inches

FTT • 1/2" & 3/4"

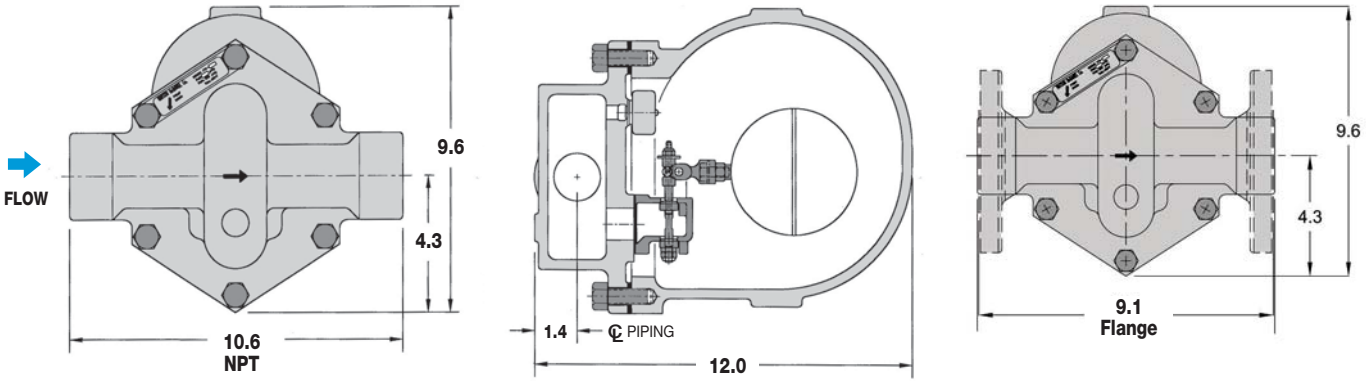
Weight: **6 lbs.**



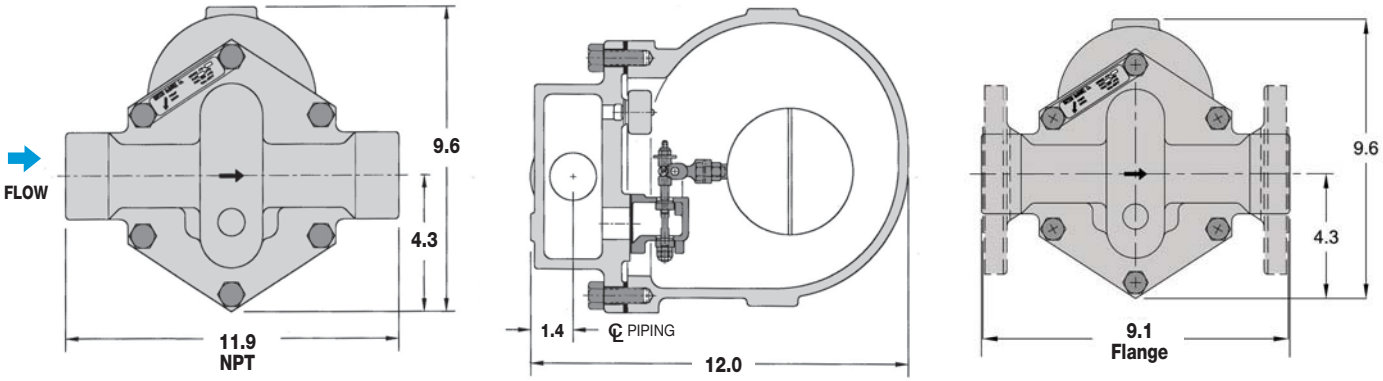
FTT 1" Weight threaded NPT: **16 lbs.**



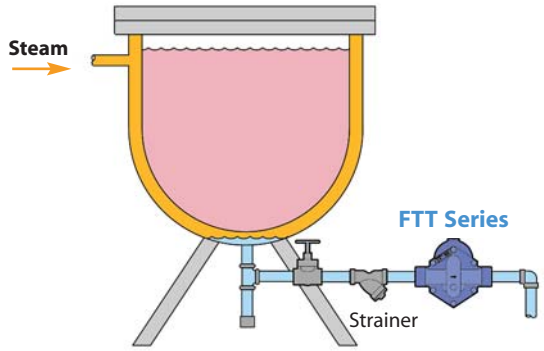
FTT • 1 1/2" • Weight threaded NPT **38 lbs.**



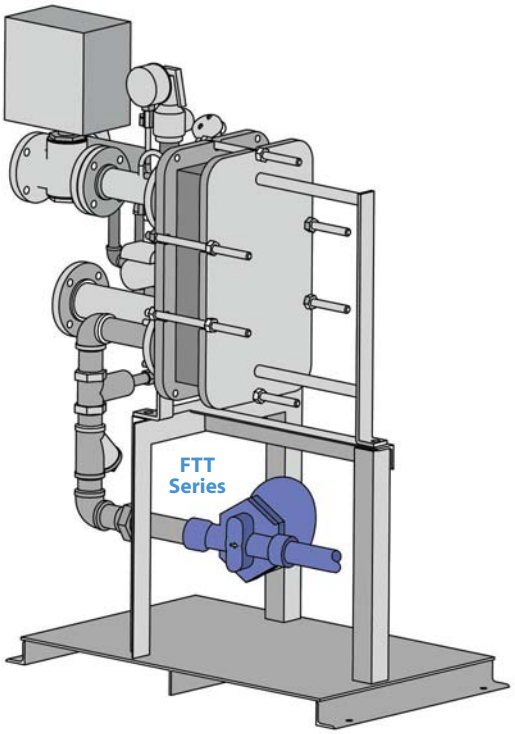
FTT • 2" • Weight threaded NPT **42 lbs.**



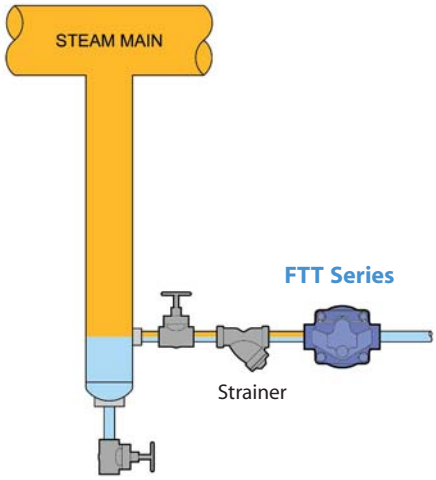
Typical Applications for Float & Thermostatic Steam Traps



Jacketed Kettle Application



Instantaneous Steam to Hot Water Heater (Heat Miser)



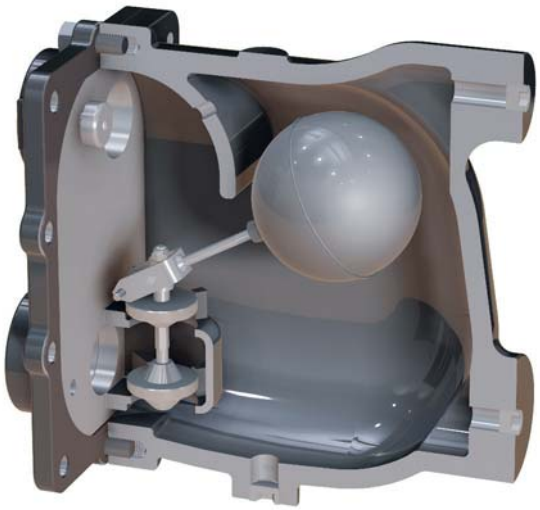
Steam Main Drip Application

Steam Traps
Float & Thermostatic Steam Trap

FTE & FTES
Float & Thermostatic

Model	FTE	FTES
Sizes	1½", 2", 2½"	2½"
Connections	NPT	NPT, SW, FLG
Body Material	Ductile Iron	Cast Steel
PMO Max. Operating Pressure	200 PSIG	300 PSIG
TMO Max. Operating Temperature	450°F	450°F
PMA Max. Allowable Pressure	300 PSIG up to 450°F	300 PSIG up to 750°F
TMA Max. Allowable Temperature	450°F @ 300 PSIG	750°F @ 300 PSIG

The FTE & FTES are used for extremely high capacity condensate drainage applications.



Typical Applications

PROCESS: **FTE & FTES** Series are high capacity steam traps specifically designed to remove condensate and air from HVAC and industrial process applications with extremely high condensate load requirements. Examples include reboilers, absorption chillers, large air-handling coils, large heat exchangers and other large process equipment. They are available with a ductile iron (FTE) or steel body (FTES) and contain a high quality welded stainless steel thermostatic air vent and stainless mechanism. F&T traps have excellent air-handling capability, making them a better choice than Inverted Bucket traps for most process applications.

Features

- Ductile Iron has a higher pressure and temperature rating and is more resistant to shock loads than Cast Iron
- Cast Steel Body will allow operating pressures and temperatures up to 300 PSIG and 450°F
- High capacity steam trap for draining large process equipment (over 100,000 lbs/hr)
- All stainless steel internals with hardened seat and wear parts
- In-line repairability is simplified by having all internals attached to the cover
- Welded stainless steel thermostatic air vent resists shock from waterhammer. Live orifice air vent is available for superheated applications
- Excellent air handling capability allows air to be discharged rapidly so steam can enter the system quickly during start-up
- F&T traps discharge condensate immediately as it is formed (no condensate will back up into the system)

How It Works

Float and thermostatic traps contain a float and seat mechanism with a separate thermostatic element which work together to remove both condensate and air from the steam system. The float, which is attached to a valve, rises and opens the valve when condensate enters the trap. This allows the condensate to discharge. Air is discharged through the thermostatic air vent to the outlet side of the trap. Steam entering the trap causes the thermostatic element to expand, closing the air vent and trapping the steam.

Sample Specification

The trap shall be of float and thermostatic design with ductile iron or cast steel body. The trap must incorporate all stainless steel internals with hardened seat and welded stainless steel thermostatic air vent. Trap must be in-line repairable.

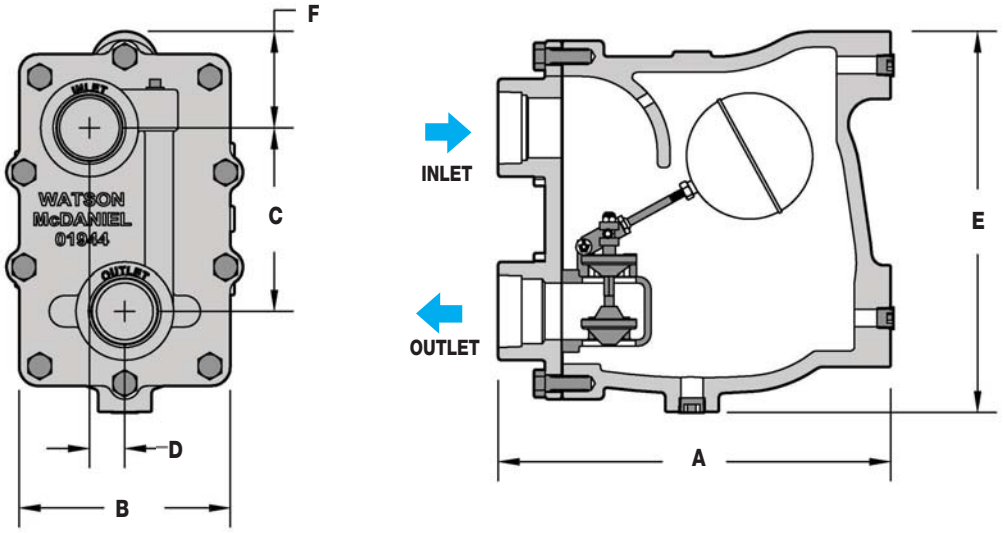
Installation and Maintenance

The trap must be installed upright and level for the float mechanism to operate properly. All internal components can be replaced with the trap body remaining in-line. Repair kits include thermostatic air vent, float, valve seat and disc, and gaskets. The **FTES** Series have cast steel bodies and are available in 2½" NPT, socket weld and flange connections. The standard thermostatic air vent can be damaged by superheat; therefore, in applications with superheated steam, the thermostatic air vent should be replaced with a special "live orifice" air vent.

Options

Live orifice air vent for superheated steam applications.

Parallel-pipe inlet/outlet connections are standard as shown. An optional In-line inlet/outlet connection is available; contact factory.



DIMENSIONS & WEIGHTS – *inches*

Size/Model	A	B	C	D	E	F	Weight
2" FTE-20	12.6	5.7	4.5	0.5	11.1	3.9	54
2" FTE-50	16.0	8.4	7.3	1.4	15.6	3.6	150
2 1/2" FTE-50	15.5	8.4	7.3	1.4	15.6	3.6	150
2 1/2" FTE-125	15.5	8.4	7.3	1.4	15.6	3.6	150
1 1/2" FTE-200	9.6	4.3	3.0	0.7	8.8	2.6	35
2" FTE-200	12.6	5.7	4.5	0.5	11.1	3.9	65
2 1/2" FTE-200	15.5	8.4	7.3	1.4	15.6	3.6	150
2 1/2" FTES-300	15.5	8.4	7.3	1.4	15.6	3.6	150

Note: 2 1/2" **FTES-50**, **125** & **300** have same dimensions and weights.

MATERIALS

Body & Cover (FTE)	Ductile Iron
Body & Cover (FTES)	Cast Steel, ASTM A-216
Cover Screw	Grade 5 Carbon Steel
Cover Gasket	Grafoil
Valve Discs	Stainless Steel, AISI 17-4PH
Main Valve Assembly Housing	Stainless Steel, AISI 17-4PH
Valve Assembly Gasket	Garlock
Ball Float	Stainless Steel, AISI 304
Thermostatic Vent	Stainless Steel, AISI 300 Optional: Live orifice air vent

How to Size / Order

The PMO (maximum operating pressure) rating of model selected must meet or exceed the maximum steam pressure or the trap may not open. For example; the FTE-125 has a PMO of 125 psi. Condensate capacity (lbs/hr) of the trap is based on the differential pressure across the trap. The condensate loads (lbs/hr) for process applications are normally calculated at the maximum steam pressure; then an appropriate safety margin is applied in order to select a trap with sufficient capacity when operating at lower steam pressures. Reference full explanation of Safety Load Factors in Steam Traps Introduction section.

When a temperature control valve is regulating flow to the process equipment, it is recommended to select a trap with a PMO that will exceed the inlet steam pressure to the control valve.

For Example: Process application has a maximum steam inlet pressure of 100 psi, a maximum condensate load of 10,000 lbs/hr and is discharging to a condensate return line with a possible back pressure of 25 psig. **ΔP** = 100-25 = 75 PSI

To select trap: If the Safety Load Factor is chosen to be 2X max capacity at max differential pressure, then Trap should be selected based on 20,000 lbs/hr (10,000 x 2 = 20,000) at 75 PSI differential pressure with a PMO in excess of 100 PSIG

Selection: FTE-200-17-N, PMO=200 PSIG, 2" NPT with a condensate capacity of 21,500 lbs/hr at 75 PSI differential pressure.

CAPACITIES – *Condensate (lbs/hr)*

Model Code	PMO (PSIG)	Pipe Size	Orifice Size	ΔP = Differential Pressure (PSI) 1/4	1/2	1	2	5	10	15	20	30	50	75	100	125	200	250	300
FTE-20-17-N*	20	2"	.937"	6100	7800	9300	11800	15900	19500	22500	26000								
FTE-50-17-N	50	2"	2.125"	12800	16900	20100	25300	33000	40200	43500	46000	47800	52500						
FTE-50-18-N	50	2 1/2"	2.125"	20400	25700	31000	37000	46300	55100	60300	65100	72000	82100						
FTE-125-18-N	125	2 1/2"	2.125"	20400	25700	31000	37000	46300	55100	60300	65100	72000	82100	90400	97700	105000			
FTE-200-16-N	200	1 1/2"	.375"	950	1350	1900	2200	2700	3300	3900	4400	5300	6400	7600	8500	9400	11900		
FTE-200-17-N	200	2"	.75"	2700	4100	5700	7400	9900	11800	13400	14400	16400	19000	21500	23000	24500	29200		
FTE-200-18-N	200	2 1/2"	1.5"	7200	12300	17400	21500	27600	32600	36000	39300	43100	49200	54700	58800	61900	74000		
FTES-50-18-N	50	2 1/2"	2.125"	20400	25700	31000	37000	46300	55100	60300	65100	72000	82100						
FTES-125-18-N	125	2 1/2"	2.125"	20400	25700	31000	37000	46300	55100	60300	65100	72000	82100	90400	97700	105000			
FTES-300-18-N	300	2 1/2"	1.5"	7200	12300	17400	21500	27600	32600	36000	39300	43100	49200	54700	58800	61900	74000	86000	100550

** Single seat orifice. All others are double seated.*

FT600 & FT601
Float & Thermostatic

Model	**FT600 & FT601***
Sizes	3/4", 1", 1 1/2", 2", 3", 4"
Connections	NPT, SW, FLG
Body Material	Carbon Steel or 316SS
Options	Live Orifice Air Vent
PMO Max. Operating Pressure	**450 PSIG**
TMO Max. Operating Temperature	750°F
PMA Max. Allowable Pressure	990 PSIG @ 100°F
TMA Max. Allowable Temperature	750°F @ 670 PSIG

**** FT601 Body Material is 316 SS***
FT600 Body Material is Carbon Steel

Typical Applications

PROCESS: FT600 Series steam traps with Cast Steel Body were specifically designed for removing condensate and air from higher pressure steam applications or where steel bodies are specified. They are typically used in chemical plants and petrochemical refineries on re-boilers, heat exchangers, and other critical process applications. The excellent air-handling capability of float and thermostatic traps make them a better choice than bucket traps for applications requiring quick system start-up. Maximum steam pressure is 450 PSIG. Note: Model FT601 is identical to FT600 except body material is 316 SS.

How It Works

Float and thermostatic traps contain a float and seat mechanism with a separate thermostatic element which work together to remove both condensate and air from the steam system. The float, which is attached to a valve, rises and opens the valve when condensate enters the trap. This allows the condensate to discharge. Air is discharged through the thermostatic air vent to the outlet side of the trap. Steam entering the trap causes the thermostatic element to expand, closing the air vent and trapping the steam.

Features

- Investment cast steel body and cover with class 400 shell rating (670 PSIG @ 750°F)
- Hardened stainless steel seat and disc for extended service life even at extreme temperatures and pressures
- Excellent air handling capability allows air to be discharged rapidly so steam can enter the system quickly during start-up
- In-line repairability is simplified by having all internals attached to the cover. Studded cover allows for easier removal of body.
- Welded stainless steel air vent resists shock from waterhammer. Live orifice air vent is available for superheated applications
- F&T traps discharge condensate immediately as it is formed (no condensate will back up into the system)

Options

Live orifice air vent for superheated applications.

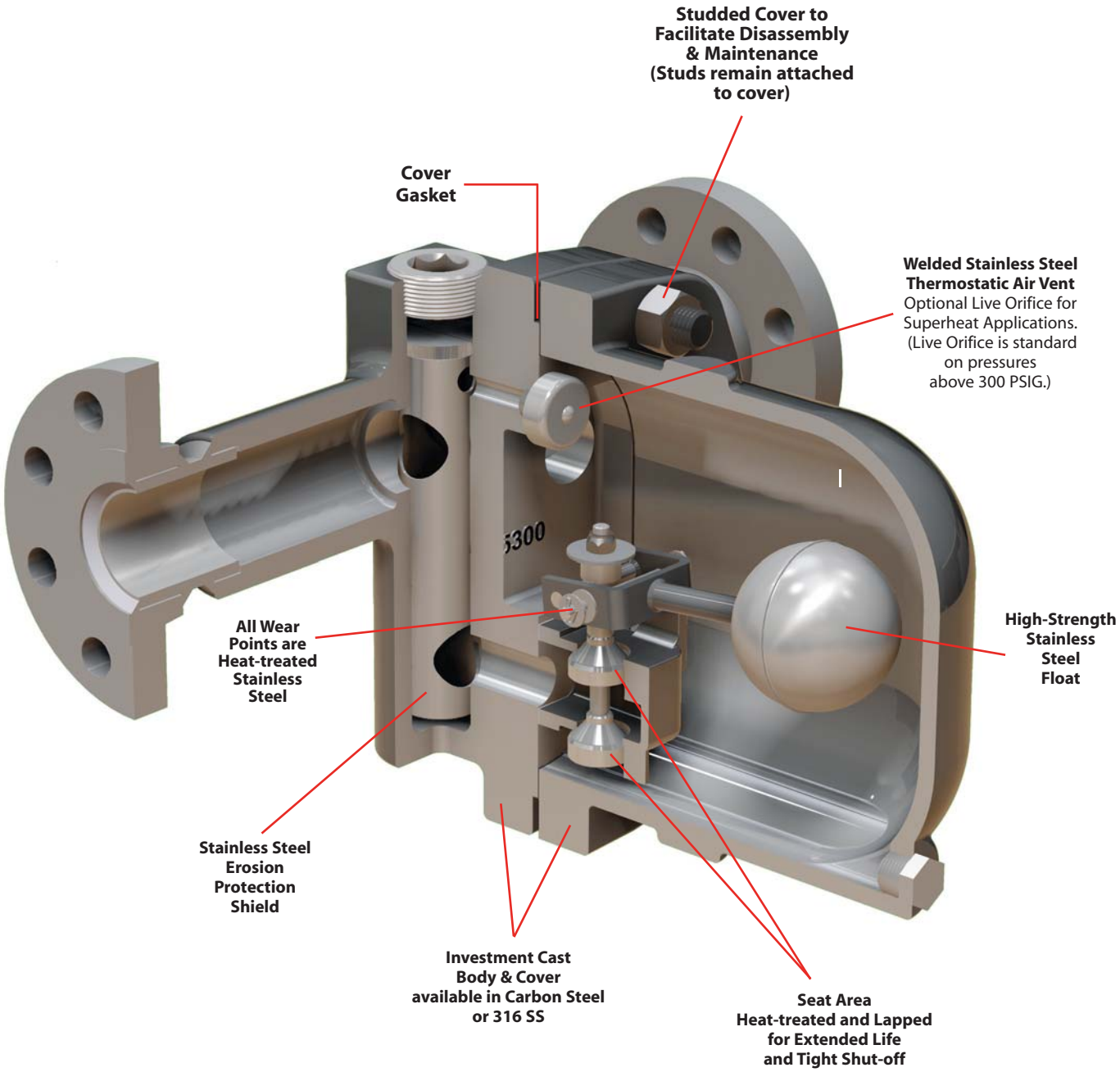
Sample Specification

The steam trap shall be of the mechanical float type having cast steel bodies, horizontal in-line connections in NPT, SW, or flanged, and all stainless steel internals. Incorporated into the trap body shall be an all stainless steel welded thermal element air vent which is water hammer resistant. The air vent is to be located at the high point of trap body to assure proper venting of non-condensables. The trap body will be in-line renewable. All bodies and covers shall be class 400 shell design, suitable for 670 PSIG @ 750°F.

Installation and Maintenance

The trap must be installed upright and level for the float mechanism to operate properly. All internal components can be replaced while the steam trap remains connected to the piping (in-line repairable). Threaded studs are permanently installed into the cover assembly which greatly simplifies the removal and replacement of the body when servicing. Internal components include a high quality welded stainless steel thermostatic air vent and stainless steel seat and mechanism. The standard thermostatic air vent can be damaged by superheat; therefore, in applications with superheated steam, the thermostatic air vent should be replaced with a special "live orifice" air vent.

FT600 & FT601
Float & Thermostatic



MATERIALS	
FT 600: Body & Cover	Cast Steel, ASTM A-216
FT 601: Body & Cover	316 SS
Cover Studs	Steel, AS 193, GR B7
Cover Nuts	Steel, SA 194, GR 2H
Cover Gasket	Stainless Steel Reinforced Grafoil
Valve Assembly	Stainless Steel, AISI 431
Gasket, Valve Assembly	Stainless Steel Reinforced Grafoil
Pivot Assembly	Stainless Steel, 17-4 PH
Mounting Screws	Stainless Steel Hex Head, 18-8
Float	Stainless Steel, ASTM -240, 304
Air Vent Assembly	Thermostatic element 304 SS Optional: Live orifice

How to Size / Order

The maximum operating pressure (PMO) rating of model selected must meet or exceed the maximum steam pressure or the trap may not open. For example; the FT600-145 has a PMO of 145 psi. Condensate capacity (lbs/hr) of the trap is based on the differential pressure across the trap.

For drip applications, a (3/4)" FT600 size is sufficient to exceed warm-up loads with a 2X safety factor. The condensate loads (lbs/hr) for process applications are normally calculated at the maximum steam pressure; then an appropriate safety margin is applied in order to select a trap with sufficient capacity when operating at lower steam pressures. Reference full explanation of Safety Load Factors in Steam Traps Introduction section.

When a temperature control valve regulates the flow of steam to the process equipment (Heat Exchanger) being drained of condensate, it is recommended to select a trap with a PMO that exceeds the inlet steam pressure to the temperature control valve. This assures that under all operating conditions, the steam pressure will not exceed the PMO of the trap.

For Example: Process application has a maximum steam inlet pressure of 100 psi, a maximum condensate load of 2,500 lbs/hr and is discharging to a condensate return line with a possible back pressure of 20 psig. **ΔP** = 100-20 = 80 PSI

To select trap: If the Safety Load Factor is chosen to be 2X max capacity at max differential pressure, then Trap should be selected based on 5,000 lbs/hr (2,500 x 2 = 5,000) at 80 PSI differential pressure with a PMO in excess of 100 PSIG

Selection: **FT600-145-16-N**, PMO=145 PSIG, 1 1/2" NPT with a condensate capacity of 9,900 lbs/hr at 80 PSI differential pressure.

Connection Codes:
(**N**=NPT, **SW**=Socket Weld, **F150**=150# FLG, **F300**=300# FLG, **F600**=600# FLG)

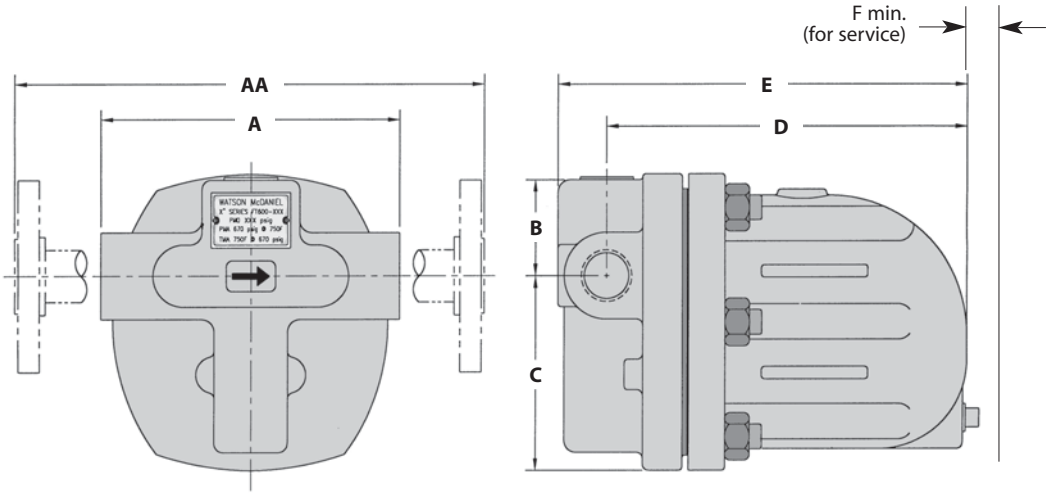
CAPACITIES – *Condensate (lbs/hr)*

Model Code*	PMO (PSIG)	Sizes	ΔP = Differential Pressure (PSI) 1	2	3	4	5	10	20	30	40	50	65	80	100	145	200	300	400	450
FT600-65-13-N	65	3/4"	225	300	363	413	463	635	960	1060	1180	1320	1460							
FT600-65-14-N	65	1"	775	1094	1340	1520	1690	2370	3260	3990	4500	5000	5500							
FT600-65-16-N	65	1 1/2"	2500	3450	4130	4750	5300	7500	10625	13125	15000	16800	18850							
FT600-65-17-N	65	2"	8500	11950	14670	16800	18700	25250	35900	43000	49600	55500	61250							
FT600-145-13-N	145	3/4"	137	180	218	250	275	380	520	625	725	863	895	995	1120	1315				
FT600-145-14-N	145	1"	400	555	660	755	850	1237	1593	1925	2240	2490	2750	3000	3430	3935				
FT600-145-16-N	145	1 1/2"	1275	1750	2125	2430	2740	3750	5100	6250	7200	7995	8875	9900	11250	13300				
FT600-145-17-N	145	2"	3125	4400	5375	6250	6900	9250	14625	16875	19375	21875	25000	27500	31000	37000				
FT600-200-13-N	200	3/4"	93	137	160	187	205	287	400	487	560	610	710	775	875	1060	1250			
FT600-200-14-N	200	1"	300	410	487	560	610	925	1140	1375	1520	1687	1875	2060	2312	2750	3100			
FT600-200-16-N	200	1 1/2"	825	1130	1400	1570	1760	25000	375	4125	4740	5250	6000	6600	7300	8650	10200			
FT600-200-17-N	200	2"	1560	2187	2800	3100	3490	4800	6750	8250	9500	10625	12400	13700	15000	18120	21200			
FT600-300-13-N	300	3/4"	50	68	83	95	106	155	197	240	275	300	340	375	413	490	570	710		
FT600-300-14-N	300	1"	225	300	363	413	463	635	960	1060	1180	1320	1468	1640	1815	2130	2550	3000		
FT600-300-16-N	300	1 1/2"	825	1130	1400	1570	1760	25000	375	4125	4740	5250	6000	6600	7300	8650	10200	12600		
FT600-300-17-N	300	2"	1560	2187	2800	3100	3490	4800	6750	8250	9500	10625	12400	13700	15000	18120	21200	26250		
FT600-450-13-N	450	3/4"	32	42	49	56	62	84	119	145	163	175	192	210	186	275	312	375	425	450
FT600-450-14-N	450	1"	137	180	218	250	275	380	520	625	725	863	895	995	1120	1315	1500	1870	2125	2250
FT600-450-16-N	450	1 1/2"	825	1130	1400	1570	1760	2500	3375	4125	4740	5250	6000	6600	7300	8650	10200	12600	14375	15200
FT600-450-17-N	450	2"	1560	2187	2800	3100	3490	4800	6750	8250	9500	10625	12400	13700	15000	18120	21200	26250	28700	31250

Note: *For 450 Model, the Thermostatic Air Vent is replaced with a live Orifice.*

*** Chart is applicable for both Models FT600 & FT601**

FT600 & FT601:
3/4", 1", 1 1/2", 2"



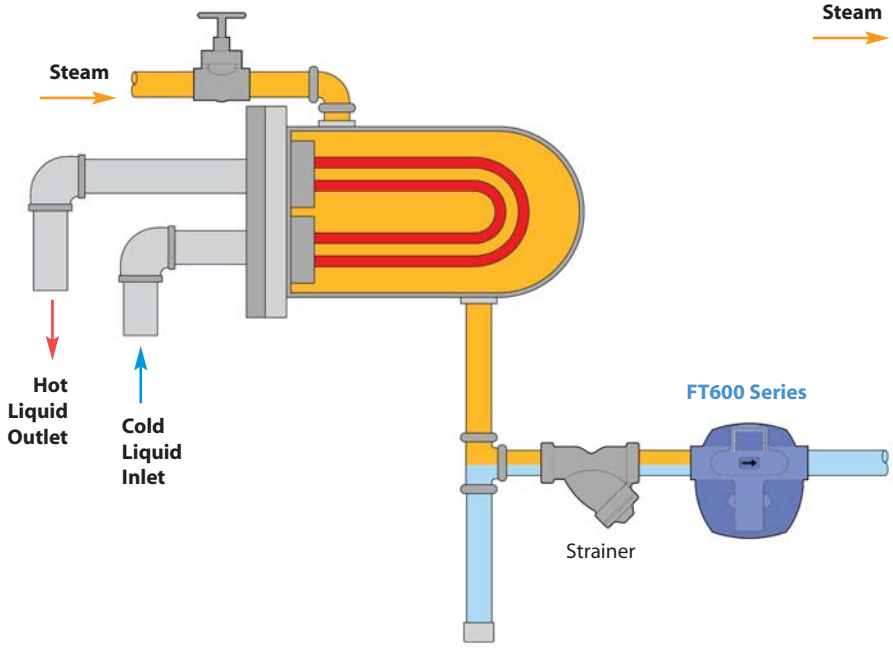
DIMENSIONS & WEIGHTS – *inches*

Model*	Size	A	AA	B	C	D	E	F	Weight (lbs) NPT/SW	Weight (lbs) FLG
FT600	3/4"	6.10	10.10	2.07	3.93	7.38	8.41	5.75	25	31
FT600	1"	6.50	10.40	2.50	5.50	8.44	9.50	6.25	31	36
FT600	1 1/2"	9.80	14.00	3.26	6.85	10.40	11.94	7.75	82	91
FT600	2"	11.80	16.00	3.60	7.40	11.59	13.27	8.00	93	107

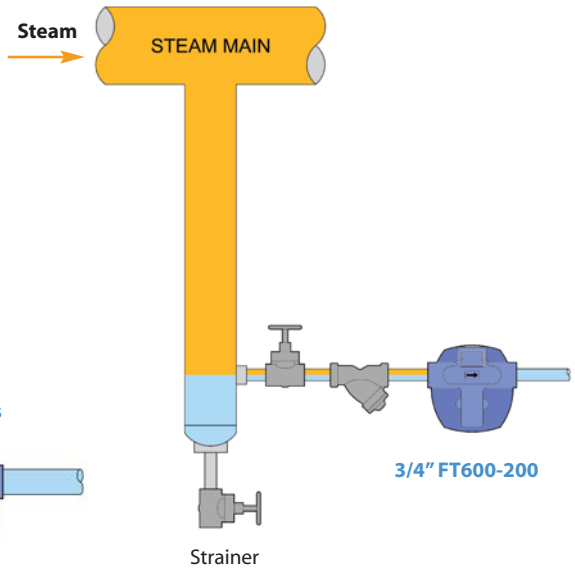
*** Chart is applicable for FT600 & FT601**

Typical Applications for Float & Thermostatic Steam Traps

Shell & Tube Heat Exchanger Application:



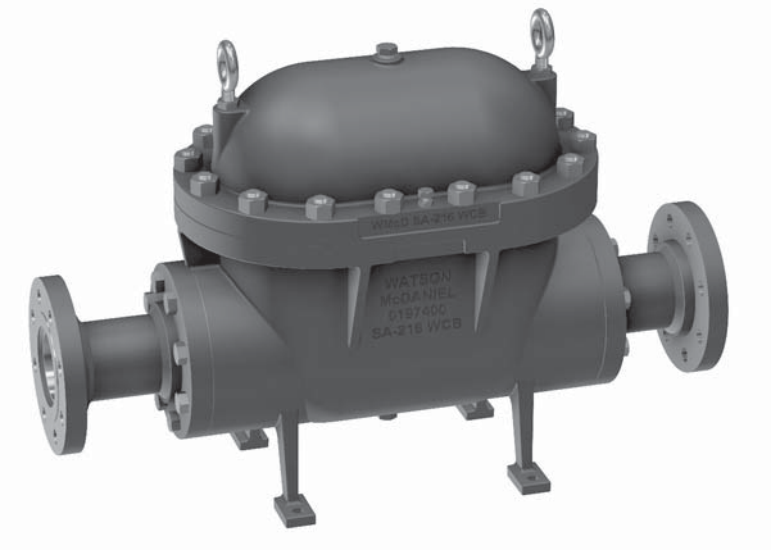
Steam Main Drip Application



Model	**FT600 & FT601***
Sizes	**3", 4"**
Connections	**NPT, SW, FLG**
Body Material	**Carbon Steel or 316SS**
PMO Max. Operating Pressure	**450 PSIG**
TMO Max. Operating Temperature	**750ºF**
PMA Max. Allowable Pressure	**990 PSIG @ 100ºF**
TMA Max. Allowable Temperature	**750ºF @ 670 PSIG**

**** FT601 Body Material is 316 SS***
FT600 Body Material is Carbon Steel

3" & 4" FT600 & FT601 contain an open orifice air vent.
If a thermostatic air vent is required, contact factory.



PRESSURE-TEMPERATURE RATING - 3" & 4" Models

PMA 650 PSIG up to 450˚F
TMA 750˚F @ 375 PSIG

Size	Conn	PMO (PSIG)	Model Code
3"	NPT	**450**	**FT600-450-19-N**
3"	SW	**450**	**FT600-450-19-SW**
3"	**150 #** Flg	**285**	**FT600-285-19-F150**
3"	**300 #** Flg	**450**	**FT600-450-19-F300**
3"	**600 #** Flg	**450**	**FT600-450-19-F600**
4"	**150 #** Flg	**285**	**FT600-285-20-F150**
4"	**300 #** Flg	**450**	**FT600-450-20-F300**
4"	**600 #** Flg	**450**	**FT600-450-20-F600**

CAPACITIES – *Condensate (**1000 lbs/hr**)*

	Differential Pressure (PSI)																				
Temp	**1/2**	**1**	**2**	**5**	**10**	**15**	**20**	**30**	**40**	**50**	**75**	**100**	**125**	**150**	**175**	**200**	**250**	**300**	**350**	**400**	**450**
COLD*	44	59	81	122	170	205	230	280	317	350	425	480	540	580	625	670	740	800	860	910	960
HOT	44	53	64	83	100	112	121	138	149	159	177	190	201	212	222	230	247	260	270	280	290

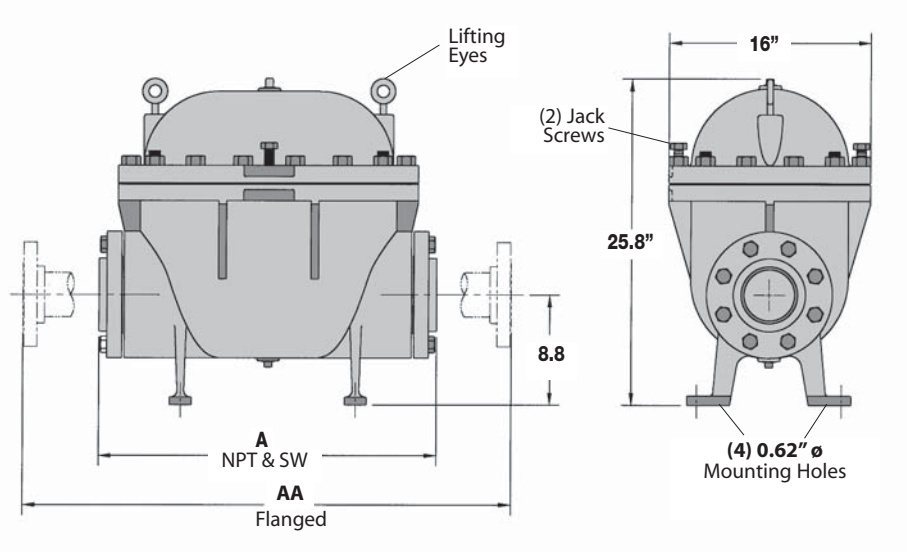
** Cold Water capacities are to be used when the trap is used as a liquid drain trap.*
Note: For liquid drain trap applications, please specify "liquid drain trap" when ordering.

CAPACITY CORRECTION FACTORS

To obtain capacity with a liquid other than water, multiply water capacity by correction factor.

Spec. Gravity	**1**	.98	.96	.94	.92	.90	.88	.86	.84	.82	.80	.75	.70	.65	.60	.55	.50
Corr. Factor	**1**	.990	.980	.970	.959	.949	.938	.927	.917	.906	.894	.866	.837	.806	.775	.742	707

FT600 & FT601:
3" & 4"

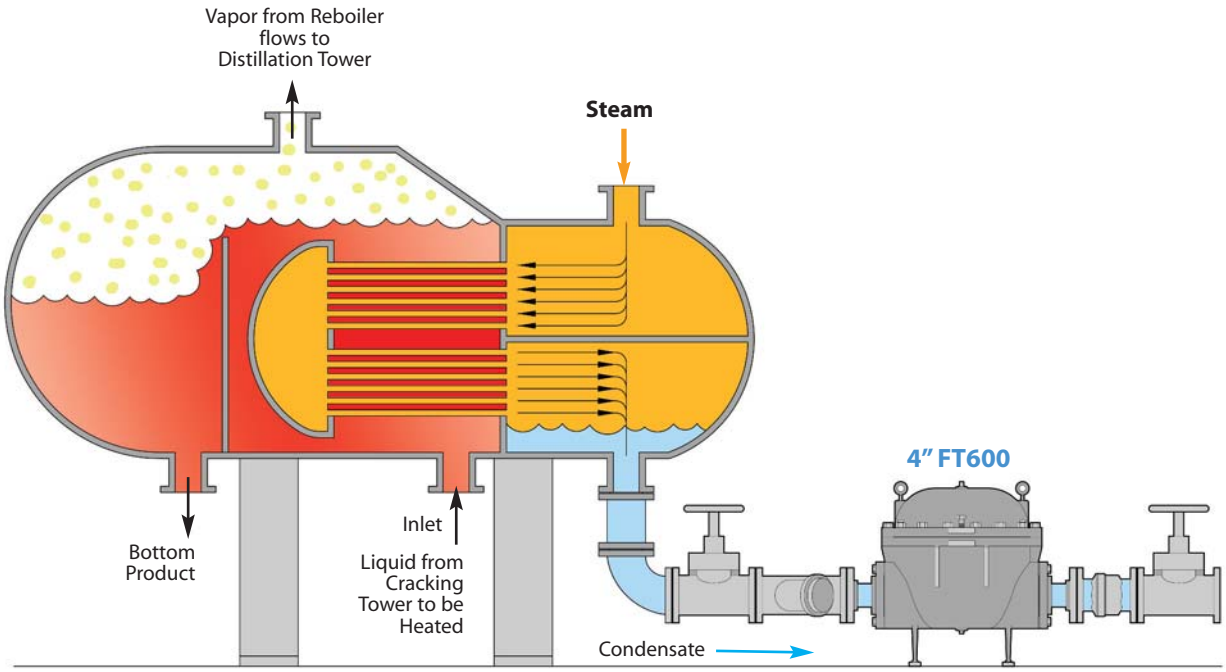


DIMENSIONS & WEIGHTS – *inches*

Model*	Size	A	AA	Weight (lbs) Connection	Weight (lbs) FLG
FT600	3"	27	39	587 (NPT, SW)	626
FT600	4"	27	39	587 (SW)	654

*** Chart is applicable for both Models FT600 & FT601**

FT600: 3" - 4" :
Process: Refinery Reboiler Application



Steam Traps
Float & Thermostatic Steam Trap

FT Series
Float & Thermostatic

Model	**FT**
Sizes	**3/4", 1", 1 1/4", 1 1/2", 2"**
Connections	**NPT**
Body Material	**Cast Iron**
PMO Max. Operating Pressure	**75 PSIG**
TMO Max. Operating Temperature	**Saturated Steam Temperature**
PMA Max. Allowable Pressure	**75 PSIG up to 450°F**
TMA Max. Allowable Temperature	**450°F @ 75 PSIG**

Typical Applications

DRIP, PROCESS: FT Series steam traps are designed for operating pressures up to 75 PSIG. These float and thermostatic traps are used for lower pressure HVAC and light industrial process applications. They are used on unit heaters, water heaters, pressing machines, heat exchangers and coils. For drip applications, such as draining steam mains and steam supply lines, use 3/4" FT-075 (FT73-075-13-N). F&T traps have excellent air-handling capability, which make them a better choice than Inverted Bucket traps for most process applications. FT Series traps have a dual inlet-outlet H-Pattern connection allowing for additional flexibility in installation.

How It Works

Float and thermostatic traps contain a float and seat mechanism with a separate thermostatic element which work together to remove both condensate and air from the steam system. The float, which is attached to a valve, rises and opens the valve when condensate enters the trap. This allows the condensate to discharge. Air is discharged through the thermostatic air vent to the outlet side of the trap. Steam entering the trap causes the thermostatic element to expand, closing the air vent and trapping the steam.

Sample Specification

The trap shall be of float and thermostatic design with cast iron body. Thermostatic element to be welded stainless steel. Float and seating material to be stainless steel. Trap must be in-line repairable.

Features

- H-pattern design allows piping from either side of the steam trap (there are two inlet ports at top and two outlet ports at bottom)
- F&T traps have excellent air handling capability allows air to be discharged rapidly and steam to enter the system quickly during start-up
- Welded stainless steel thermostatic air vent resists shock from waterhammer
- In-line repairable (all internals are attached to cover)

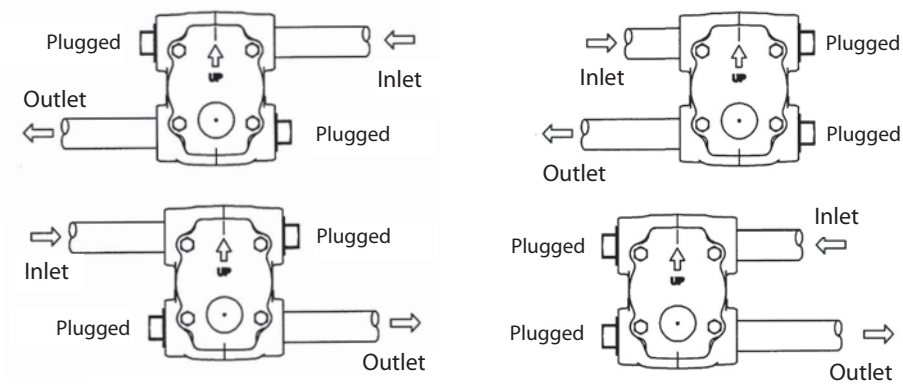
Installation and Maintenance

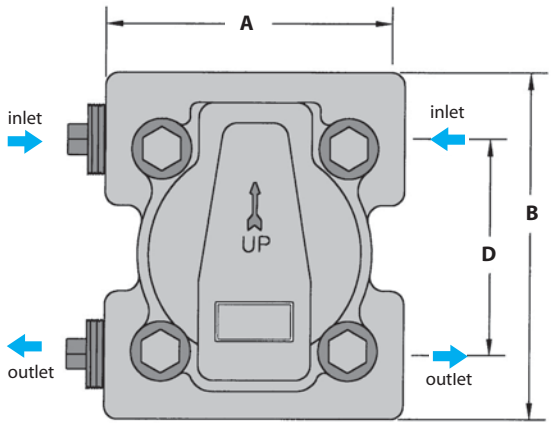
The trap must be installed upright and level for the float mechanism to operate properly. All internal components can be replaced with the trap body piped in-line. Repair kit includes thermostatic element, valve seat and disc, float and sealing gasket.

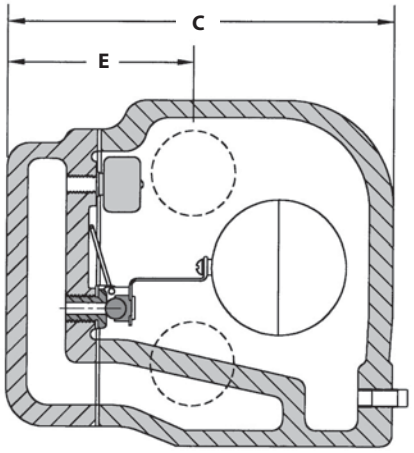
Helpful Selection Information

Select a model that can handle the maximum working pressure of the steam system. For example, the FT3-015 has a maximum working pressure of 15 PSI. Consult capacity tables to properly size unit. Available in 3/4" through 2" NPT connections. Select these models for steam systems with maximum working pressure of 75 PSIG.

Demonstration of H-Style piping connections:







DIMENSIONS & WEIGHTS – *inches/pounds*

Model	A	B	C	D	E	Weight
FT-3, FT-4, FT-33 FT-34, FT-73, FT-74	4.125	5.00	5.125	3.125	2.75	7.50
FT-6, FT-35, FT-36 FT-75, FT-76	5.00	6.81	6.47	4.125	3.43	13.0
FT-7, FT-37L, FT-77L	6.375	7.68	8.218	5.25	4.41	21.0
FT-8, FT-38, FT-78 FT-S8-15, FT-S8-75	6.50	11.0	8.968	7.468	4.531	40.0

MATERIALS

Body & Cover	Cast Iron, ASTM A-126 Class B
Nuts & Bolts	High-Tensile Steel
Gasket	Grafoil/Garlock
Float	Stainless Steel
Valve & Seat	Stainless Steel
Thermostatic Assembly	Stainless Steel Bellows & Valve

How to Size / Order

The maximum operating pressure (PMO) rating of model selected must meet or exceed the maximum steam pressure or the trap may not open. For example; the FT-35-030 has a PMO of 30 psi. For drip applications, a 3/4" FT size is sufficient to exceed warm-up loads with a 2X safety factor. The condensate loads (lbs/hr) for process applications are normally calculated at the maximum steam pressure; then a safety margin is applied in order to select a trap with sufficient capacity at lower pressures. Reference full explanation of Safety Load Factors in Steam Traps Introduction section.

For Example: Process application has a maximum steam inlet pressure of 50 psi, a maximum condensate load of 1,700 lbs/hr and is discharging to a condensate return line with a possible back pressure of 10 psig. **ΔP** = 50-10 = 40 PSI

To select trap: If the Safety Load Factor is chosen to be 2X max capacity at max differential pressure, then Trap should be selected based on 3,400 lbs/hr (1,700 x 2 = 3,400) at 40 PSI differential pressure with a PMO in excess of 50 PSIG

Selection: **FT77L-075-16-N**, PMO=75 PSIG, 1 1/2" NPT with a condensate capacity of 3,750 lbs/hr at 40 PSI differential pressure.

CAPACITIES – *Condensate (lbs/hr)*

Model Code	PMO (PSIG)	Pipe Size	Orifice Size	ΔP = Differential Pressure (PSI) 1/4	1/2	1	2	3	5	10	15	20	25	30	40	50	60	75
FT3-015-13-N	15	3/4"	9/32"	340	440	600	830	990	1280	1790	2150							
FT4-015-14-N	15	1"	9/32"	340	440	600	830	990	1280	1790	2150							
FT6-015-15-N	15	1 1/4"	25/64"	850	1100	1460	2000	2350	2950	4000	4800							
FT7-015-16-N	15	1 1/2"	1/2"	1300	1700	2050	2550	2900	3500	4400	5300							
FT8-015-17-N	15	2"	21/32"	2500	3150	4000	5700	6100	6800	8300	9800							
FTS8-015-17-N	15	2"	15/16"	4400	5850	7400	9200	10300	12600	15300	18100							
FT33-030-13-N	30	3/4"	11/64"	220	300	405	530	650	890	1210	1485	1705	1865	2010				
FT34-030-14-N	30	1"	11/64"	220	300	405	530	650	890	1210	1485	1705	1865	2010				
FT35-030-14-N	30	1"	1/4"	450	600	880	1205	1420	1845	2560	3230	3715	4100	4405				
FT36-030-15-N	30	1 1/4"	1/4"	450	600	880	1205	1420	1845	2560	3230	3715	4100	4405				
FT37L-030-16-N	30	1 1/2"	7/16"	600	800	1200	1680	2210	2600	3500	4500	5200	5700	6100				
FT38-030-17-N	30	2"	13/32"	1550	2045	2625	3560	4260	5660	7890	9440	10500	11360	12095				
FT73-075-13-N	75	3/4"	9/64"	140	195	265	360	430	580	770	990	1110	1210	1290	1430	1560	1680	1830
FT74-075-14-N	75	1"	9/64"	140	195	265	360	430	580	710	990	1110	1210	1290	1430	1560	1680	1830
FT75-075-14-N	75	1"	#16	270	360	485	660	780	1020	1430	1740	1980	2200	2420	2670	2910	3135	3370
FT76-075-15-N	75	1 1/4"	#16	270	360	485	660	780	1020	1430	1740	1980	2200	2420	2670	2910	3135	3370
FT77L-075-16-N	75	1 1/2"	5/16"	340	460	690	900	1200	1400	1900	2350	2700	3000	3250	3750	4150	4500	4700
FT78-075-17-N	75	2"	5/16"	800	1075	1300	1700	2000	2600	3750	4350	4700	5050	5400	5960	6500	6950	7550
FTS8-075-17-N	75	2"	13/32"	1360	1800	2100	2800	3300	4300	6300	7300	8000	8500	9000	10000	11000	11600	12500

Inverted Bucket

Model	Body Material	PMO (PSIG)	Sizes	Connections	Page No.
SIB/SIBH	Stainless Steel	**450**	1/2", 3/4"	NPT, SW	**86**
IB Series 103X/104X	Cast Iron	**250**	1/2" – 1 1/2"	NPT	**88**

PMO = Maximum Operating Pressure

Inverted Bucket Traps

The Inverted Bucket Trap, with its rugged design, offers features that are advantageous in certain conditions. The discharge orifice of the IB is mounted at the top of the trap, making them less susceptible to failure from dirt and pipe scale when compared to other trap types. Although they are typically not the primary choice for process applications due to their lack of air venting capability, they are often used in drip applications. They can be used on less critical process applications which do not require venting of air during system start-up or when a secondary air vent is added to the system.

SIB Series Stainless Steel Body

SIB/SIBH

IB Series Cast Iron Body (No Strainer)

1031 1032 1033 1034

IB Series Cast Iron Body (with Strainer)

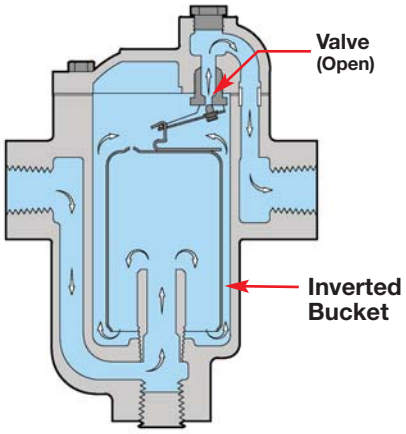
1041 1042 1044 & 1038S

INVERTED BUCKET TRAPS.

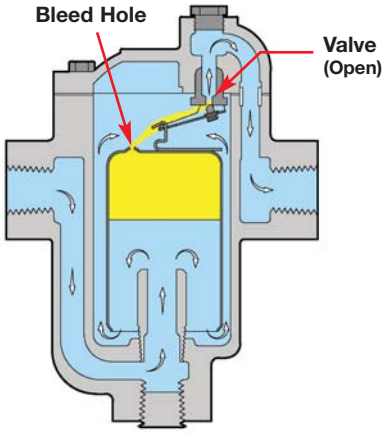
Operation:

Due to its weight, the inverted bucket within the trap will rest on the bottom of the trap body keeping the valve open and allowing condensate to be discharged (**Figure A**). In the top of the bucket there is a small bleed hole which allows air to escape from inside the bucket and exit through the outlet port (**Figure B**). When steam arrives through the inlet of the trap, it fills the inverted bucket which makes it buoyant and rise to the top of the trap, closing the valve (**Figure C**). As steam condenses and/or is bled through the small bleed hole in the top of the bucket, the bucket loses buoyancy which causes it to sink to the bottom of the trap. The valve then opens allowing condensate to be discharged from the system (**Figure A**). The bucket trap must maintain a certain amount of water (prime) in order to operate. If the trap loses its prime, the bucket will not be able to float when steam enters; keeping the valve in the open position which allows steam to escape (**Figure D**). Due to the balance of forces required between the incoming pressure and internal trap components, several orifice sizes are required to accommodate various differential pressure ranges. For this reason care must be used to select a trap model with an equal or higher PMO rating than the steam pressure.

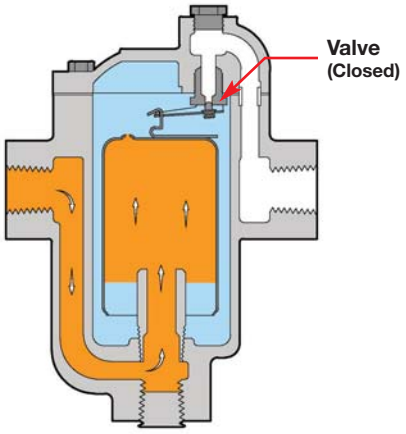
A) Discharging Condensate



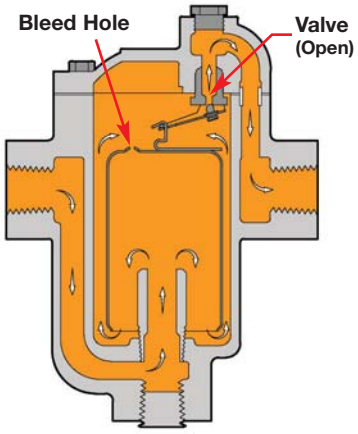
B) Discharging Air



C) Closed (Trapping Steam)



D) Potential Failure Mode
Loss of Prime



A) With condensate completely filling the trap, the bucket is in the down position with the valve open, allowing condensate to be discharged.

B) Small amounts of air will pass thru the bleed hole on top of the bucket and be discharged. (Note: Large amounts of air will lift the bucket and close off the trap, temporarily air locking the system.)

C) When steam enters the trap, the inverted bucket fills with steam and floats to the surface, closing off the valve, preventing steam from escaping.

D) Potential Failure Mode: Bucket traps must maintain a water prime to function properly. If the prime is lost, the bucket will remain in the down position with the valve open, and live steam will be discharged from the system.

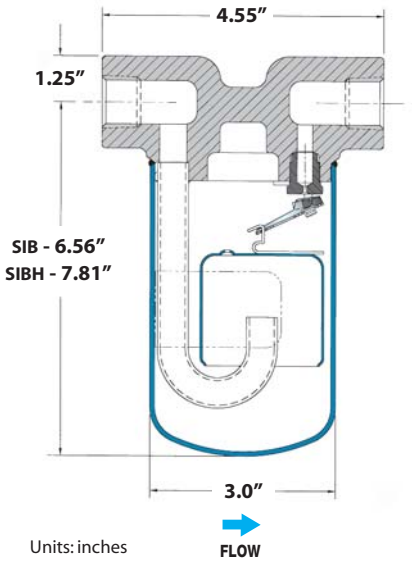
Air
Steam
Condensate

Steam Traps
Inverted Bucket Steam Trap

SIB/SIBH
Inverted Bucket

Model	SIB, SIBH
Size	1/2", 3/4"
Connections	NPT, SW
Body Material	Stainless Steel
PMO Max. Operating Pressure	450 PSIG*
TMO Max. Operating Temperature	750°F
PMA Max. Allowable Pressure	720 PSIG @ 100°F
TMA Max. Allowable Temperature	750°F @ 400 PSIG

SIB
Inverted Bucket
Steam Trap



Units: inches

Typical Applications

DRIP, TRACING: The **SIB & SIBH** Inverted Bucket Steam traps are suitable for removing condensate from steam mains and steam supply lines. They are also used on unit heaters, laundry equipment, and other smaller, low capacity and less critical process applications where slow start-up can be tolerated. The discharge orifice of the inverted bucket trap is mounted at the top of the trap body, which makes them less susceptible to failure from dirt and debris when compared to other trap types. The SIBH is physically larger and has a higher pressure capability for a particular orifice size than the SIB.

How It Works

When the trap is filled with condensate, the inverted bucket inside the steam trap loses its buoyancy and rests on the bottom of the trap. This pulls the disc off the seat allowing condensate to be discharged through the seat orifice located at the top of the trap. When steam enters, it fills the inverted bucket causing the bucket to float to the surface which closes the discharge valve, containing the steam in the system. Eventually, the steam is bled off through a small hole in the top of the bucket causing it to sink, which repeats the cycle.

Features

- All stainless steel body
- Acceptable for superheated steam (with check valve installed at inlet)
- Waterhammer resistant
- Valve & seat are located at the top of the trap body making them less prone to clogging from debris and pipe scale
- All stainless steel internals with hardened valve & seat

Sample Specification

Steam trap shall be an all stainless steel module design inverted bucket type with a frictionless valve lever assembly.

Option

Internal Check Valve

Installation and Maintenance

Trap must be installed in upright position to function properly. The stainless steel body is seal welded and therefore non-repairable. If a new trap is required, remove and replace. Bucket traps require an internal water seal to operate. Applications with superheated steam can cause the water seal to flash into steam and trap to fail in open position. A check valve installed at trap inlet will help prevent the loss of prime.

MATERIALS

Body	Stainless Steel GR CF3
Cover	304L Stainless Steel
Internals	300 Series Stainless Steel
Valve Plug & Seat	420F Stainless Steel

CAPACITIES – *Condensate (lbs/hr)*

Model	Orifice Size	PMO (PSIG)	Differential Pressure (PSI) 5	10	15	20	25	30	40	50	60	70	80	100	125	150	180	200	250	350	450
SIB-20	3/16"	20	450	560	640	690															
SIB-80	1/8"	80	300	350	400	440	460	500	550	580	635	660	690								
SIB-150	#38	150	210	250	280	300	320	350	380	400	420	450	470	500	550	570					
SIB-450	.057	450	31	50	70	84	95	105	120	133	145	152	160	174	187	198	208	215	228	248	263
SIBH-15	1/4"	15	830	950	1060																
SIBH-30	3/16"	30	530	700	820	880	950	1000													
SIBH-70	5/32"	70	380	500	560	620	680	710	770	840	90	950									
SIBH-125	1/8"	125	285	375	440	485	530	560	620	670	720	780	800	860	950						
SIBH-200	7/64"	200	205	265	315	350	385	410	465	500	580	590	620	650	700	810	840	860			
SIBH-250	#38	250	155	205	240	270	295	320	360	400	500	530	550	580	630	660	690	710	760		
SIBH-450	.057	450	31	50	70	84	95	105	120	133	145	152	160	174	187	198	208	215	228	248	263

Helpful Selection Information

The PMO (maximum operating pressure) rating of model selected must meet or exceed the maximum steam pressure or the trap may not open. For example; the **SIB-12-N-150** has a PMO of 150 PSI. Condensate capacity (lbs/hr) of the trap is based on the differential pressure across the trap.

SIB
Inverted Bucket
Steam Trap

SIBH
Inverted Bucket
Steam Trap

Size/ Connection	Model Code	PMO PSI	Weight lbs	Cross Reference Spirax Sarco	Armstrong
1/2" NPT	**SIB-12-N-20**	20	5.0	SIB30	1810
3/4" NPT	**SIB-13-N-20**				
1/2" SW	**SIB-12-SW-20**				
3/4" SW	**SIB-13-SW-20**				
1/2" NPT	**SIB-12-N-80**	80	5.0	SIB30	1810
3/4" NPT	**SIB-13-N-80**				
1/2" SW	**SIB-12-SW-80**				
3/4" SW	**SIB-13-SW-80**				
1/2" NPT	**SIB-12-N-150**	150	5.0	SIB30	1810
3/4" NPT	**SIB-13-N-150**				
1/2" SW	**SIB-12-SW-150**				
3/4" SW	**SIB-13-SW-150**				
1/2" NPT	**SIB-12-N-450**	450	5.0	SIB30	1810
3/4" NPT	**SIB-13-N-450**				
1/2" SW	**SIB-12-SW-450**				
3/4"SW	**SIB-13-SW-450**				
1/2" NPT	**SIBH-12-N-15**	15	5.5	SIB30H	1811
3/4" NPT	**SIBH-13-N-15**				
1/2" SW	**SIBH-12-SW-15**				
3/4" SW	**SIBH-13-SW-15**				
1/2" NPT	**SIBH-12-N-30**	30	5.5	SIB30H	1811
3/4" NPT	**SIBH-13-N-30**				
1/2" SW	**SIBH-12-SW-30**				
3/4" SW	**SIBH-13-SW-30**				
1/2" NPT	**SIBH-12-N-70**	70	5.5	SIB30H	1811
3/4" NPT	**SIBH-13-N-70**				
1/2" SW	**SIBH-12-SW-70**				
3/4" SW	**SIBH-13-SW-70**				
1/2" NPT	**SIBH-12-N-125**	125	5.5	SIB30H	1811
3/4" NPT	**SIBH-13-N-125**				
1/2" SW	**SIBH-12-SW-125**				
3/4" SW	**SIBH-13-SW-125**				
1/2" NPT	**SIBH-12-N-200**	200	5.5	SIB30H	1811
3/4" NPT	**SIBH-13-N-200**				
1/2" SW	**SIBH-12-SW-200**				
3/4" SW	**SIBH-13-SW-200**				
1/2" NPT	**SIBH-12-N-250**	250	5.5	SIB30H	1811
3/4" NPT	**SIBH-13-N-250**				
1/2" SW	**SIBH-12-SW-250**				
3/4" SW	**SIBH-13-SW-250**				
1/2" NPT	**SIBH-12-N-450**	450	5.5	SIB30H	1811
3/4" NPT	**SIBH-13-N-450**				
1/2" SW	**SIBH-12-SW-450**				
3/4" SW	**SIBH-13-SW-450**				

Model	**1031, 1032, 1033, 1034, 1041, 1042, 1044, 1038S**
Sizes	**1/2", 3/4", 1", 1 1/4", 1 1/2"**
Connections	**NPT**
Body Material	**Cast Iron**
Options	**Internal check valve, Thermic vent**
PMO Max. Operating Pressure	**250 PSIG**
TMO Max. Operating Temperature	**450°F**
PMA Max. Allowable Pressure	**250 PSIG up to 450°F**
TMA Max. Allowable Temperature	**450°F @ 250 PSIG**

1031/1032
1033/1034
(No Strainer)

1041/1042
1044/1038S
(with Strainer)

Typical Applications

DRIP, TRACING PROCESS: **IB Series** inverted bucket steam traps are used in drip applications to remove condensate from steam mains and steam supply lines. For drip applications, the smaller sized units have adequate capacity. The discharge orifice of the inverted bucket trap is mounted at the top of the trap body, which makes them less susceptible to failure from dirt and debris when compared to other trap types. Since Inverted Bucket traps have poor air-handling capability, they are normally not recommended for most process applications. However, they can be used on certain process applications such as unit heaters and laundry equipment, where discharging air during system start-up is not a critical factor. F&T traps are the preferred choice for systems where air *must* be quickly discharged.

How It Works

When the trap is filled with condensate, the inverted bucket inside the steam trap loses its buoyancy and rests on the bottom of the trap. This pulls the disc off the seat allowing condensate to be discharged through the seat orifice located at the top of the trap. When steam enters, it fills the inverted bucket causing the bucket to float to the surface which closes the discharge valve, containing the steam in the system. Eventually, the steam is bled off through a small hole in the top of the bucket causing it to sink, which repeats the cycle.

Features

- Waterhammer resistant
- Suitable for superheated steam (use internal check valve option to eliminate loss of prime)
- In-line repairability is simplified by having all internals attached to the cover
- Valve & seat are located at the top of the trap body making them less prone to clogging from debris and pipe scale
- All stainless steel internals with hardened valve & seat

Sample Specification

The steam trap shall be of an inverted bucket trap design.

Installation and Maintenance

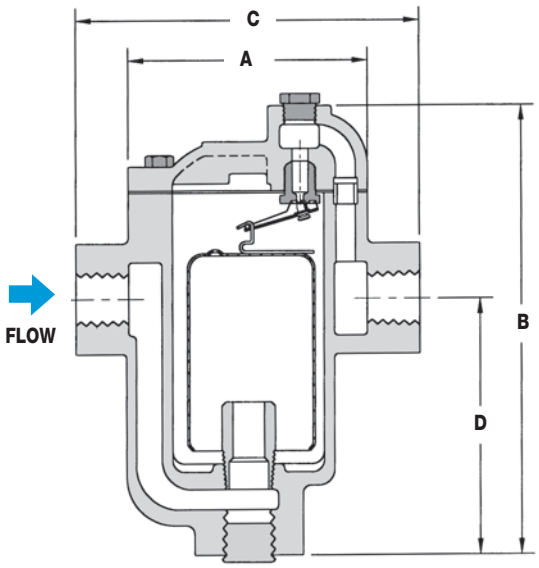
Trap must be installed in upright position to function properly. All working components can be replaced with the trap body remaining in-line. With superheated steam, a check valve should be installed at inlet or trap may lose prime. A replacement kit containing the lever and seat assembly is a more economical option than replacing the entire steam trap. Also available are replacement screens, gaskets and buckets. When ordering replacement lever and seat assemblies, specify model and operating pressure. See Replacement Parts and Kits Section for exact cross-reference to Armstrong PCA (Pressure Change Assembly) kits.

Helpful Selection Information

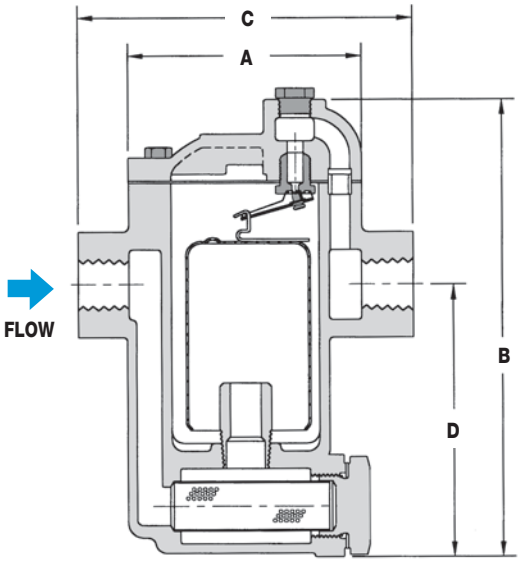
Select a model with a higher maximum operating pressure (PMO) that meet or exceed the maximum steam pressure or the trap may not open. For example, the **IB-1032-14-N-250** has a PMO of 250 PSI. Choose a model that will handle the capacity requirement based on the differential pressure across the trap. Reference capacity charts.

Options

Strainer and Blowdown valve connection available on 1041, 1042, 1044 & 1038S. Thermic vent to improve air handling capability. Internal check valve for superheated or condensate backflow applications.



1031/1031S/1032/1033/1034
without Strainer (except 1031S)



1041/1042/1044/1038S
with Strainer

DIMENSIONS & WEIGHTS – *inches*

Model	A	B	C	D	Weight (lbs)
1031	3.75	5.875	5.00	2.75	5
1031S*	3.75	5.875	5.00	2.75	5
1032	3.75	6.875	5.00	4.25	6
1033	5.625	9.06	6.50	5.375	15
1034	7.00	11.75	7.75	7.03	27
1041*	3.75	6.06	5.00	3.43	5
1042*	3.75	7.06	5.00	4.43	6
1044*	7.00	12.375	7.125	7.375	30
1038S*	7.00	12.375	7.125	7.375	30

**** With Integral Strainer***

MATERIALS

Body & Cover	Cast Iron, ASTM A-278 Class 30
Nuts & Bolts	High-Tensile Steel
Gasket	Garlock
Bucket	Stainless Steel
Lever & Seat Assembly	Stainless Steel
Valve & Seat	Hardened Stainless Steel
Integral Strainer*	Stainless Steel

** 1031S, 1038S, 1041, 1042, 1044 models only.*

How to Order Options: (reference model code chart)

Check Valve (suffix **CV**)
Built-in Inlet Check Valve is recommended when used on Superheated Steam
Example: **IB1032-12-N-125-CV**

Thermic Vent (suffix **TV**)
A Thermic Vent is recommended when using a Bucket Trap on any type of process application or where the removal of air from the system is critical.
Example: **IB1032-12-N-125-TV**

Thermic Vent & Check Valve (suffix **TCV**)
For both Check Valve & Thermic Vent Options use Suffix Code
Example: **IB1032-12-N-125-TCV**

Blowdown Valve (add **B** to Model Code)
Blowdown connection is available on Models IB1038S, 1041, 1042 and 1044
Example: **IB1041B-13-N-150**
(Model IB1041, 3/4" NPT, 150 PSI max operating pressure with Blowdown & Strainer)

How to Size / Order

From the capacity chart, select the model that can handle the working pressure of the system (PMO). Select the appropriate trap that will meet the capacity requirements at the differential pressure. Example:

Application: 1000 lbs/hr at 75 PSIG working pressure and 2 PSI differential pressure

Note: Specify Model, PMO and Connection Size

Size/Model: **IB-1034, 80 PSIG**, Specify pipe size (3/4", 1"), or **IB-1044, 80 PSIG**, Specify pipe size (3/4", 1")

Cross Reference Chart

NO STRAINER		STRAINER	
Watson McDaniel	Armstrong	Watson McDaniel	Armstrong
1031	**800**	**1041**	**880**
1032	**811**	**1042**	**881**
1033	**812**	**1044**	**883**
1034	**813**		

Steam Traps
Inverted Bucket Steam Trap

IB Series
Inverted Bucket

NO STRAINER

Conn. NPT	Model Code	PMO PSI	Weight lbs	Cross Ref. Armstrong
1/2″	IB1031-12-N-20	20	7	800
3/4″	IB1031-13-N-20			
1/2″	IB1031-12-N-80	80	7	800
3/4″	IB1031-13-N-80			
1/2″	IB1031-12-N-125	125	7	800
3/4″	IB1031-13-N-125			
1/2″	IB1031-12-N-150	150	7	800
3/4″	IB1031-13-N-150			


1031

Conn. NPT	Model Code	PMO PSI	Weight lbs	Cross Ref. Armstrong
1/2″	IB1032-12-N-15	15	8	811
3/4″	IB1032-13-N-15			
1″	IB1032-14-N-15			
1/2″	IB1032-12-N-30	30	8	811
3/4″	IB1032-13-N-30			
1″	IB1032-14-N-30			
1/2″	IB1032-12-N-70	70	8	811
3/4″	IB1032-13-N-70			
1″	IB1032-14-N-70			
1/2″	IB1032-12-N-125	125	8	811
3/4″	IB1032-13-N-125			
1″	IB1032-14-N-125			
1/2″	IB1032-12-N-200	200	8	811
3/4″	IB1032-13-N-200			
1″	IB1032-14-N-200			
1/2″	IB1032-12-N-250	250	8	811
3/4″	IB1032-13-N-250			
1″	IB1032-14-N-250			


1032

Conn. NPT	Model Code	PMO PSI	Weight lbs	Cross Ref. Armstrong
1/2″	IB1033-12-N-15	15	17	812
3/4″	IB1033-13-N-15			
1/2″	IB1033-12-N-30	30	17	812
3/4″	IB1033-13-N-30			
1/2″	IB1033-12-N-70	70	17	812
3/4″	IB1033-13-N-70			
1/2″	IB1033-12-N-125	125	17	812
3/4″	IB1033-13-N-125			
1/2″	IB1033-12-N-200	200	17	812
3/4″	IB1033-13-N-200			
1/2″	IB1033-12-N-250	250	17	812
3/4″	IB1033-13-N-250			


1033

Conn. NPT	Model Code	PMO PSI	Weight lbs	Cross Ref. Armstrong
3/4″	IB1034-13-N-15	15	30	813
1″	IB1034-14-N-15			
3/4″	IB1034-13-N-30	30	30	813
1″	IB1034-14-N-30			
3/4″	IB1034-13-N-60	60	30	813
1″	IB1034-14-N-60			
3/4″	IB1034-13-N-80	80	30	813
1″	IB1034-14-N-80			
3/4″	IB1034-13-N-125	125	30	813
1″	IB1034-14-N-125			
3/4″	IB1034-13-N-180	180	30	813
1″	IB1034-14-N-180			
3/4″	IB1034-13-N-250	250	30	813
1″	IB1034-14-N-250			


1034

WITH STRAINER

Conn. NPT	Model Code	PMO PSI	Weight lbs	Cross Ref. Armstrong
1/2″	IB1041-12-N-20	20	7	880
3/4″	IB1041-13-N-20			
1/2″	IB1041-12-N-80	80	7	880
3/4″	IB1041-13-N-80			
1/2″	IB1041-12-N-125	125	7	880
3/4″	IB1041-13-N-125			
1/2″	IB1041-12-N-150	150	7	880
3/4″	IB1041-13-N-150			


1041

Conn. NPT	Model Code	PMO PSI	Weight lbs	Cross Ref. Armstrong
1/2″	IB1042-12-N-15	15	8	881
3/4″	IB1042-13-N-15			
1/2″	IB1042-12-N-30	30	8	881
3/4″	IB1042-13-N-30			
1/2″	IB1042-12-N-70	70	8	881
3/4″	IB1042-13-N-70			
1/2″	IB1042-12-N-125	125	8	881
3/4″	IB1042-13-N-125			
1/2″	IB1042-12-N-200	200	8	881
3/4″	IB1042-13-N-200			
1/2″	IB1042-12-N-250	250	8	881
3/4″	IB1042-13-N-250			


1042

Conn. NPT	Model Code	PMO PSI	Weight lbs	Cross Ref. Armstrong
3/4″	IB1044-13-N-15	15	37	883
1″	IB1044-14-N-15			
3/4″	IB1044-13-N-30	30	37	883
1″	IB1044-14-N-30			
3/4″	IB1044-13-N-60	60	37	883
1″	IB1044-14-N-60			
3/4″	IB1044-13-N-80	80	37	883
1″	IB1044-14-N-80			
3/4″	IB1044-13-N-125	125	37	883
1″	IB1044-14-N-125			
3/4″	IB1044-13-N-180	180	37	883
1″	IB1044-14-N-180			
3/4″	IB1044-13-N-250	250	37	883
1″	IB1044-14-N-250			
1 1/4″	IB1038S-15-N-15	15	37	883
1 1/2″	IB1038S-16-N-15			
1 1/4″	IB1038S-15-N-30	30	37	883
1 1/2″	IB1038S-16-N-30			
1 1/4″	IB1038S-15-N-60	60	37	883
1 1/2″	IB1038S-16-N-60			
1 1/4″	IB1038S-15-N-80	80	37	883
1 1/2″	IB1038S-16-N-80			
1 1/4″	IB1038S-15-N-125	125	37	883
1 1/2″	IB1038S-16-N-125			
1 1/4″	IB1038S-15-N-180	180	37	883
1 1/2″	IB1038S-16-N-180			
1 1/4″	IB1038S-15-N-250	250	37	883
1 1/2″	IB1038S-16-N-250			


1044 & 1038S

Helpful Selection Information

Select a model with a higher maximum operating pressure (PMO) that meet or exceed the maximum steam pressure or the trap may not open. For example, the **IB-1032-14-N-250** has a PMO of 250 PSI. Choose a model that will handle the capacity requirement based on the differential pressure across the trap. Reference capacity charts.

CAPACITIES – *Condensate (lbs/hr)*

Model	Pipe Size	Orifice Size	PMO (PSIG)	Differential Pressure (PSI) 1/4	1/2	1	2	5	10	15	20	30	50	60	70	80	100	125	150	180	200	250
1031 1041 1031S *	1/2", 3/4"	3/16"	20	139	200	270	340	450	560	640	690											
	1/2", 3/4"	1/8"	80	75	115	150	190	300	350	400	440	500	580	635	660	690						
	1/2", 3/4"	7/64"	125	50	80	100	145	240	280	320	350	410	490	520	560	580	640	680				
	1/2", 3/4"	#38	150	35	50	75	105	150	250	280	300	350	400	420	450	470	500	550	570			
1032	1/2", 3/4",1"	1/4"	15	191	300	450	590	830	950	1060												
	1/2", 3/4",1"	3/16"	30	150	235	325	410	530	700	820	880	1000										
	1/2", 3/4",1"	5/32"	70	85	145	220	275	380	500	560	620	710	840	900	950							
	1/2", 3/4",1"	1/8"	125	70	110	160	210	285	375	440	485	560	670	720	780	800	860	950				
	1/2", 3/4",1"	7/64"	200	45	75	110	145	205	265	315	350	410	500	550	580	620	650	700	810	840	860	
	1/2", 3/4",1"	#38	250	15	40	80	105	155	205	240	270	320	400	500	530	550	580	630	660	690	710	760
1042	1/2", 3/4"	1/4"	15	191	300	450	590	830	950	1060												
	1/2", 3/4"	3/16"	30	150	235	325	410	530	700	820	880	1000										
	1/2", 3/4"	5/32"	70	85	145	220	275	380	500	560	620	710	840	900	950							
	1/2", 3/4"	1/8"	125	70	110	160	210	285	375	440	485	560	670	720	780	800	860	950				
	1/2", 3/4"	7/64"	200	45	75	110	145	205	265	315	350	410	500	550	580	620	650	700	810	840	860	
	1/2", 3/4"	#38	250	15	40	80	105	155	205	240	270	320	400	500	530	550	580	630	660	690	710	760
1033	1/2", 3/4"	5/16"	15	350	570	850	1140	1600	1900	2100												
	1/2", 3/4"	1/4"	30	270	400	640	810	1000	1300	1600	1800	2050										
	1/2", 3/4"	3/16"	70	195	300	480	610	750	950	1200	1375	1600	1900	2000	2200							
	1/2", 3/4"	5/32"	125	130	205	320	415	595	775	910	900	1100	1380	1480	1600	1650	1800	2000				
	1/2", 3/4"	1/8"	200	75	120	200	255	365	490	585	630	700	900	980	1080	1120	1220	1400	1500	1560	1600	
	1/2", 3/4"	7/64"	250	30	80	130	170	250	335	400	470	525	665	600	700	800	900	1000	1100	1180	1220	1300
1034 1044	3/4", 1"	1/2"	15	950	1410	1880	2300	2900	3500	3900												
	3/4", 1"	3/8"	30	600	960	1300	1640	2200	2800	3300	3500	4000										
	3/4", 1"	5/16"	60	490	800	1090	1400	1750	2200	2600	2900	3500	4100	4400								
	3/4", 1"	9/32"	80	330	580	720	1070	1450	1800	2100	2400	2800	3300	3600	3800	4000						
	3/4", 1"	1/4"	125	260	430	620	810	1150	1650	1800	1900	2200	2600	2800	3000	3200	3600	3900				
	3/4", 1"	7/32"	180	200	310	470	610	880	1170	1380	1510	1800	2100	2300	2500	2700	2900	3200	3500	3700		
	3/4", 1"	3/16"	250	170	250	380	490	700	940	1100	1250	1450	1700	1800	2000	2100	2300	2700	2800	3100	3200	3500
1038S	1 1/4", 1 1/2"	1/2"	15	1188	1763	2350	2875	3625	4375	4875												
	1 1/4", 1 1/2"	3/8"	30	760	1190	1625	2050	2750	3500	4125	4375	5125										
	1 1/4", 1 1/2"	5/16"	60	615	1000	1375	1750	2188	2750	3250	3625	4375	5125	5500								
	1 1/4", 1 1/2"	9/32"	80	420	720	900	1340	1810	2250	2625	3000	3500	4125	4500	4750	5000						
	1 1/4", 1 1/2"	1/4"	125	330	540	775	1010	1440	2063	2250	2375	2750	3250	3500	3750	4000	4500	4875				
	1 1/4", 1 1/2"	7/32"	180	250	390	590	760	1100	1470	1725	1890	2063	2375	2875	3125	3375	3625	4000	4375	4625		
	1 1/4", 1 1/2"	3/16"	250	210	320	470	610	875	1170	1380	1560	1800	2125	2250	2500	2625	2875	3375	3500	3875	4000	4375

** 1031S only available @ PMO = 125 PSIG.*

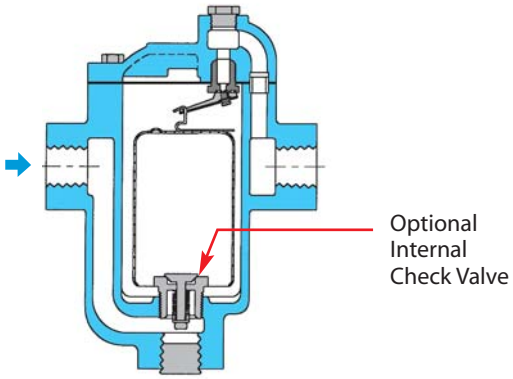
Replacement Kits

A replacement kit containing the lever and seat assembly is a more economical option than replacing the entire steam trap. Also available are replacement screens, gaskets and buckets.

When ordering replacement lever and seat assemblies specify model and operating pressure. See Replacement Parts and Kits Section for exact cross-reference to Armstrong PCA (Pressure Change Assembly) Kits.

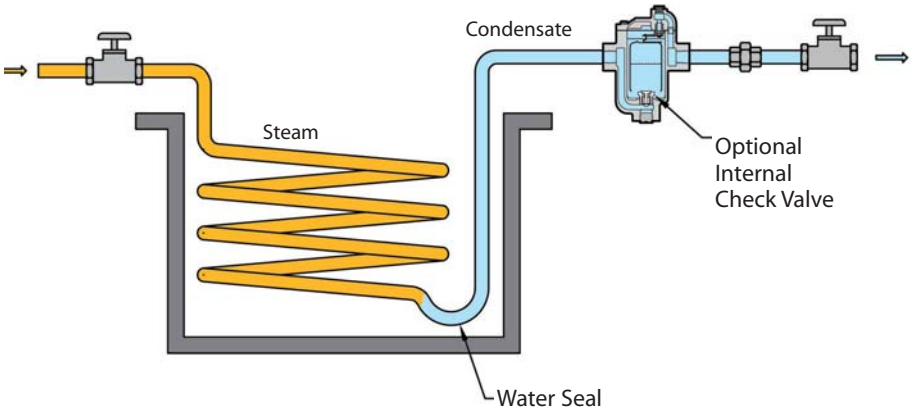
Why use a Check Valve Option ?

The optional internal check valve allows the bucket trap to retain its prime even when exposed to superheated steam. The IB Trap must retain hot condensate inside the trap body to operate. Superheated steam or a sudden drop in inlet pressure can flash off the hot condensate inside the trap body causing the trap to lose its prime. If the steam pressure falls below the discharge pressure on the outlet side of the steam trap, the internal check valve will stop the back flow of condensate into the steam system. When discharging to a condensate return line, a check valve is always recommended.



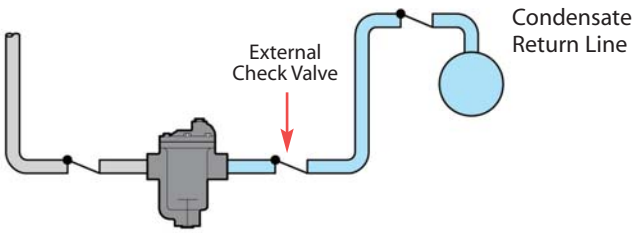
Steam Trap Installed Above Condensate Collection Point

In this example, condensate must travel upwards to reach the trap. Under this condition, it is possible for condensate to flow from the condensate return line into the steam coils, thereby flooding the system. The internal check valve, inside the IB trap, prevents the back flow of condensate.



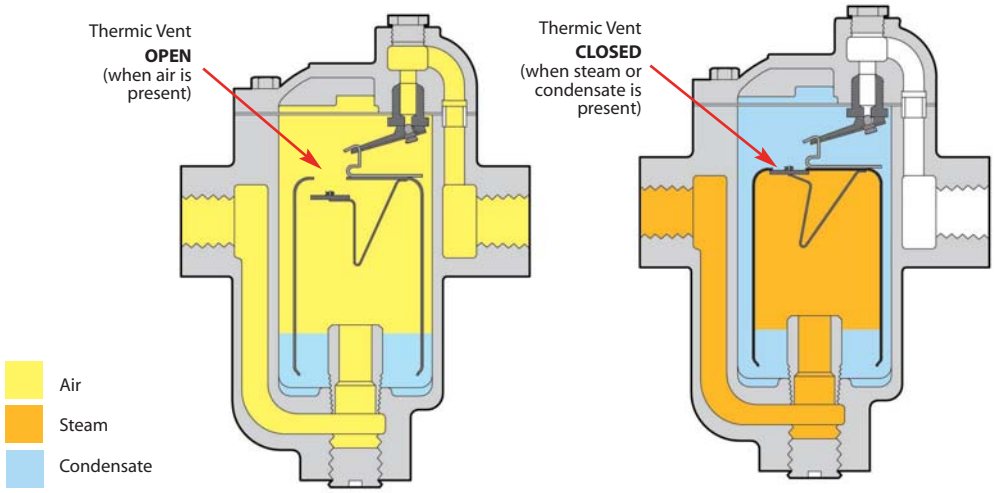
Steam Trap Discharging into Elevated Condensate Return Line

When a steam trap discharges condensate to an elevated location,a check valve should be used to stop condensate from flowing backwards into the steam system.



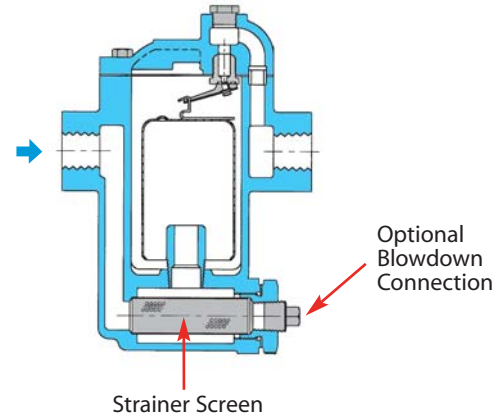
Why use a Thermic Vent ?

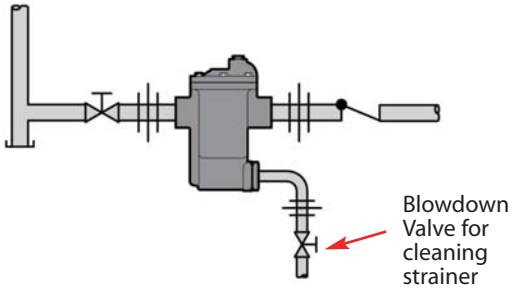
The Thermic Vent is used for discharging air from the steam system during start-up.



Blowdown Valve Connection

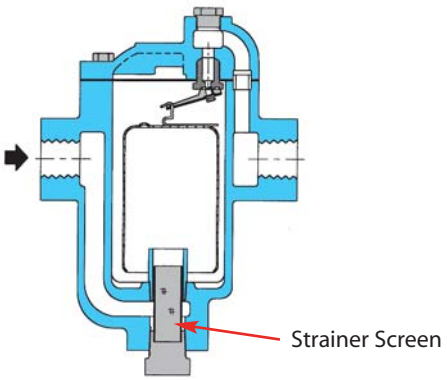
A Blowdown Valve connection is available as an option on the **1041**, **1042**, **1044**, and **1038S** models. This simplifies maintenance by allowing the strainer to be cleaned without removal. User to supply blowdown valve.





1031S

The **1031S** is equipped with a small protection screen to guard against dirt in the steam system. It is a more economical alternative than the 1041 which has a full-port strainer. Specifically designed for use in laundries. Available in 125 PSIG model only.

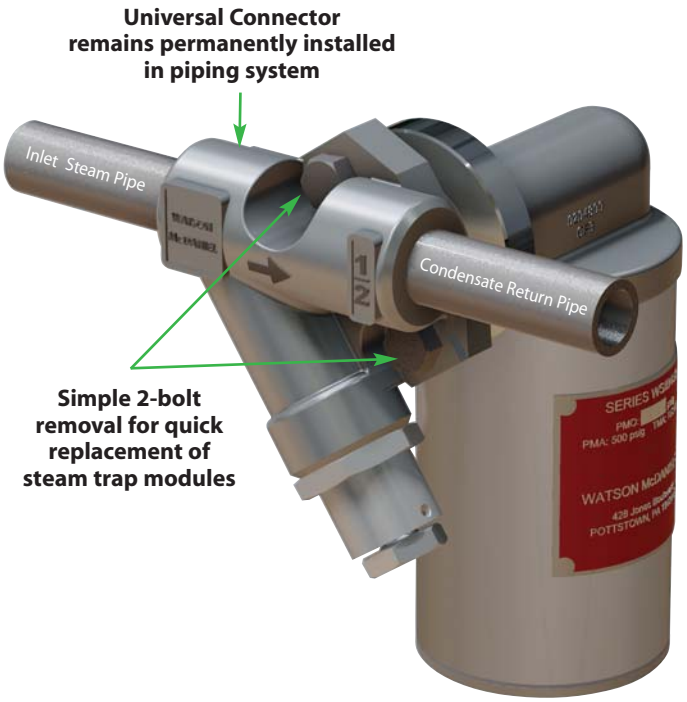


UC450 Series
Quick-Change Universal Style Trap-Connector System

The **UC450 Series QUICK-CHANGE Universal Trap-Connector System** with multiple choices for trap modules and multiple choices for connectors are used in steam systems where a simplified and economical maintenance program of steam traps is desired. These Universal Style quick replacement steam traps can be used on steam supply lines as well as for tracing and small process applications. They are commonly used in chemical plants, petrochemical refineries, paper mills and other industrial facilities.

The All Stainless Steel Universal Style Steam Traps feature a permanent installation of the Universal Connector with a 2-bolt mounting arrangement for the Universal Steam Trap Module, allowing the Steam Trap to be removed and replaced in minutes:

- Steam trap is replaced without having to unthread piping
- By removing only 2 bolts with a socket or open-end wrench
- Trap module can swivel 360° on the universal connector allowing proper orientation



"QUICK-CHANGE" Universal Trap Modules

STEP 1:
Select an appropriate Universal **STEAM TRAP MODULE**

UTD450
Thermodynamic
"Top Mount"

UTD450SM
Thermodynamic
"Side Mount"

UT450
Thermostatic
Bellows

UB450
Thermostatic
Adjustable Bi-Metal

USIB450
Inverted
Bucket

UFT450
Float &
Thermostatic

"QUICK-CHANGE" Universal Connectors

STEP 2:
Select appropriate Universal **CONNECTOR**. Any Universal Connector (shown right) will work with any Universal Steam Trap Module. (Including those of other manufacturers. See product catalog for full offering of Connectors.) Trap orientation must be considered.

UC450

UC450S

UC450SR

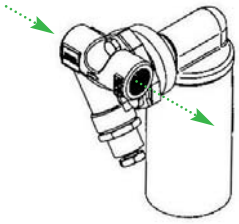
Quick-Change Universal Style Trap-Connector System

Why Use the UC450 Series "QUICK-CHANGE" Universal Style Trap-Connector System ?

Quick-Change Steam Traps
are recommended in any application – particularly those which require simple and frequent replacement of steam traps

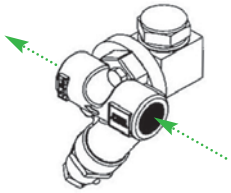
Universal Connectors
These Connectors remain permanently installed in the piping system. The convenient 2-bolt mounting system allows the Trap Module to be replaced quickly and easily using a socket or open-end wrench without having to unthread piping.

Quick-Change Steam Trap Modules with Universal Connectors



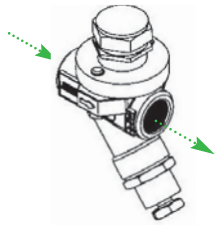
Inverted Bucket Trap

USIB450 Steam Trap
(shown with)
UC450S Connector



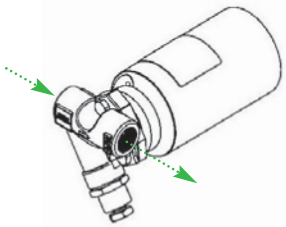
Thermodynamic "side-mount" Trap

UTD450SM Steam Trap
(shown with)
UC450SBL Connector



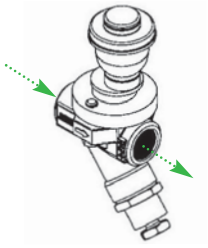
Thermodynamic "top-mount" Trap

UTD450 Steam Trap
(shown with)
UC450SB Connector



Float & Thermostatic Trap

UFT450 Steam Trap
(shown with)
UC450SBR Connector



Thermostatic Trap

UT450 Steam Trap
(shown with)
UC450SB Connector

4 basic configurations of connectors are available:

UC450, UC450S & UC450R/ UC450L.

Choice is based on strainer orientation or if a piping interference exists.

The UC450SR is the standard connector choice.

The R & L versions are a mirror image of each other and are strictly a user's preference based on piping orientation.

UC450

UC450S

UC450SR

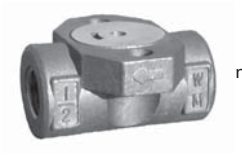
UC450 Series

Universal Style Quick-Change Connectors

(For use with Universal Quick-Change **Trap** Modules)

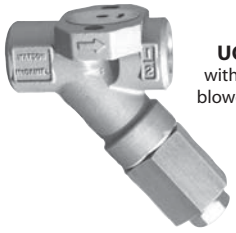
Model	UC450, UC450S, UC450SB UC450SR, UC450SBR, UC450SL, UC450SBL
Sizes	1/2", 3/4", 1"
Connections	NPT, SW, FLG
Body Material	Stainless Steel
PMO Max. Operating Pressure	(trap module dependent)
TMO Max. Operating Temperature	(trap module dependent)
PMA Max. Allowable Pressure	750 PSIG @ 100°F
TMA Max. Allowable Temperature	800°F @ 400 PSIG

Steam Trap Modules that mount to Universal Connectors are shown on the following pages. Trap modules available in: Inverted Bucket, Float & Thermostatic, Thermodynamic, Thermostatic and Bi-metallic type.



UC450
no strainer

UC450S
with strainer



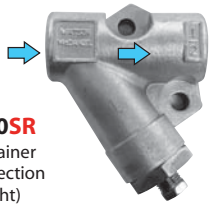
UC450SB
with strainer & blowdown valve

Typical Applications

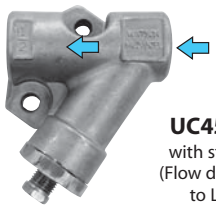
DRIP, TRACER: UC450 Series Universal Trap Connectors reduce the time and manpower to replace steam traps. The stainless steel Connector remains permanently in-line allowing steam trap module to be replaced in minutes. These universal connectors can be used for drip service on steam mains and steam supply lines, tracing, or for small process equipment. Industrial standard 2-bolt universal connectors are commonly used in chemical plants, petrochemical refineries, paper mills, and other industrial facilities. The UC450 connectors conform to industrial standards, making them compatible with other manufacturers' universal steam trap modules.

Used with the following Watson McDaniel Steam Trap Modules:

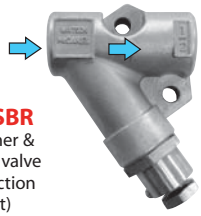
USIB450 - Inverted Bucket
UTD450 - Thermodynamic
UTD450SM - Thermodynamic
UTD600LSM - Thermodynamic
UT450 - Thermostatic
UFT450 - Float & Thermostatic
UB450 - Bi-Metallic



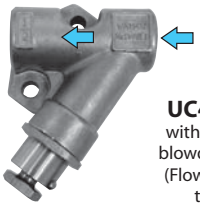
UC450SR
with strainer (Flow direction to Right)



UC450SL
with strainer (Flow direction to Left)



UC450SBR
with strainer & blowdown valve (Flow direction to Right)



UC450SBL
with strainer & blowdown valve (Flow direction to Left)

Note: Optional Flanged units available.

How It Works

Universal connectors remain permanently installed in the piping system. The convenient 2-bolt mounting system allows the trap module to be removed and replaced quickly and easily using a socket or open-end wrench without disturbing the existing piping.

Features

- Universal connector with 2-bolt mounting allows for fast, easy replacement of trap module making it more cost-effective than replacing conventional type steam traps
- All stainless steel construction
- Trap module can rotate 360° on the universal connector allowing any orientation during installation
- Compatible with other manufacturers' trap modules
- Available with integral strainer and blowdown valve

Sample Specification

The Universal Connector shall be all stainless steel construction with a two-bolt 360 degree swivel mount flange design and available with integral strainer and blowdown valve.

Installation and Maintenance

The universal connector can be installed in vertical or horizontal piping and available in 1/2", 3/4" and 1" threaded NPT and socket weld (SW). In horizontal installations, orientation of connecter body may be dependent on the specific type of trap module used. These connectors remain permanently installed in the piping system. The convenient 2-bolt mounting system allows the trap module to be easily replaced using a socket or open-end wrench without having to unthread piping.

MATERIALS	
Body	Stainless Steel, AISI 316
Strainer	40 Mesh Stainless Steel, AISI 304
Blowdown Valve	Stainless Steel, AISI 303

How to Size / Order

Connectors and Trap Modules are ordered separately. See following pages for the Trap Modules.

UC450 Series

Universal Style Quick-Change Connectors

(For use with Universal Quick-Change **Trap** Modules)

Helpful Selection Information
Choose the desired style connector:
UC450, UC450S
UC450SR (flow to right)
UC450SL (flow to left)

Four basic configurations of connectors are available: UC450, UC450S, and UC450S**R**/UC450S**L**. The UC450SR (with strainer, flow to right) is the most common connector choice. Choice is based upon strainer orientation or if a piping interference exists. All connector styles operate with any trap module. The **R** and **L** versions are mirror images of each other and are selected based on which side the user prefers the trap mounted on.

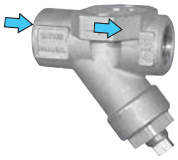
UC450 Type

UC450
No Strainer

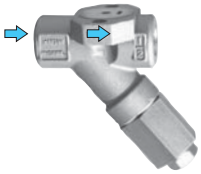
Size	Model Code Threaded - NPT	Model Code Socket Weld	Weight lbs
Connector			
1/2"	UC450-12-N	UC450-12-SW	1.5
3/4"	UC450-13-N	UC450-13-SW	1.5
1"	UC450-14-N	UC450-14-SW	3.0

UC450S Type

UC450S
Strainer



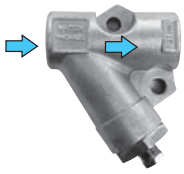
UC450SB
Strainer &
Blowdown Valve



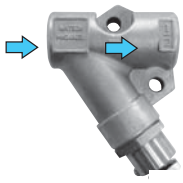
Size	Model Code Threaded - NPT	Model Code Socket Weld	Weight lbs
Connector (with Strainer)			
1/2"	UC450S-12-N	UC450S-12-SW	2.5
3/4"	UC450S-13-N	UC450S-13-SW	2.5
1"	UC450S-14-N	UC450S-14-SW	3.5
Connector (with Strainer & Blowdown Valve)			
1/2"	UC450SB-12-N	UC450SB-12-SW	2.5
3/4"	UC450SB-13-N	UC450SB-13-SW	2.5
1"	UC450SB-14-N	UC450SB-14-SW	4.5

UC450SR Type — Flow to Right (as viewed)

UC450SR
Strainer



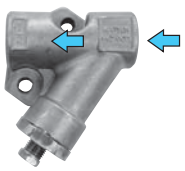
UC450SBR
Strainer &
Blowdown Valve



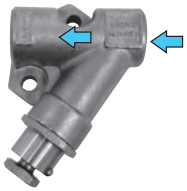
Size	Model Code Threaded - NPT	Model Code Socket Weld	Weight lbs
Connector (with Strainer) FLOW TO RIGHT			
1/2"	UC450SR-12-N	UC450SR-12-SW	2.5
3/4"	UC450SR-13-N	UC450SR-13-SW	2.5
1"	UC450SR-14-N	UC450SR-14-SW	2.5
Connector (with Strainer & Blowdown Valve) FLOW TO RIGHT			
1/2"	UC450SBR-12-N	UC450SBR-12-SW	2.5
3/4"	UC450SBR-13-N	UC450SBR-13-SW	2.5
1"	UC450SBR-14-N	UC450SBR-14-SW	2.5

UC450SL Type — Flow to Left (as viewed)

UC450SL
Strainer



UC450SBL
Strainer &
Blowdown Valve

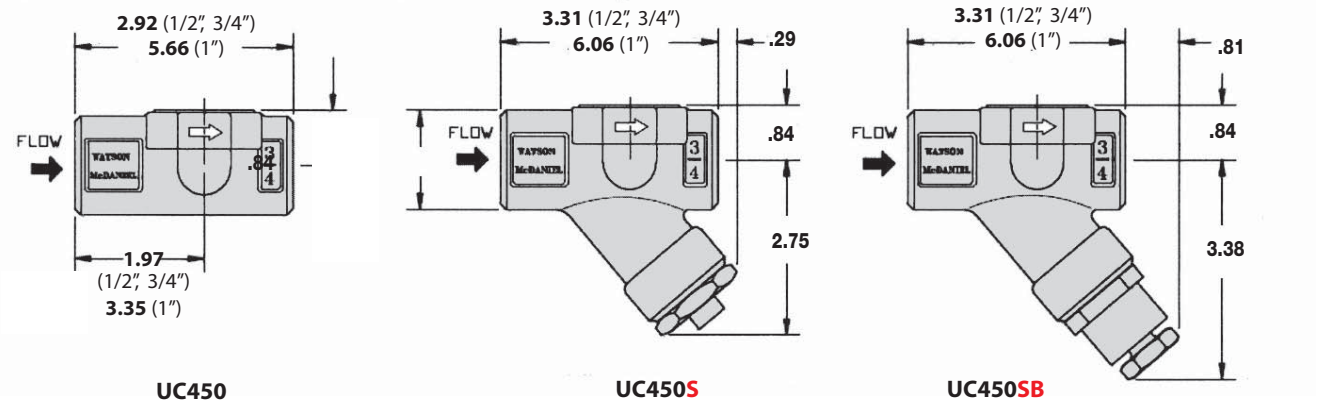


Size	Model Code Threaded - NPT	Model Code Socket Weld	Weight lbs
Connector (with Strainer) FLOW TO LEFT			
1/2"	UC450SL-12-N	UC450SL-12-SW	2.5
3/4"	UC450SL-13-N	UC450SL-13-SW	2.5
1"	UC450SL-14-N	UC450SL-14-SW	2.5
Connector (with Strainer & Blowdown Valve) FLOW TO LEFT			
1/2"	UC450SBL-12-N	UC450SBL-12-SW	2.5
3/4"	UC450SBL-13-N	UC450SBL-13-SW	2.5
1"	UC450SBL-14-N	UC450SBL-14-SW	.5

UC450, UC450S, UC450SB Universal Connectors

Connectors available in 1/2", 3/4" and 1" sizes in NPT or Socket-Weld Connections

Note: Optional Flange units available.



UC450
(No Strainer)

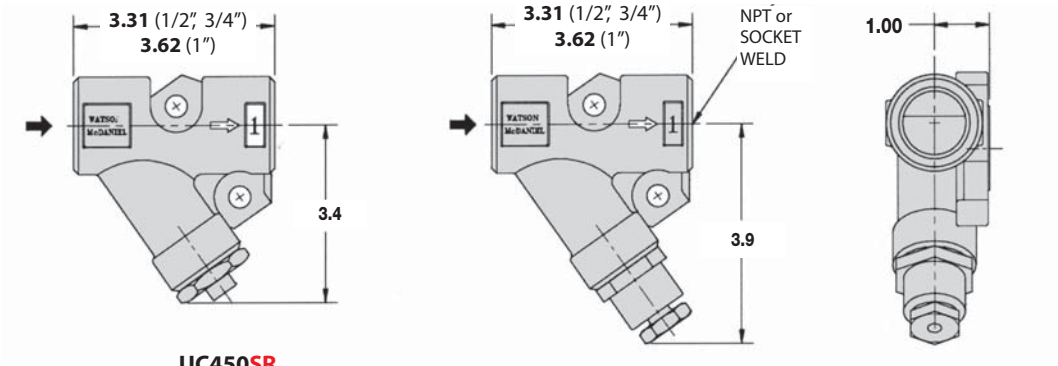
UC450S
(Strainer)

UC450SB
(Strainer & Blowdown)

UC450SR & UC450SBR Universal Connectors — Flow Direction - To RIGHT

Connectors available in 1/2", 3/4" and 1" sizes in NPT or Socket-Weld Connections

Note: Optional Flange units available.



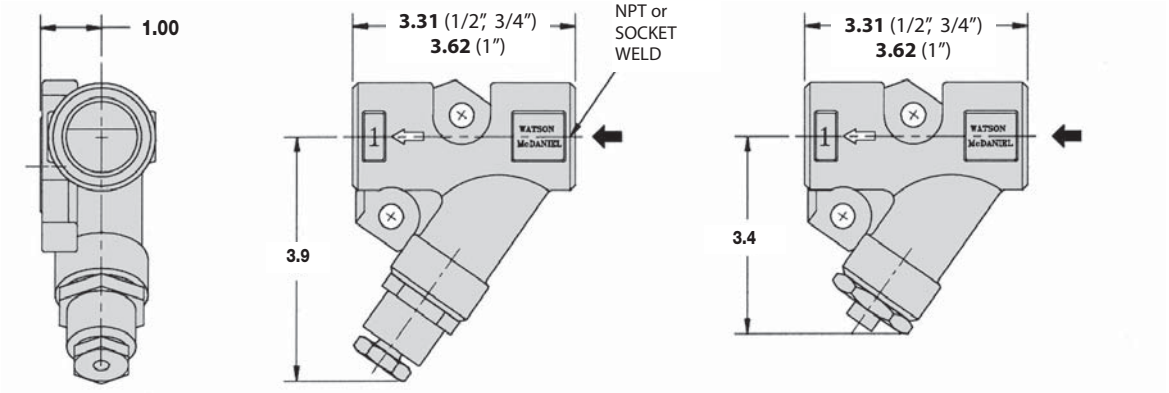
UC450SR
(Strainer)

UC450SBR
(Strainer & Blowdown)

UC450SL & UC450SBL Universal Connectors — Flow Direction - To LEFT

Connectors available in 1/2", 3/4" and 1" sizes in NPT or Socket-Weld Connections

Note: Optional Flange units available.



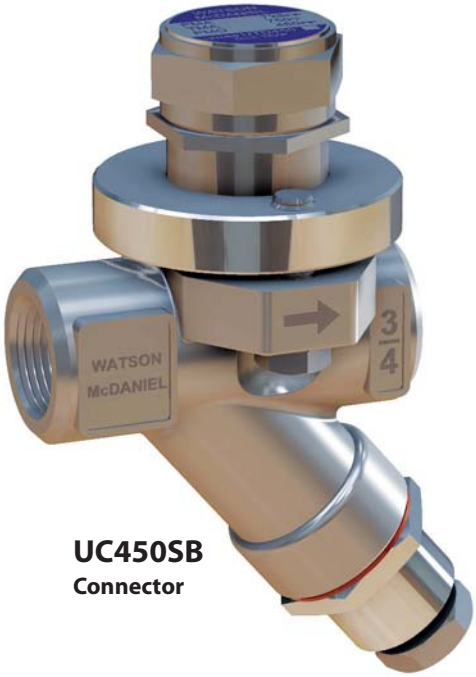
UC450SBL
(Strainer & Blowdown)

UC450SL
(Strainer)

UC450SBR
Connector

USIB450
Trap Module

UTD450
Trap Module

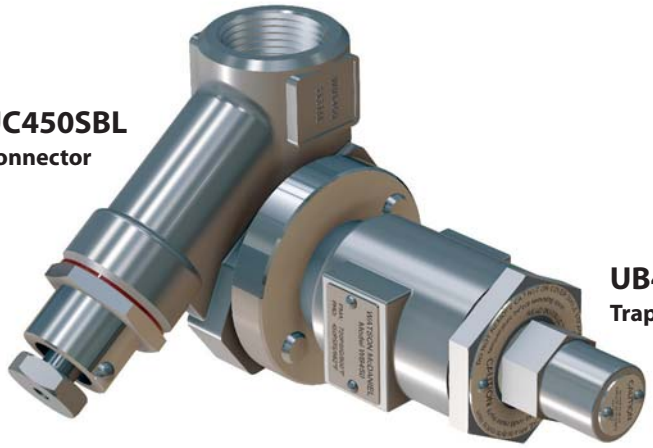


UC450SB
Connector

UC450SL
Connector

UT450
Trap Module

UC450SBL
Connector



UB450
Trap Module

USIB450

Universal Style
Quick-Change Trap Module

Inverted Bucket Steam Trap Module (mounts to UC450 Universal Connectors)

Model	**USIB450, USIB450H**
Connections	**Fits UC450 Series Universal Connectors**
Body Material	**Stainless Steel**
PMO Max. Operating Pressure	**450 PSIG***
TMO Max. Operating Temperature	**800ºF**
PMA Max. Allowable Pressure	**720 PSIG @ 100ºF**
TMA Max. Allowable Temperature	**800ºF @ 400 PSIG**

**750ºF @ operating pressures below 400 PSIG. See installation note regarding using trap in superheated applications.*

Steam trap modules can be used with other manufacturers' Universal Connectors.

Typical Applications

DRIP, TRACER: The **USIB450** inverted bucket steam trap modules must be mounted to a universal connector. They are typically used for drip applications such as draining condensate from steam mains or steam supply lines as well as for steam tracing applications. **USIB450H** is the higher capacity model.

How It Works

The UC450 universal connector is permanently installed into the pipeline where the steam trap would normally be placed. The trap module, which functions like any standard inverted bucket steam trap, is fastened to the universal connector with two bolts. When a new trap module is needed, it can be easily removed and replaced with a standard open-end or socket wrench without disturbing the existing piping.

Sample Specification

The steam trap shall be an all stainless steel modular design, inverted bucket type with a frictionless valve lever assembly. The trap shall have a 360 degree swivel mount on a stainless steel Universal Connector that is available with integral strainer and blowdown valve options.

Options

Universal Connectors are available with an integral strainer and blowdown valve. Connector is purchased separately. See the UC450 Universal Connectors section for more information.

Installation and Maintenance

Universal connector is first permanently threaded or welded into piping system. The USIB trap module is attached to the universal connector with two bolts. When a new trap is needed, it can be easily removed and replaced with a standard open-end or socket wrench without disturbing the existing piping. Trap must be installed in upright position as shown to function properly. With superheated steam, a check valve must be installed at inlet of trap to prevent the loss of prime. In vertical piping installations with upward flow, use of a blowdown valve is not recommended because discharge would be in upward and possibly unsafe direction.

Features

- Trap module can be easily removed and replaced in minutes without having to disconnect any piping
- Hardened stainless steel valves and seat
- Freeze resistant
- Connectors available with integral strainers and blowdown valves
- 360º swivel design for convenient installation

MATERIALS

Body	Stainless Steel GR CF3
Cover	304L Stainless Steel
Internals	300 Series Stainless Steel
Valve Plug & Seat	420F Stainless Steel
Bolts	ASTM A193 GR B7
Gasket	Spiral-Wound 304 Stainless Steel with Grafoil Filler
Swivel Flange	303 Stainless Steel

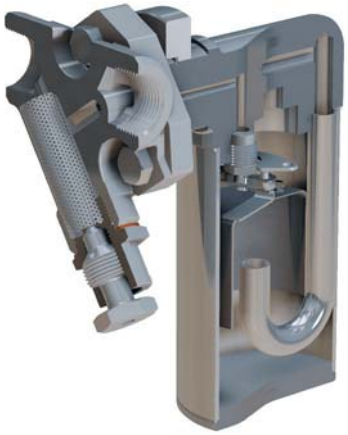
CAPACITIES – *Condensate (lbs/hr)*

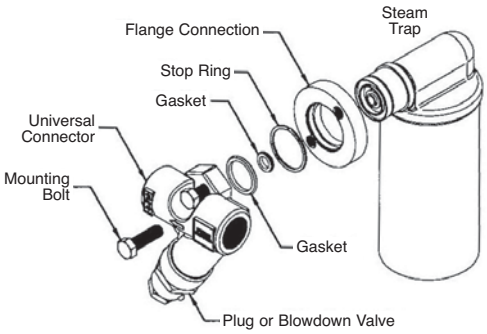
Model	Orifice Size	PMO (PSIG)	Differential Pressure (PSI) 5	10	15	20	25	30	40	50	60	70	80	100	125	150	180	200	250	350	450
USIB450-20	3/16″	20	450	560	640	690															
USIB450-80	1/8″	80	300	350	400	440	460	500	550	580	635	660	690								
USIB450-150	#38	150	210	250	280	300	320	350	380	400	420	450	470	500	550	570					
USIB450-450	.057	450	31	50	70	84	95	105	120	133	145	152	160	174	187	198	208	215	228	248	263
USIB450H-15	1/4″	15	830	950	1060																
USIB450H-30	3/16″	30	530	700	820	880	950	1000													
USIB450H-70	5/32″	70	380	500	560	620	680	710	770	840	900	950									
USIB450H-125	1/8″	125	285	375	440	485	530	560	620	670	720	780	800	860	950						
USIB450H-200	7/64″	200	205	265	315	350	385	410	465	500	580	590	620	650	700	810	840	860			
USIB450H-250	#38	250	155	205	240	270	295	320	360	400	500	530	550	580	630	660	690	710	760		
USIB450H-450	.057	450	31	50	70	84	95	105	120	133	145	152	160	174	187	198	208	215	228	248	263

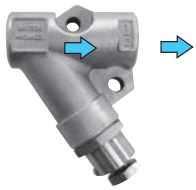
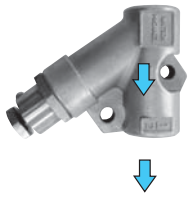
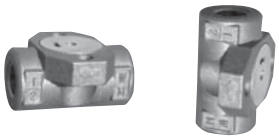
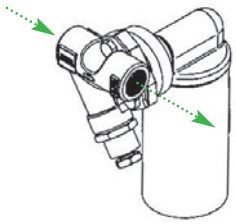
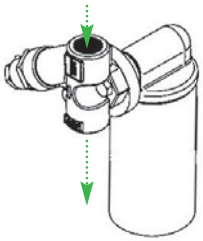
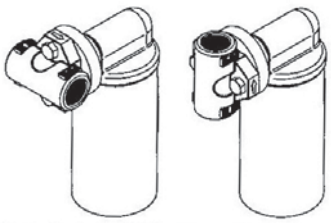
USIB450

Universal Style Quick-Change Trap Module

Inverted Bucket Steam Trap Module (mounts to UC450 Universal Connectors)

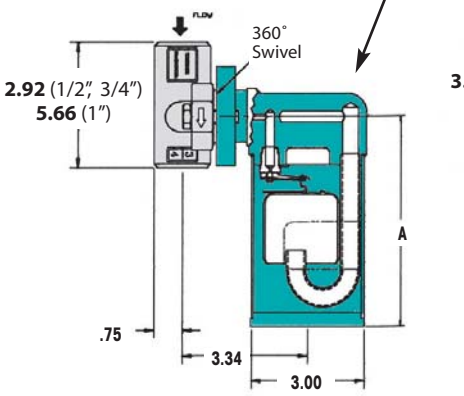




Horizontal Piping (Connector with Strainer)	Vertical Piping (Connector with Strainer)	Vertical or Horizontal Piping (No Strainer)
Steam Flow to the Right (Standard)	**Steam Flow Downward**	**Steam Flow Any Direction**
		
Trap shown with **UC450SR** Connector (Use **L** Style if a Piping Constraint exists)	Trap shown with **UC450SR** Connector	Trap shown with **UC450** Connector
		

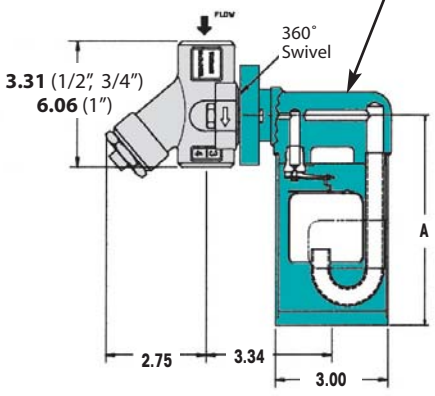
Connectors available in 1/2", 3/4" and 1" sizes in NPT or Socket-Weld Connections

UC450 CONNECTOR — **USIB450 Trap Module**

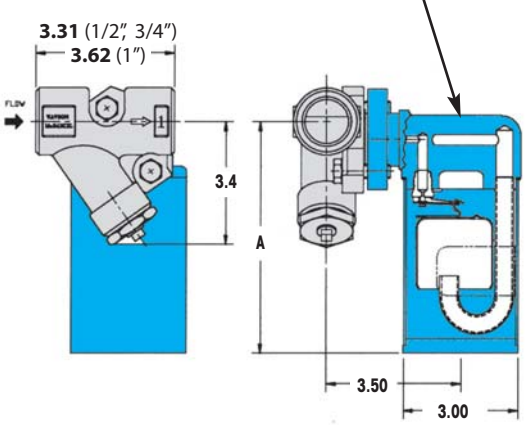


USIB450 A-Dimension = 5.81"
USIB450H A-Dimension = 6.81"

UC450S CONNECTOR Strainer — **USIB450 Trap Module**



UC450SR CONNECTOR Strainer — **USIB450 Trap Module**



USIB450 A-Dimension = 6.12"
USIB450H A-Dimension = 7.12"

UFT450

Universal Style Quick-Change Trap Module

Float & Thermostatic Steam Trap Module (mounts to UC450 Universal Connectors)

Model	**UFT450**
Connections	**Fits UC450 Series Universal Connectors**
Body Material	**Stainless Steel**
PMO Max. Operating Pressure	**225 PSIG**
TMO Max. Operating Temperature	**397°F**
PMA Max. Allowable Pressure	**720 PSIG @ 100°F**
TMA Max. Allowable Temperature	**800°F @ 400 PSIG**

Steam trap modules can be used with other manufacturers' Universal Connectors.

UFT450
Float & Thermostatic
Steam Trap Module

Typical Applications

PROCESS, DRIP: The **UFT450** Float & Thermostatic steam trap module can be used on small process equipment which generate light condensate loads. F&T traps have excellent air handling capability. These F&T trap modules can also be used in drip service on steam mains and steam supply lines. Mounts to any universal connector.

How It Works

The UC450 universal connector is permanently installed into the pipeline where the steam trap would normally be placed. The trap module, which functions like any F&T steam trap, is fastened to the universal connector with two bolts. When a new trap module is needed, it can be easily removed and replaced with a standard open-end or socket wrench without disturbing the existing piping.

Sample Specification

The steam trap shall be an all stainless steel modular design, float & thermostatic unit. The thermostatic air vent to be pressure balanced welded bellows. The trap shall have a 360 degree swivel mount on a stainless steel Universal Connector that is available with integral strainer and blowdown valve options.

Installation and Maintenance

Universal connector is first permanently threaded or welded into piping system. The UFT450 mounts to any 2-Bolt Quick-Change Universal Connector. Trap module must be installed in orientation shown. The trap module is bolted to the universal connector with two bolts. When a new trap module is needed, it can be easily removed and replaced with a standard open-end or socket wrench without disturbing the existing piping.

Features

- Trap module can be easily removed and replaced in minutes without having to disconnect any piping
- Hardened stainless steel valves and seat
- Freeze-resistant
- Connectors available with integral strainers and blowdown valves
- 360° swivel design for convenient installation

Options

Universal Connectors are available with an integral strainer and blowdown valve. Connector is purchased separately. See the Universal Connectors section for more information.

Helpful Selection Information
Select a model with a PMO (maximum operating pressure) that meets or exceeds the steam pressure of the system. For example, the UFT450-65 has a maximum operating pressure of 65 PSI. Any universal connector can be used. Recommended connector: UC450SR

MATERIALS	
Body	Stainless Steel GR CF3
Cover	304L Stainless Steel
Internals	300 Series Stainless Steel
Valve Disc	420F Stainless Steel
Valve Seat	17-4 PH Stainless Steel
Bolts	ASTM A193 GR B7
Gasket	Spiral-Wound 304 Stainless Steel with Grafoil Filler
Swivel Flange	303 Stainless Steel

CAPACITIES – *Condensate (lbs/hr)*

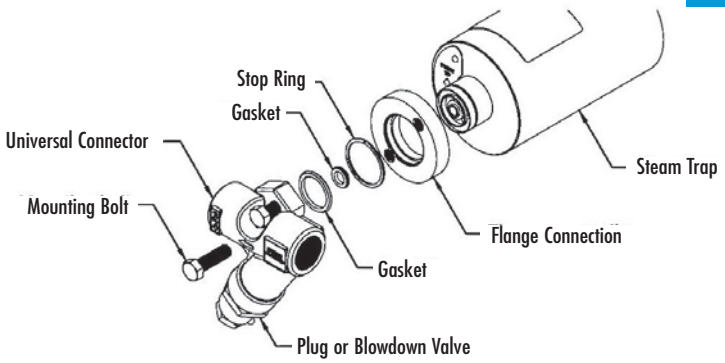
Model	PMO (PSIG)	Differential Pressure (PSI) 1/4	1/2	1	2	5	10	15	20	30	40	50	65	75	100	125	145	200	225
UFT450-15	15	390	490	620	780	1050	1320	1500											
UFT450-65	65	115	155	205	270	390	520	610	685	810	910	995	1110						
UFT450-145	145	55	75	100	135	200	270	320	365	435	490	540	600	640	725	795	850		
UFT450-225	225	40	50	70	95	135	185	220	245	290	330	360	405	430	485	530	565	645	680

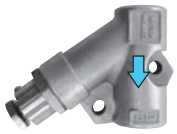
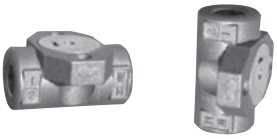
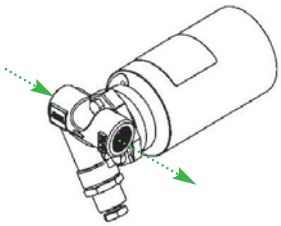
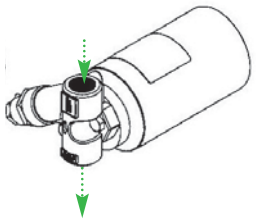
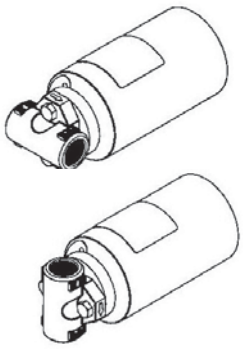
UFT450

Universal Style Quick-Change Trap Module

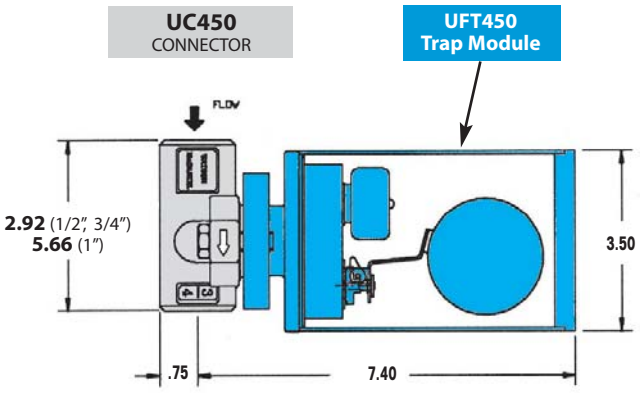
Float & Thermostatic Steam Trap Module (mounts to UC450 Universal Connectors)

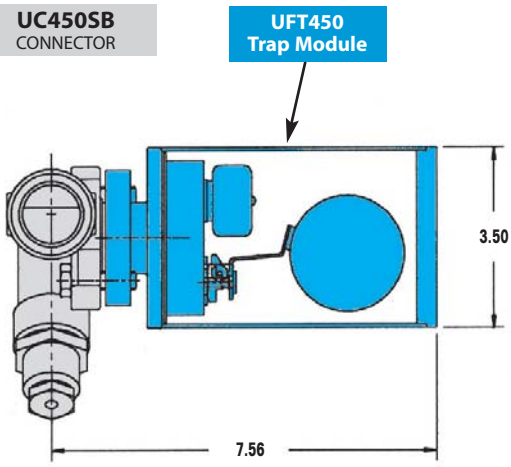
UFT450 Trap Module must be oriented Horizontally, as shown.



Horizontal Piping (Connector with Strainer)	Vertical Piping (Connector with Strainer)	Vertical or Horizontal Piping (No Strainer)
Steam Flow to the Right UC450SBR Connector (with Blowdown Valve) shown below	**Steam Flow Downward** UC450SBR Connector (with Blowdown Valve) shown below	**Steam Flow Any Direction** UC450 Connector shown below
		
Trap shown with **UC450SBR** Connector (Use **L** Style Connector to reverse orientation as an alternative if a Piping Constraint exists)	Trap shown with **UC450SBR** Connector	Trap shown with **UC450** Connector
		

Connectors available in 1/2", 3/4" and 1" sizes in NPT or Socket-Weld Connections





UTD450
UTD600

Universal Style
Quick-Change Trap Module

Thermodynamic Steam Trap Module (mounts to UC450 Universal Connectors)

Model *(Side Mount Style)*	UTD450LSM UTD450SM	UTD600LSM
Connections	Fits UC450 Series Universal Connectors	
Body Material	Stainless Steel	Stainless Steel
PMO Max. Operating Pressure	450 PSIG	600 PSIG
TMO Max. Operating Temperature	750°F	750°F
PMA Max. Allowable Pressure	720 PSIG @ 100°F	720 PSIG @ 100°F
TMA Max. Allowable Temperature	800°F @ 400 PSIG	800°F @ 600 PSIG

UTD450 & UTD600
Thermodynamic Steam Trap Module
(Side Mount Style)
For vertical or horizontal piping installations.

Steam trap modules can be used with other manufacturers' Universal Connectors.

Typical Applications

DRIP, TRACER: Designed for drip applications for the draining of condensate from steam mains and other steam supply lines as well as for tracing applications. The **UTD450 & UTD600** Steam Trap Modules can be used anywhere conventional thermodynamic steam traps are used. This trap module can be used on either vertical or horizontal piping installations and can mount to any 2-bolt Quick-Change Universal Connector.

How It Works

The UC450 universal connector is permanently installed into the pipeline where the steam trap would normally be placed. The trap module, which functions like any thermodynamic steam trap, is fastened to the universal connector with two bolts. When a new trap module is needed, it can be easily removed and replaced with a standard open-end or socket wrench without disturbing the existing piping.

Features

- Trap module can be easily removed and replaced in minutes without having to disconnect any piping
- Trap modules can be used with most manufacturers' 2-bolt universal connector
- All stainless steel construction with hardened seat

Sample Specification

The steam trap module shall be designed to attach to the industry standard two-bolt universal connector. Trap module shall be of a thermodynamic design. Universal connector shall conform to the two bolt industry standard with integral strainer and blowdown options.

Installation and Maintenance

Universal connector is first permanently installed (threaded, welded, flanged) into piping system. Trap module should be installed in orientation shown with cap facing upwards. The trap module is fastened to the universal connector using two bolts. If the trap fails for any reason, replace only the trap module. In vertical piping installations with upward flow, use of a blowdown valve is not recommended. Discharge would be in upward and unsafe direction.

Options

Universal Connectors are available with an integral strainer and blowdown valve. Connector is purchased separately. See the Universal Connectors section for more information.

Helpful Selection Information
Connector selection to use with the UTD450SM and UTD600LSM: UC450 (no strainer), UC450SR (strainer), UC450SBR (strainer and blowdown).

MATERIALS

Body	Stainless Steel, AISI 420
Disc	Stainless Steel, AISI 420
Cap	Stainless Steel, AISI 416
Insulation Cover	Stainless Steel, AISI 304
Bolts	Steel, ASTM A193 GR B7
Gaskets (2)	Spiral Wound 304 Stainless Steel with Grafoil Filler

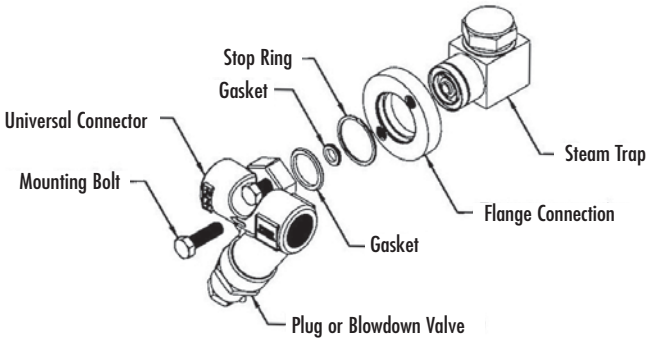
CAPACITIES – *Condensate (lbs/hr)*

	Differential Pressure (PSI)																
Model	4	10	15	20	25	30	40	50	75	100	150	200	250	300	400	450	600
UTD450LSM	140	215	242	270	295	320	355	390	455	510	600	670	730	790	880	925	
UTD450SM	247	370	420	475	520	560	625	685	800	900	1060	1185	1300	1400	1560	1630	
UTD600LSM											465	500	550	600	632	675	730

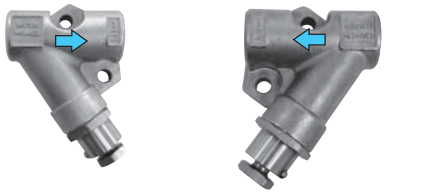
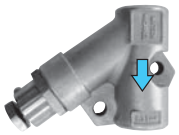
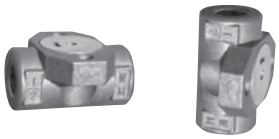
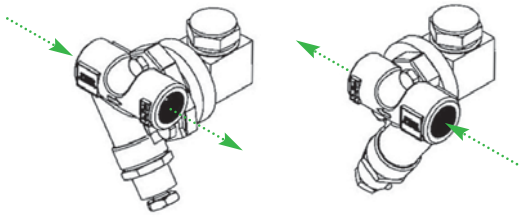
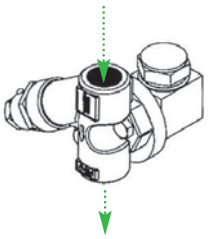
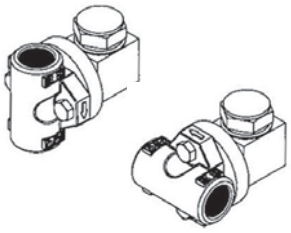
UTD450
UTD600

Universal Style
Quick-Change Trap Module

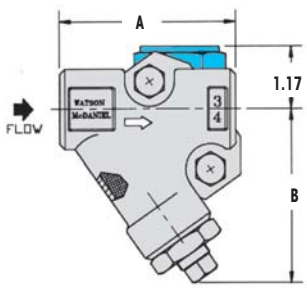
Thermodynamic Steam Trap Module (mounts to UC450 Universal Connectors)



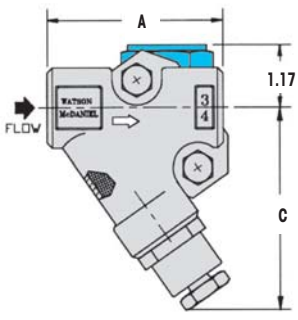
UTD450/UTD600 Trap Module should be oriented with cap facing Upwards, As shown.

Horizontal Piping (Connector with Strainer)	Vertical Piping (Connector with Strainer)	Vertical or Horizontal Piping (No Strainer)
Steam Flow to the Right or to the Left	**Steam Flow Downward**	**Steam Flow Vertically or Horizontally**
		
Trap shown with **UC450SBR** Connector / Trap shown with **UC450SBL** Connector	Trap shown with **UC450SBR** Connector	Trap shown with **UC450** Connector
		

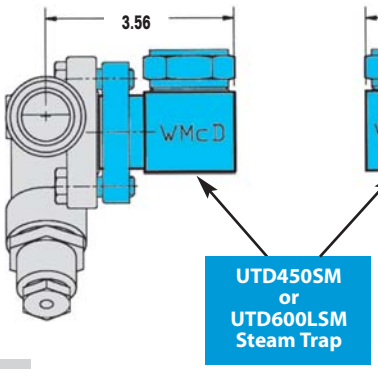
Connectors available in 1/2", 3/4" and 1" sizes in NPT and Socket-Weld Connections



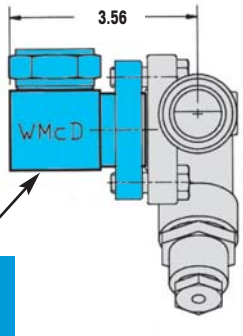
UC450SR
CONNECTOR
Strainer



UC450SBR
CONNECTOR
Strainer & Blowdown



UTD450SM or UTD600LSM Steam Trap



UC450SBL
CONNECTOR
Strainer & Blowdown

DIMENSIONS – *inches*

Size	A	B	C
1/2"	3.31	3.25	3.78
3/4"	3.31	3.25	3.78
1"	3.62	3.44	3.95

UTD450

Universal Style Quick-Change Trap Module

Thermodynamic Steam Trap Module (mounts to UC450 Universal Connectors)

Model *(Top Mount Style)*	**UTD450** **UTD450L**
Connections	**Fits UC450 Series Universal Connectors**
Body Material	**Stainless Steel**
PMO Max. Operating Pressure	**450 PSIG**
TMO Max. Operating Temperature	**750°F**
PMA Max. Allowable Pressure	**720 PSIG @ 100°F**
TMA Max. Allowable Temperature	**800°F @ 400 PSIG**

Steam trap modules can be used with other manufacturers' Universal Connectors.

UTD450
Thermodynamic Steam Trap Module
(Top Mount Style)
Recommended for horizontal piping installations only so that cap can be oriented upwards as shown.

Typical Applications

DRIP, TRACER: Designed to work as a drip trap for the draining of condensate from steam mains and other steam supply lines, the **UTD450** Thermodynamic Steam Trap Module can be used anywhere conventional thermodynamic steam traps are used. Can also be used on tracing applications. This model is only recommended for horizontal piping installations to allow the cap to be oriented upwards. The UTD450 mounts to any 2-bolt Quick-Change Universal Connector.

The UTD450 is recommended for horizontal piping only so that cap can be oriented upwards, as shown.

How It Works

The UC450 universal connector is permanently installed into the pipeline where the steam trap would normally be placed. The trap module, which functions like any thermodynamic steam trap, is fastened to the universal connector with two bolts. When a new trap module is needed, it can be easily removed and replaced with a standard open-end or socket wrench without disturbing the existing piping.

Features

- Trap module can be easily removed and replaced in minutes without having to disconnect any piping
- Trap modules can be used with most manufacturers' 2-bolt universal connector
- All stainless steel construction with hardened seat

Sample Specification

The steam trap module shall be designed to attach to the industry standard two-bolt universal connector. Trap module shall be of a thermodynamic design. Universal connector shall conform to the two bolt industry standard with integral strainer and blowdown options.

Installation and Maintenance

The UTD450 Trap module was intended for horizontal piping installations so the trap can be installed with cap facing upwards. Trap module is attached to the connector using two bolts. If the trap fails for any reason, replace only the trap module. When a new trap module is needed, it can be easily removed and replaced with a standard open-end or socket wrench without disturbing the existing piping.

Options

Universal Connectors are available with an integral strainer and blowdown valve. Connector is purchased separately. See the Universal Connectors section for more information.

Helpful Selection Information

Connector selection to use with the UTD450: UC450 (no strainer), UC450S (strainer), UC450SB (strainer and blowdown). Select this model for steam systems with maximum working pressure of 450 PSIG.

MATERIALS

Body	Stainless Steel, AISI 420
Disc	Stainless Steel, AISI 420
Cap	Stainless Steel, AISI 416
Insulation Cover	Stainless Steel, AISI 304
Bolts	Steel, ASTM A193 GR B7
Gaskets (2)	Spiral Wound 304 Stainless Steel with Grafoil Filler

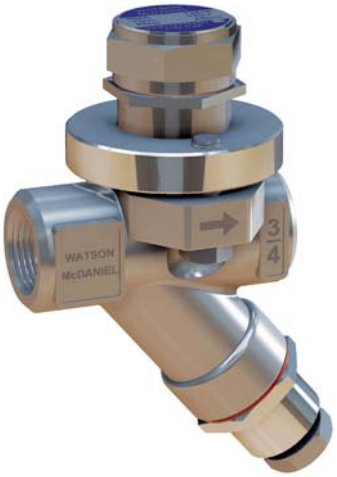
CAPACITIES – *Condensate (lbs/hr)*

	Differential Pressure (PSI)																
Model	**4**	**10**	**15**	**20**	**25**	**30**	**40**	**50**	**75**	**100**	**150**	**200**	**250**	**300**	**350**	**400**	**450**
UTD450L	140	215	242	270	295	320	355	390	455	510	600	670	730	790	840	880	925
UTD450	247	370	420	475	520	560	625	685	800	900	1060	1185	1300	1400	1485	1560	1630

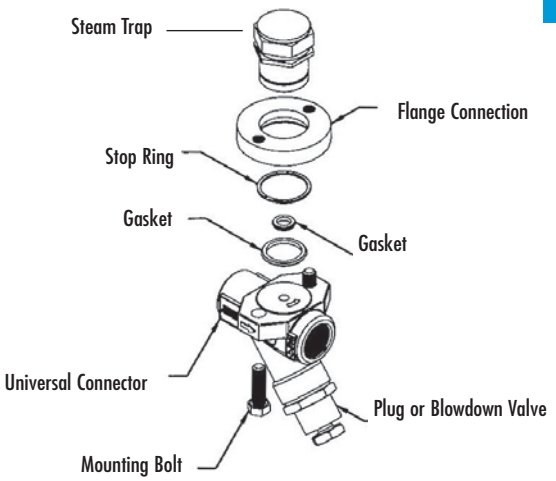
UTD450

Universal Style Quick-Change Trap Module

Thermodynamic Steam Trap Module (mounts to UC450 Universal Connectors)



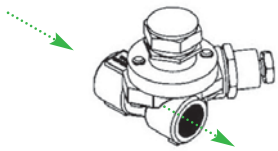
UTD450 Trap Module should be oriented with cap facing Upwards. Therefore it should only be used with Horizontal Piping, as shown.



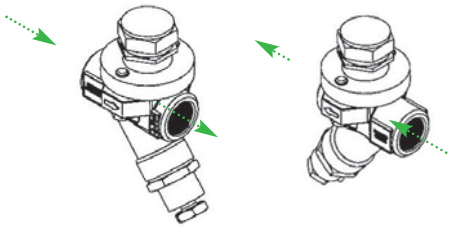
Horizontal Piping (Connector with Strainer)	Horizontal Piping (No Strainer)

Steam Flow to the Right or to the Left
UC450SBR & UC450SB Connector (with Blowdown Valve) shown below

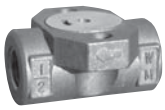
Trap shown with **UC450SBR** Connector
Strainer & Blowdown Valve is directed to the side



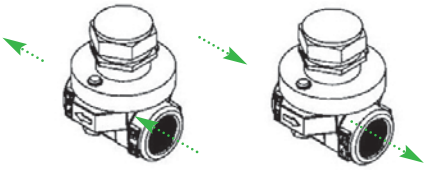
Trap shown with **UC450SB** Connector
Strainer & Blowdown Valve is directed downwards



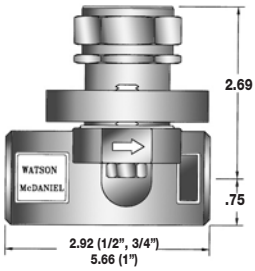
Steam Flow Horizontally
UC450 Connector shown below



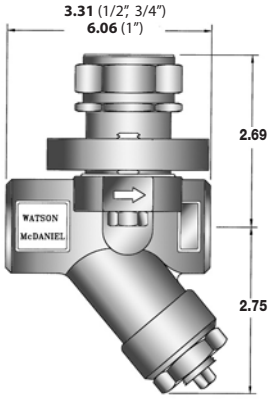
Trap shown with **UC450** Connector



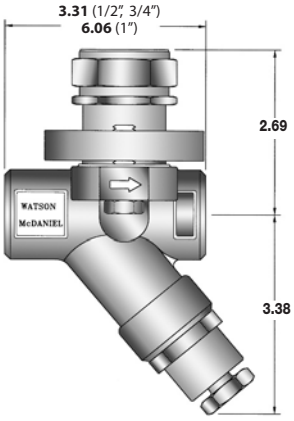
Connectors available in 1/2", 3/4" and 1" sizes in NPT and Socket-Weld Connections



UTD450 Trap Module
with **UC450** Connector



UTD450 Trap Module
with **UC450S** Connector
(Strainer)



UTD450 Trap Module with
UC450SB Connector
(Strainer & Blowdown)

UT450

Universal Style
Quick-Change Trap Module

Thermostatic Steam Trap Module (mounts to UC450 Universal Connectors)

Model	**UT450**
Connections	**Fits UC450 Series Universal Connectors**
Body Material	**Stainless Steel**
PMO Max. Operating Pressure	**450 PSIG**
TMO Max. Operating Temperature	**Saturated Steam Temp.**
PMA Max. Allowable Pressure	**720 PSIG @ 100°F**
TMA Max. Allowable Temperature	**800°F @ 400 PSIG**

Steam trap modules can be used with other manufacturers' Universal Connectors.

UT450
Thermostatic Steam Trap Module

Typical Applications

DRIP, TRACER, PROCESS: The **UT450** Thermostatic Steam Trap Module can be used anywhere conventional thermostatic steam traps are used. Used for drip, tracing and light process applications. Trap module mounts to any 2-bolt Quick-Change Universal Connector.

How It Works

The UC450 universal connector is permanently installed into the pipeline where the steam trap would normally be placed. The trap module is fastened to the universal connector with two bolts. When a new trap module is needed, it can be easily removed and replaced with a standard open-end or socket wrench without disturbing the existing piping.

Features

- Trap module can be easily removed and replaced in minutes without having to disconnect any piping
- Trap modules can be used with most manufacturers' 2-bolt universal connector
- All stainless steel construction with hardened seat

Sample Specification

The steam trap module shall be designed to attach to the industry standard two-bolt universal connector. Trap module shall be of a thermostatic design. The universal connector shall conform to the two-bolt industry standard with integral strainer and blowdown options.

Installation and Maintenance

Mounts to any two-bolt quick change universal connector. Trap module is attached to the connector using two bolts and two sealing gaskets. When a new trap module is needed, it can be easily removed and replaced with a standard open-end or socket wrench without unthreading the existing piping. In vertical piping installations with upward flow, use of a blowdown valve is not recommended. Discharge would be in upward and unsafe direction.

Options

Universal Connectors are available with an integral strainer and blowdown valve. Connector is purchased separately. See the Universal Connectors section for more information.

Helpful Selection Information
Connector selection to use with the UT450: UC450 (no strainer), UC450SR (strainer), UC450SBR (strainer and blowdown). Select this model for steam systems with maximum working pressure of 450 PSIG.

MATERIALS

Body	Stainless Steel, AISI 420
Thermal Element	Stainless Steel, AISI 302
Disc & Seat	Stainless Steel, AISI 420
Insulation Cover	Stainless Steel, AISI 304
Bolts	Steel, ASTM A193 GR B7
Gaskets (2)	Spiral Wound 304 Stainless Steel with Grafoil Filler

CAPACITIES — *Condensate (lbs/hr)*

Model	Orifice Size	Steam Inlet Pressure (PSIG) 5	10	20	50	100	125	150	200	250	300	350	400	450
UT450	3/16"	441	625	882	1391	1827	1969	2095	2305	2483	2636	2777	2903	3019

Note: *5/64" low capacity orifice is available upon request.*

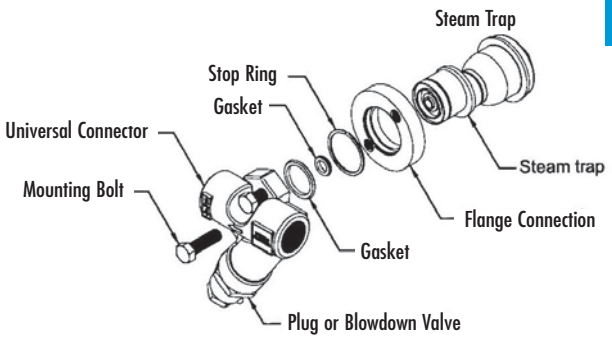
UT450

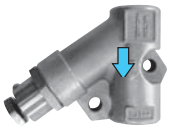
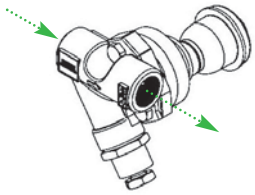
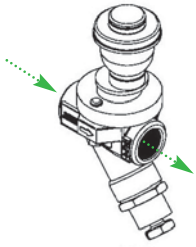
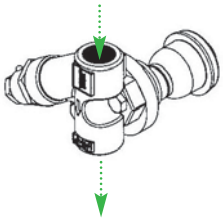
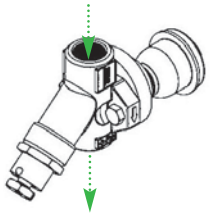
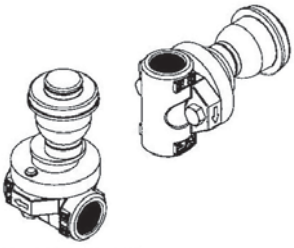
Universal Style Quick-Change Trap Module

Thermostatic Steam Trap Module (mounts to UC450 Universal Connectors)

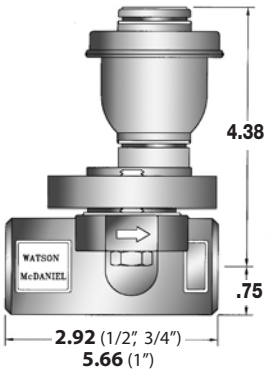
UT450 Thermostatic Steam Trap Module shown with **UC450SL** Connectors

UT450 Trap Module may be mounted in any orientation

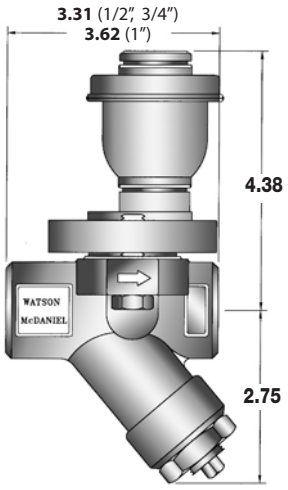


Horizontal Piping (Connector with Strainer)		Vertical Piping (Connector with Strainer)		Vertical or Horizontal Piping (No Strainer)
Steam Flow to the Right or to the Left UC450SBR & UC450SB Connector shown below		**Steam Flow Downward** UC450SBR & UC450SB Connector shown below		**Steam Flow Vertically or Horizontally** UC450 Connector shown below
				 
Trap shown with **UC450SBR** Connector	Trap shown with **UC450SB** Connector	Trap shown with **UC450SBR** Connector	Trap shown with **UC450SB** Connector	Trap shown with **UC450** Connector
				

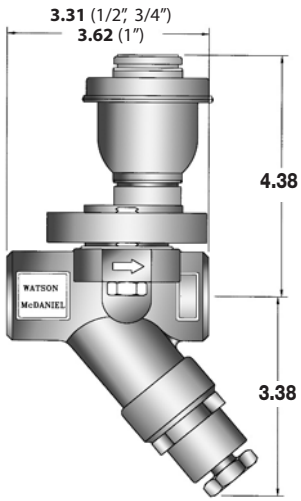
Connectors available in 1/2", 3/4" and 1" sizes in NPT and Socket-Weld Connections



UT450 Trap Module with **UC450** Connector



UT450 Trap Module with **UC450S** Connector (Strainer)



UT450 Trap Module with **UC450SB** Connector (Strainer & Blowdown)

UB450

Universal Style
Quick-Change Trap Module

Bi-Metallic Steam Trap Module (mounts to UC450 Universal Connectors)

Model	**UB450**
Connections	**Fits UC450 Series Universal Connectors**
Body Material	**Stainless Steel**
PMO Max. Operating Pressure	**450 PSIG**
TMO Max. Operating Temperature	**662˚F**
PMA Max. Allowable Pressure	**720 PSIG @ 100˚F**
TMA Max. Allowable Temperature	**800ºF @ 400 PSIG**

Steam trap modules can be used with other manufacturers' Universal Connectors.

UB450 Bi-Metallic Steam Trap Module

Field-adjustable discharge temperature

UB450 Bi-Metallic Steam Trap Module shown with **UC450SBL** connector

Typical Applications

The **UB450** Series Bi-Metallic Steam Trap Modules are used in steam tracing applications (for process line heating, instrumentation and winterization, general steam jacketing). In tracing applications, the externally-adjustable (temperature adjustment) bi-metal element provides accurate control of condensate discharge temperature as required to maintain a specific product temperature as well provide maximum usage of energy.

How It Works

Bi-metallic plates of dissimilar metals which are connected to the valve seat assembly respond to temperature variations. At relatively cool conditions, the trap is open for the discharge of condensate. When the temperature of the condensate is equal to or higher than the set temperature, the metals react and expand, closing the trap. External field-adjustability of the bi-metal element allows control of the condensate discharge temperature. Trap module is fastened to the universal connector using 2 bolts.

Features

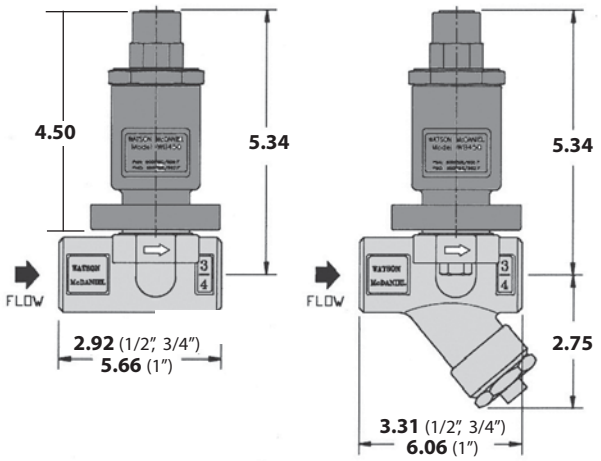
- Excellent for various steam tracing and small process applications where maximum energy usage is desired
- Field-adjustable bimetal element allows control of ondensate discharge temperature, providing maximum use of additional energy in the condensate
- Internal screen and seat/plug design help prevent pipe scale and debris from accumulating on seating surfaces to provide trouble-free operation

Installation and Maintenance

Universal connector is first permanently threaded or welded into piping system. Trap module is attached to the universal connector using two bolts. If the trap fails for any reason, replace only the trap module. In vertical piping installations with upward flow, use of a blowdown valve is not recommended. Discharge would be in upward and unsafe direction.

MATERIALS

Body and Cover	Stainless Steel, A-351, Gr. CF8
Bimetal Element	GB14
Valve Seat	17-4 Ph Stainless Steel
Gaskets (2)	Spiral Wound 304 Stainless Steel with Grafoil Filler



Shown with UC450 & UC450S Connectors

Maximum Trap Capacities at Various Inlet Pressures and Set Temperatures – *Condensate (lbs/hr)*

Set Temperature	Steam Inlet Pressure (PSIG) 15	30	50	100	125	150	200	250	300	350	400	450
220˚F	56	70	102	144	161	177	204	228	250	270	289	306
240˚F	116	164	212	300	336	368	425	475	520	562	600	637
260˚F	134	190	245	346	387	424	490	548	600	648	693	735
280˚F	143	202	261	370	413	453	523	584	640	691	739	784

Notes: *1) Capacities in chart are based on discharging condensate to atmosphere with a condensate temperature of 200˚ F.*
2) Contact factory for additional information including other condensate set and discharge temperatures.
3) To ensure proper operation and eliminate possible steam loss, the Set Temperature should be lower than 27 ˚F subcool (degrees below inlet steam saturation temperature).

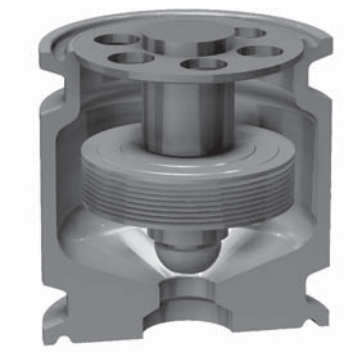
Introduction

What is Clean Steam or Pure Steam?

Clean Steam is steam that is made from deionized or distilled water in specialty boilers or steam generators. It is typically used in pharmaceutical applications such as sterilizers, fermenters and bioreactors as well as in the food production industries, distilleries and hospitals. Clean Steam should be used on any process that utilizes steam in such a way that it may come into direct contact with the end product and cause contamination. Industrial grade steam (most common grade of steam) is unsuitable for direct product contact because it contains contaminants from boiler additives, rust, and other heat transfer equipment. Pure Steam is clean steam that is produced to be virtually free of pyrogens and endotoxins, and is defined as "Water For Injection" or WFI.

Materials of construction

The Ultra-Pure water that is used to make clean steam has been depleted of all of its ions during the purification process, making it very chemically aggressive to metals, or "ion hungry." Therefore, only corrosion resistant metals such as 316 Stainless Steel can be used in products that handle clean steam. It's often required that the Stainless Steel in contact with Clean Steam must be passivated, a chemical process that removes any residual surface iron and promotes Chrome Oxide formation, further improving corrosion resistance.



Surface Finish

Smoothing the surfaces by means of polishing reduces the ridges and crevices where micro-organisms (bacteria) may grow. While mechanical polishing will reduce the surface ridges significantly, electro-polishing is required to meet the standards of sanitary systems. Electro-polishing is an electro-chemical process that smoothes the surface of a metal object by removing surface metal ion by ion. Ra is measured in microinches and refers to the smoothness of a surface. The lower the Ra number, the smoother the surface and the less chance for surface contamination and microorganism growth.

FDA300

FDA400

FDA500

FDA600

FDA800

Clean Steam

62-65

Model	Body Material	PMO (PSIG)	Sizes	Connections	Page No.
FDA300	Stainless Steel	**90**	1 1/2"	Tri-Clamp	**113**
FDA400	Stainless Steel	**90**	1/2", 3/4"	Tri-Clamp	**114**
FDA500	Stainless Steel	**90**	1/2", 3/4", 1"	Tri-Clamp, NPT, TW	**116**
FDA600	Stainless Steel	**110**	1/2", 3/4", 1"	Tri-Clamp, NPT, TW	**118**
FDA800	Stainless Steel	**150**	1/2"	Tri-Clamp, NPT, TW	**119**

Sanitary Steam Traps Vs. Clean Steam Traps

Steam traps to be installed in sanitary piping systems must adhere to stringent design standards beyond traps merely suitable for clean steam applications.

Sanitary Steam Traps are designed to offer free flow through internal passages by incorporating very smooth internal finishes. The internal electro-polish finish on a sanitary steam trap must be between 20-25 Ra while the external finish is usually between 25-32 Ra. Because the system must be periodically passivated to provide sterilization, these traps offer a sanitary tri-clamp connection on the body to allow for removal of the thermal element. Removal of the element allows unobstructed flow through the trap during passivation. The FDA300, FDA400 & FDA500 are Sanitary Steam Traps.

Clean Steam Traps are steam traps designed for the same functionality as the sanitary traps, but do not offer the same level of surface finish, RA. Therefore clean steam traps cannot be used when a sanitary specified application is required.

Clean-in-place (CIP) & Sterilization-in-place (SIP)

CIP is a system which allows the automatic cleaning and disinfecting of plant equipment without dismantling, using cleaning fluids such as detergents, acids, alkalis, and water. CIP uses a high flow, highly turbulent solution to remove soil in the system. Chemicals are used to break up and remove the remaining soil. Sanitizer is then used to kill remaining microorganisms.

SIP is the process of sterilizing plant equipment without dismantling, usually following CIP procedures. SIP uses low pressure steam for sterilization purposes – typically 30 – 35 psig. The steam trap bodies must be passivated to remove any residual iron deposits as well as to promote a chrome oxide layer to enhance corrosion resistance of the stainless steel.

Connections

Because different facilities may identify different areas of potential contamination in a piping system, various end connections are available to satisfy customer needs.

Sanitary Tri-Clamp - A quick disconnect type fitting that meets sanitary piping standards allowing piping systems or products to be easily dismantled.

Tube Weld (TW) – a connection offered where welding of the steam trap is preferred for sanitary applications

NPT – a standard national pipe thread taper connection offered for applications with less stringent requirements, often considered on main line drip applications

Manufacturing and Design Standards

ASME BPE – Provides requirements of equipment used in bioprocessing, pharmaceutical and other applications that require high hygienic levels.

USP 24 – Standard for Pharmaceutical Grade Water which specifies the chemical composition of the allowable number of contaminants.

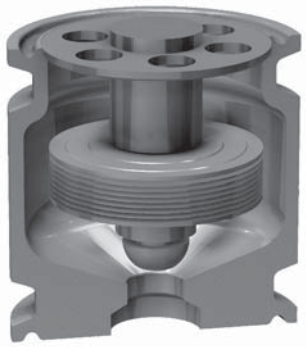
FDA CFR Title 21-177.1550 – Standard for perfluoro-carbon resins that may be safely used as components intended to contact food.

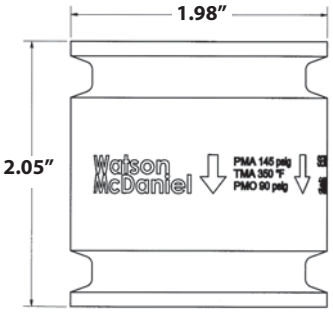
3A Sanitary Standards – Standards provide material specifications, design criteria and other necessary information for equipment types to satisfy public health concerns where a high degree of sanitation is required.

Clean Steam Thermostatic Steam Trap (Repairable)

High-Capacity Sanitary

Model	**FDA300**
Sizes	1 1/2"
Connections	Tri-Clamp
Body Material	Stainless Steel
PMO Max. Operating Pressure	**90 PSIG**
TMO Max. Operating Temperature	Saturated Steam Temperature
PMA Max. Allowable Pressure	145 PSIG up to 338°F
TMA Max. Allowable Temperature	350°F @ 132 PSIG





Typical Applications

PROCESS: **FDA300 Series** high-capacity thermostatic clean steams traps are used on clean steam applications, and for condensate drainage on CIP/SIP systems and various process vessels.

How It Works

This trap contains a welded 316L stainless steel thermal element that expands when heated and contracts when cooled. When air and subcooled condensate are present, the trap is in an open discharge position. When steam reaches the trap, the element expands, closing the trap tightly.

Features

- All wetted parts are 316L stainless steel
- Electro-polish finish of 20-25 microinches RA on internal surfaces of body
- Electro-polish finish of 25-32 microinches RA on external surfaces of body
- Operates close to saturation curve to minimize condensate back-up
- Completely self-draining in the vertical downward flow orientation

Sample Specification

The steam Trap shall be all 316L stainless steel thermostatic type with a balanced pressure bellows that operates close to saturated steam temperatures. Internal body parts shall have an electro-polish finish of 20-25 microinches RA internally and a 25-32 finish externally. The unit shall have a split-body sanitary clamp design for easy maintenance. Trap shall be completely self-draining when mounted vertically.

Installation and Maintenance

This trap is designed for installation in a vertical, downward flow orientation to ensure that the self-draining clean steam requirement is satisfied.

Size/Connection Inlet x Outlet	Model Code	Orifice Size	Weight lbs
1 1/2" TC x TC	**FDA300-16-TCTC**	0.394	2.25

MATERIALS	
Body	Stainless Steel, AISI 316L
Element Plate	Stainless Steel, AISI 316L
Thermal Element	Stainless Steel, AISI 316L
Clamp	Stainless Steel, AISI 304

CAPACITIES – *Condensate (lbs/hr)*

Model	Orifice (inches)	Differential Pressure (PSI) 5	10	20	50	75	90
FDA300	0.394	216	368	702	2214	4300	5904

Note: Capacities at 9°F below saturated steam temperature

Steam Traps

Clean Steam Thermostatic Steam Trap

(Repairable)

FDA400

Thermostatic Clean Steam

Model	**FDA401, FDA402, FDA403**
Sizes	**1/2", 3/4"**
Connections	**Tri-clamp**
Body Material	**Stainless Steel**
PMO Max. Operating Pressure	**90 PSIG**
TMO Max. Operating Temperature	**Saturated Steam Temperature**
PMA Max. Allowable Pressure	**145 PSIG up to 338°F**
TMA Max. Allowable Temperature	**350°F @ 132 PSIG**

Sanitary Clamp for Trap Body

Typical Applications

DRIP, PROCESS: **FDA400 Series** thermostatic clean steam traps are used in clean steam applications such as drainage for CIP/SIP systems and various process vessels. The universal horizontal connection allows the trap body to swivel to any angle. The FDA400 Series allows for a 90 degree connection on either the inlet or outlet capable of 360 degree orientation. Available with 2˚F sub-cool bellows.

How It Works

This trap contains a welded 316L stainless steel thermal element that expands when heated and contracts when cooled. When air and sub-cooled condensate are present, the trap is in an open discharge position. When steam reaches the trap, the element expands, closing the trap tightly.

Features

- Universal horizontal connection swivels to any angle
- All wetted parts are 316L stainless steel
- Electro-polish finish of 20-25 microinches RA on internal surfaces of body
- Electro-polish finish of 25-32 microinches RA on external surfaces of body
- Operates close to saturation curve to minimize condensate back-up
- Completely self-draining in the vertical downward flow orientation

Sample Specification

The Steam Trap shall be all 316L stainless steel thermostatic type with a balanced pressure bellows that operates close to saturated steam temperatures. Inlet, outlet or both connections must contain a 90˚ swivel arrangement capable of 360˚ orientation. Internal body parts shall have an electro-polish finish of 20-25 microinches RA internally and a 25-32 finish externally. The unit shall have a split-body sanitary clamp design for easy maintenance. Trap shall be completely self-draining when mounted vertically.

Installation and Maintenance

Trap is designed for installation in a vertical, downward flow orientation to ensure that the self-draining clean steam requirement is satisfied.

Size/Connection Inlet x Outlet	Model Code	Port Configuration Inlet	Outlet	Weight lbs
9/64" Orifice (0.141)				
1/2" TC x TC	**FDA401-12-TCTC**	90˚	90˚	3
1/2" TC x TC	**FDA402-12-TCTC**	90˚	Straight	3
1/2" TC x TC	**FDA403-12-TCTC**	Straight	90˚	3
5/16" Orifice (0.312)				
3/4" TC x TC	**FDA411-13-TCTC**	90˚	90˚	3
3/4" TC x TC	**FDA412-13-TCTC**	90˚	Straight	3
3/4" TC x TC	**FDA413-13-TCTC**	Straight	90˚	3

MATERIALS	
Body	Stainless Steel, AISI 316L
Gasket	Teflon/Encapsulated Viton
Element Plate	Stainless Steel, AISI 316L
Thermal Element	Stainless Steel, AISI 316L
Clamp	Stainless Steel, AISI 304

CAPACITIES – *Condensate (lbs/hr)*

Model	Orifice (inches)	Differential Pressure (PSI) 5	10	20	50	75	90
FDA400	9/64	140	240	400	690	850	950
FDA410	5/16	850	1200	1695	2690	3165	3400

Note: Capacities at 10˚F below saturation.

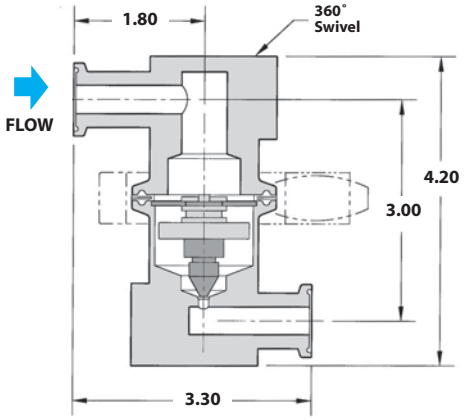
Clean Steam Thermostatic Steam Trap

(Repairable)

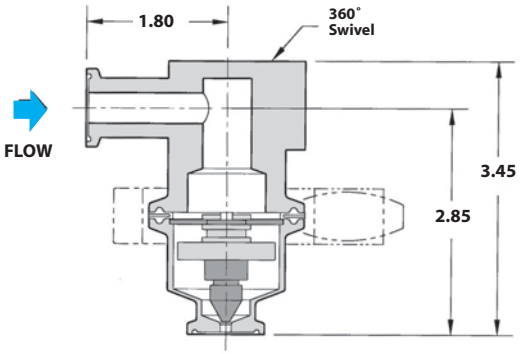
FDA400 Series **Connections: 1/2" & 3/4"**

Units: inches

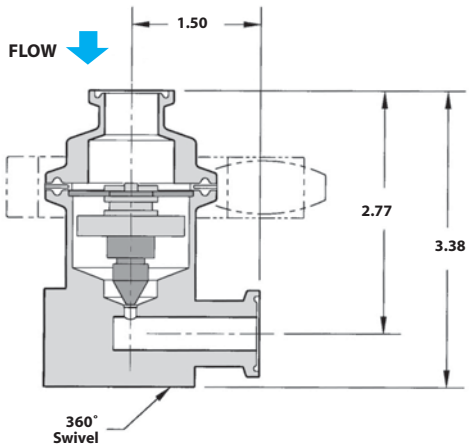
FDA401 9/64" Orifice (0.141) **Inlet: 90° Angle**
FDA411 5/16" Orifice (0.312) **Outlet: 90° Angle**



FDA402 9/64" Orifice (0.141) **Inlet: 90° Angle**
FDA412 5/16" Orifice (0.312) **Outlet: Straight**



FDA403 9/64" Orifice (0.141) **Inlet: Straight**
FDA413 5/16" Orifice (0.312) **Outlet: 90° Angle**



Steam Traps

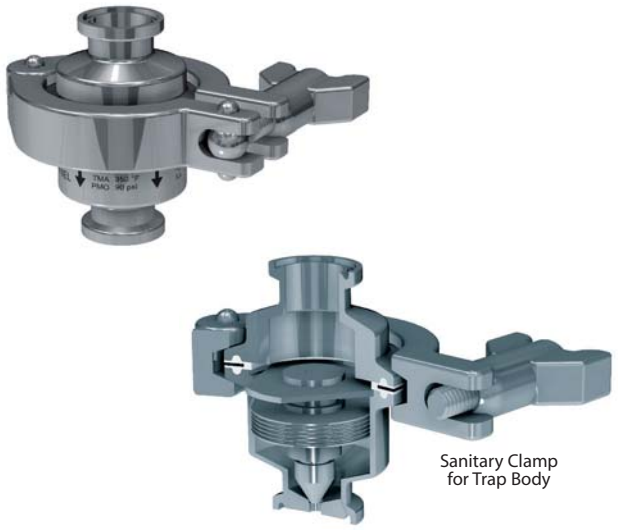
Clean Steam Thermostatic Steam Trap

(Repairable)

FDA500

Thermostatic Clean Steam

Model	**FDA500, FDA510**
Sizes	**1/2", 3/4", 1", 1 1/2"**
Connections	**Tri-clamp, NPT, Tube Weld**
Body Material	**Stainless Steel**
PMO Max. Operating Pressure	**90 PSIG**
TMO Max. Operating Temperature	**Saturated Steam Temperature**
PMA Max. Allowable Pressure	**145 PSIG up to 338°F**
TMA Max. Allowable Temperature	**350°F @ 132 PSIG**



Sanitary Clamp for Trap Body

Typical Applications

DRIP, PROCESS: **FDA500 Series** thermostatic clean steam traps are used in clean steam applications as drip traps on piping runs as well as for drainage for CIP/SIP systems and various process vessels. Available with 2°F sub-cool bellows.

How It Works

This trap contains a welded 316L stainless steel thermal element that expands when heated and contracts when cooled. When air and sub-cooled condensate are present, the trap is in an open discharge position. When steam reaches the trap, the element expands, closing the trap tightly.

Features

- All wetted parts are 316L stainless steel
- Electro-polish finish of 20-25 microinches RA on **internal** surfaces of body. Consult factory for 15RA max surface finish option.
- Electro-polish finish of 25-32 microinches RA on **external** surfaces of body
- Operates close to saturation curve to minimize condensate back-up
- Completely self-draining in the vertical downward flow orientation

Sample Specification

The steam Trap shall be all 316L stainless steel thermostatic type with a balanced pressure bellows that operates close to saturated steam temperatures. Internal body parts shall have an electro-polish finish of 20-25 microinches RA internally and a 25-32 finish externally. The unit shall have a split-body sanitary clamp design for easy maintenance. Trap shall be completely self-draining when mounted vertically.

Installation and Maintenance

This trap is designed for installation in a vertical, downward flow orientation to ensure that the self-draining clean steam requirement is satisfied. If purchased with tube weld connections with the intention of welding in-line, the thermal element and gasket must be removed during the welding process or heat damage may occur.

Size/Connection Inlet x Outlet	Model Code	Orifice Size	Weight lbs
1/2" TC x TC	**FDA500-12-TCTC**	9/64"	2.00
3/4" TC x TC	**FDA500-13-TCTC**	9/64"	2.00
1" TC x TC	**FDA500-14-TCTC**	9/64"	2.25
1 1/2" TC x TC	**FDA500-16-TCTC**	9/64"	2.25
1/2" TC x TC	**FDA510-12-TCTC**	5/16"	2.00
3/4" TC x TC	**FDA510-13-TCTC**	5/16"	2.00
1" TC x TC	**FDA510-14-TCTC**	5/16"	2.25
1 1/2" TC x TC	**FDA510-16-TCTC**	5/16"	2.25
1/2" TC x NPT	**FDA500-12-TCNP**	9/64"	2.00
3/4" TC x NPT	**FDA500-13-TCNP**	9/64"	2.00
1" TC x NPT	**FDA500-14-TCNP**	9/64"	3.00
1 1/2" TC x NPT	**FDA500-16-TCNP**	9/64"	2.25
1/2" TC x NPT	**FDA510-12-TCNP**	5/16"	2.25
3/4" TC x NPT	**FDA510-13-TCNP**	5/16"	2.25
1" TC x NPT	**FDA510-14-TCNP**	5/16"	2.25
1 1/2" TC x NPT	**FDA510-16-TCNP**	5/16"	2.25
1/2" TW x TW	**FDA500-12-TWTW**	9/64"	2.25
1/2" TW x TW	**FDA510-12-TWTW**	5/16"	2.25

MATERIALS

Body	Stainless Steel, AISI 316L
Gasket	Teflon/Encapsulated Viton
Element Plate	Stainless Steel, AISI 316L
Thermal Element	Stainless Steel, AISI 316L
Clamp	Stainless Steel, AISI 304

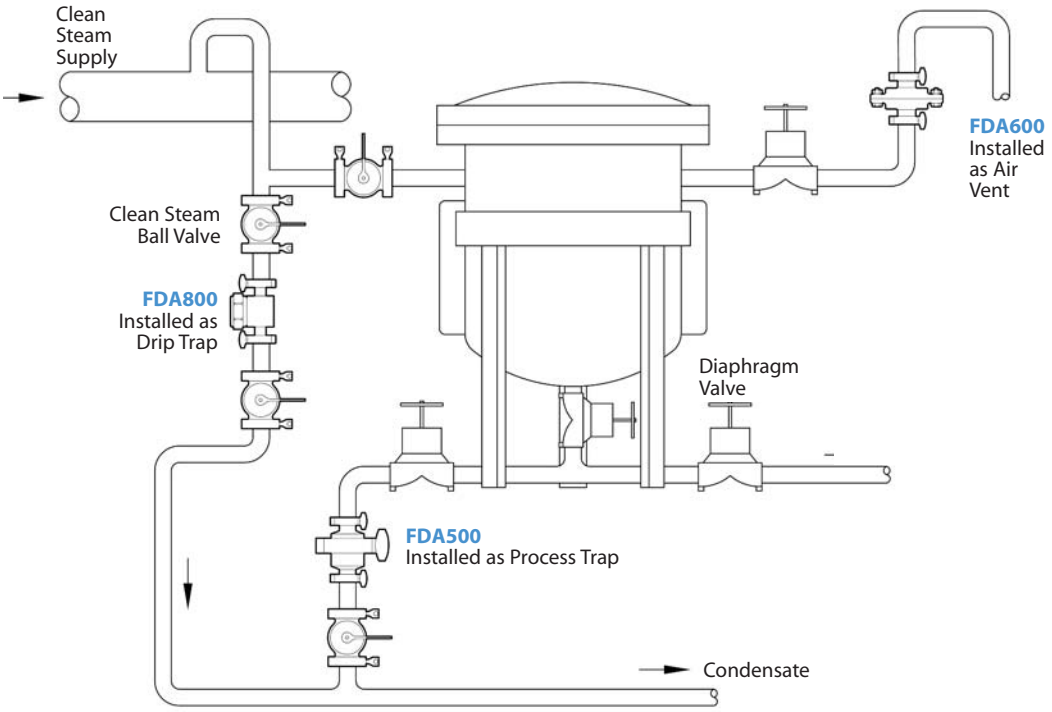
CAPACITIES – *Condensate (lbs/hr)*

Model	Orifice (inches)	Differential Pressure (PSI) 5	10	20	50	75	90
FDA500	**9/64**	140	240	400	690	850	950
FDA510	**5/16**	850	1200	1695	2690	3165	3400

Note: Capacities at 10°F below saturation.

Clean Steam Thermostatic Steam Trap
(Repairable)

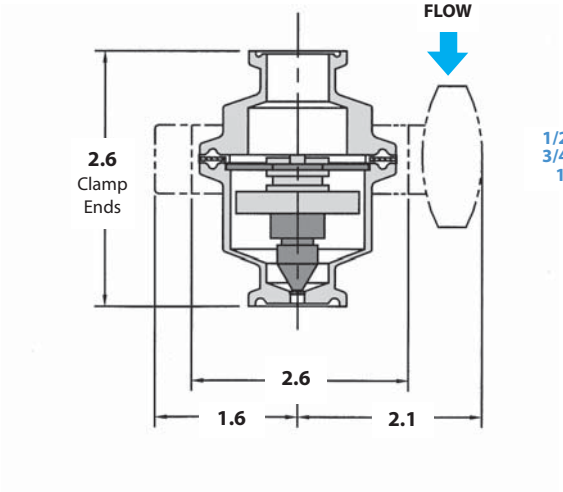
Typical Clean Steam Application



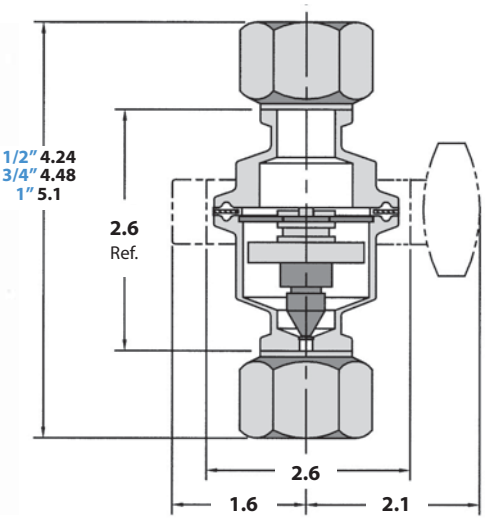
FDA500 Series **Connections: 1/2", 3/4" & 1"**

Units: inches

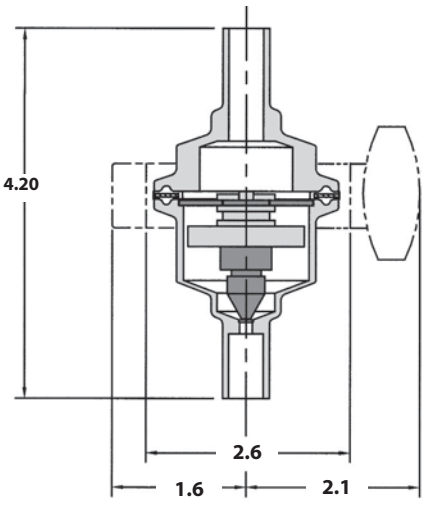
Tri-Clamp Connection: TC x TC



Connection: NP x NP or TC x NP



Tube-weld Connection: TW x TW



Steam Traps

Clean Steam Thermostatic Steam Trap

(Repairable)

FDA600

Thermostatic Clean Steam

Model	**FDA600**
Sizes	**1/2", 3/4", 1"**
Connections	**Tri-clamp, NPT, Tube Weld**
Body Material	**Stainless Steel**
PMO Max. Operating Pressure	**110 PSIG**
TMO Max. Operating Temperature	**Saturated Steam Temperature**
PMA Max. Allowable Pressure	**145 PSIG up to 338°F**
TMA Max. Allowable Temperature	**350°F @ 132 PSIG**

Typical Applications

DRIP, PROCESS: FDA600 Series thermostatic clean steam traps are used as drip traps on piping runs on clean steam applications and for drainage for CIP/SIP systems and various process vessels.

How It Works

This trap contains a welded 316L stainless steel thermal element that expands when heated and contracts when cooled. When air and subcooled condensate are present, the trap is in an open discharge position. When steam reaches the trap, the element expands, closing the trap tightly.

Features

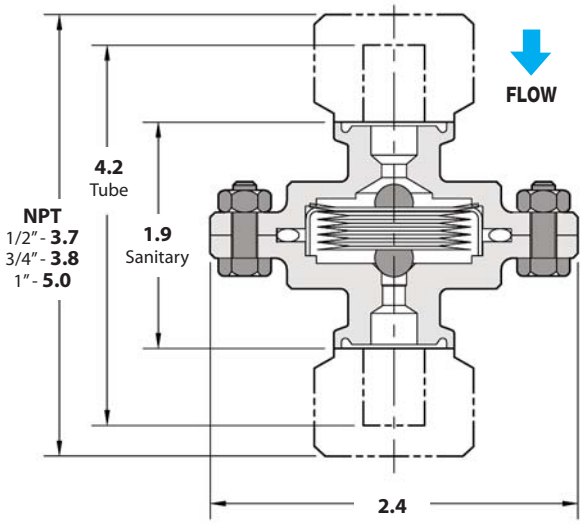
- All wetted parts are 316L stainless steel
- Operates close to saturation curve to minimize condensate back-up
- Completely self-draining in the vertical downward flow orientation

Sample Specification

The Steam Trap shall be all 316L stainless steel thermostatic type with a balanced pressure bellows that operates close to saturated steam temperatures. The unit shall have a split-body design for easy maintenance. Trap shall be completely self-draining when mounted vertically.

Installation and Maintenance

Trap is designed to be installed in a vertical, downward flow orientation to ensure that the self-draining clean steam requirement is satisfied. If purchased with tube weld connections with the intention of welding in-line, the thermal element and gasket must be removed during the welding process or heat damage may occur.



Units: Inches

Size/Connection Inlet x Outlet	Model Code	PMO PSI	Weight lbs
1/2" TC x TC	**FDA600-12-TCTC**	110	1.25
3/4" TC x TC	**FDA600-13-TCTC**	110	1.25
1" TC x TC	**FDA600-14-TCTC**	110	1.25
1/2" TC x NPT	**FDA600-12-TCNP**	110	1.25
3/4" TC x NPT	**FDA600-13-TCNP**	110	1.25
1" TC x NPT	**FDA600-14-TCNP**	110	1.25
1/2" NPT x NPT	**FDA600-12-NPNP**	110	1.25
3/4" NPT x NPT	**FDA600-13-NPNP**	110	1.25
1" NPT x NPT	**FDA600-14-NPNP**	110	1.25
1/2" TW X TW	**FDA600-12-TWTW**	110	1.25

MATERIALS	
Body	Stainless Steel, AISI 316L
Thermal Element	Stainless Steel, AISI 316L
O-Ring, FDA Grade	Teflon Coated Silicone/FEP
Nuts & Bolts	Stainless Steel, AISI 316L

CAPACITIES – *Condensate (lbs/hr)*

Condensate Temp Below Saturation	Differential Pressure (PSI) 1	5	10	20	50	75	110
10 °F	32	105	175	290	615	805	1160
20 °F	42	115	225	440	1060	1500	1850
Cold Water	735	1070	1375	1900	3100	3500	4600

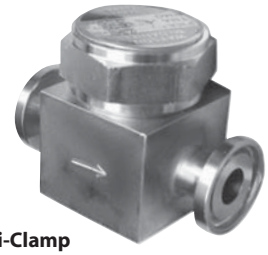
Clean Steam Thermodynamic Steam Trap

FDA800

Thermodynamic Clean Steam

Model	**FDA800**
Sizes	**1/2"**
Connections	**Tri-Clamp, NPT, Tube Weld**
Body Material	**Stainless Steel**
PMO Max. Operating Pressure	**150 PSIG**
TMO Max. Operating Temperature	**500°F**
PMA Max. Allowable Pressure	**230 PSIG @ 850°F**
TMA Max. Allowable Temperature	**850°F @ 230 PSIG**

NPT



Tri-Clamp

Typical Applications

DRIP: The **FDA800 Series** thermodynamic clean steam traps are used as drip traps on steam mains in CIP/SIP systems and drainage for separators and filters.

How It Works

Using the thermodynamic properties of flash steam, this trap features a disc that is pushed open by incoming condensate, then closes tightly when steam enters the trap. Because it normally operates in an open position, condensate is continuously discharged from the line. Steam entering the trap creates an internal pressure that forces the valve to close tightly, preventing the steam from escaping.

Features

- Small and compact
- All 316L stainless steel components
- Works in any position (horizontal preferred)

Sample Specification

The steam trap shall be a thermodynamic disc type with an all 316L stainless steel construction and integral seat design. Unit shall be capable of installation in any orientation and self-draining when mounted vertically.

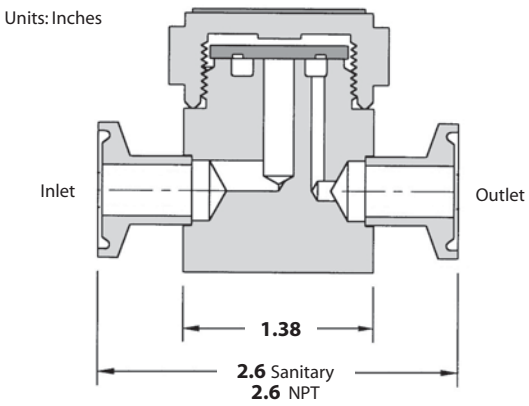
Installation and Maintenance

Can be installed in any position; however, horizontal is preferred. For self-draining requirements, the trap should be installed vertically. Installation should include a strainer before the trap inlet since dirt is a common cause of premature failure.

MATERIALS

Body	Stainless Steel, AISI 316L
Disc	Stainless Steel, AISI 316L
Cap	Stainless Steel, AISI 316L

Size/Connection **Inlet x Outlet**	Model **Code**	PMO **PSI**	Weight **lbs**
1/2" TC x TC	**FDA800-12-TCTC**	150	1.5
1/2" TW x TW	**FDA800-12-TWTW**	150	1.5
1/2" NPT x NPT	**FDA800-12-NPNP**	150	1.5



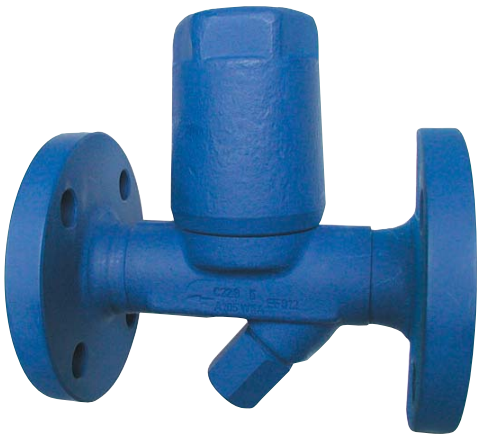
CAPACITIES — *Condensate (lbs/hr)*

	Differential Pressure (PSI)											
Size	**3.5**	**5**	**10**	**15**	**20**	**25**	**30**	**40**	**50**	**75**	**100**	**150**
1/2"	180	185	190	195	200	215	220	230	250	310	375	500

Note: *Maximum back pressure not to exceed 80% of inlet pressure.*

Steam Traps
Bi-Metallic Steam Trap

WPN Series
Bi-Metallic



Bi-Metallic Steam Traps

The **WPN Series Bi-Metallic Steam Traps** are used in steam tracing, steam main drips and non-critical process equipment. They can be used on outdoor applications that are subject to freezing. The WPN Series Traps are available in multiple sizes and pressures up to 2260 PSI.

Model	Body Material	PMO (PSIG)	Sizes	Connections	Pressure Controller	Max Diff. Pressure (PSI)
WPN-40	A105 Carbon Steel	**470**	1/2" – 2"	NPT, 150# or 300# FLG, SW, BW	**R22**	**320**
					R32	**460**
WPN-63	A182-F12CL2 Alloy Steel	**823**	1/2", 3/4", 1"	NPT, 300# FLG, SW, BW	**R56**	**810**
WPN-100	A182-F12CL2 Alloy Steel	**1220**	1/2", 3/4", 1"	NPT, 600# FLG, SW, BW	**R90**	**1200**
WPN-160	A182-F12CL2 Alloy Steel	**1620**	1/2", 3/4", 1"	NPT, 900# FLG, SW, BW	**R130**	**1600**
WPN-250	A182-F22CL3 Alloy Steel	**2260**	1/2", 3/4", 1"	NPT, 1500# FLG, SW, BW	**R150**	**2230**

Typical Applications

DRIP, TRACING: **WPN Series** Bi-metallic steam traps are used in steam tracing, steam main drips and non-critical process equipment. They are extremely robust and reliable, making them a suitable choice for high pressure applications as well as outdoor applications that are subject to freezing. They are used in systems where a quick discharge of air, non-condensable gases and large quantities of cold water need to be dischargeat start-up.

How It Works

When the system is cold, the trap is fully open; discharging air and cold condensate. When the bi-metallic plates inside the trap heat up, they expand; pulling the seat closed and restricting flow. Prior to steam temperature being reached, the trap shuts off tightly. Cooler temperatures cause the seat to open further. Therefore, trap capacity will increase when colder condensate is in contact with the Bi-metal element. Trap capacity is therefore given at different temperatures below saturated steam temperature.

Features

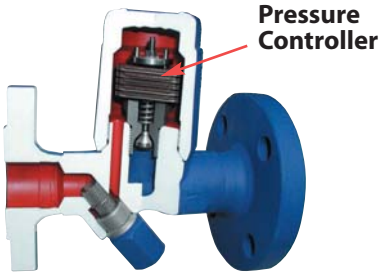
- Excellent for high-pressure and superheated steam applications
- Freeze-proof and resistant to waterhammer
- Suitable for superheated steam
- In-line repairable
- Trap can be welded into line

Sample Specification

Steam trap shall be Watson McDaniel WPN Series Bi-Metallic Steam Trap. Trap must be capable of being completely serviced while still in-line.

Installation and Maintenance

The trap can be installed in any orientation except with the cap facing downward. All internal components can be replaced while trap body remains in-line.



Max Differential Pressure for Pressure Controller	
Pressure Controller	Max Diff. Pressure PSI
R22	320
R32	460
R56	810
R90	1200
R130	1600
R150	2230

How to select a A WPN Trap:

1) Select a Pressure Controller that has a max differential pressure within the range of your application.
2) Select a Trap Body depending on System Pressure; WPN40 thru WPN250.
3) Select Connection Type & Size
4) Configure Model Code (see Examples to right)

Example Model Codes:

WPN40-A-R22-14-F150-ES
(Model WPN40, 320 PSI Max Differential Pressure, 1" 150# Flanged with External Strainer)

WPN63-C-R56-14-F600
(Model WPN63, 810 PSI Max Differential Pressure, 1" 600# Flanged with Standard Internal Strainer)

Model Configuration Chart

Position 1	Position 2	Position 3	Position 4		Position 5	Position 6
Model	Body Material (Code)	Pressure Controller Code	Connection Size	Code	Connection Type Code	Strainer Selection Code
WPN-40	Carbon Steel A105 (A)	R22 or R32	1/2"	12	F150, F300, N, SW	Internal Strainer (IS)
			3/4"	13		
			1"	14		
			1 1/2"	16		
			2"	17		
			1/2"	12	F150, F300, N, SW, BW	External Strainer (ES)
			3/4"	13		
			1"	14		
			1 1/2"	16		
			2"	17		
WPN-63	Alloy Steel A182-F12CL2 (C)	R56	1/2"	12	F300, SW, BW	
			3/4"	13		
			1"	14		
WPN-100	Alloy Steel A182-F12CL2 (C)	R90	1/2"	12	F600, SW, BW	
			3/4"	13		
			1"	14		
WPN-160	Alloy Steel A182-F12CL2 (C)	R130	1/2"	12	F900, SW, BW	
			3/4"	13		
			1"	14		
WPN-250	Alloy Steel A182-F22CL3 (C)	R150	1/2"	12	F1500, SW, BW	
			3/4"	13		
			1"	14		

Model	WPN-40	
Sizes	1/2", 3/4", 1", 1 1/2", 2"	
Connections	NPT, 150# FLG, 300# FLG, SW, BW	
Body & Cover Material	A105 (C22.8)	
PMA ANSI Class 150 with 150# FLG	190 PSIG up to 437°F	
PMA ANSI Class 300 with 300# FLG	460 PSIG up to 772°F	
TMO Max. Operating Temperature (°F)	Approx. 100°F Superheat	
Pressure Controller	R22	R32
PMO Max. Operating Differential Pressure of Pressure Controller (PSI)	320	460

Note: SW = Socket Weld
BW = Butt-Weld

1) = 18°F SUB-COOL
2) = 54°F SUB-COOL
3) = 68°F

The capacity charts show the maximum flow at factory setting.

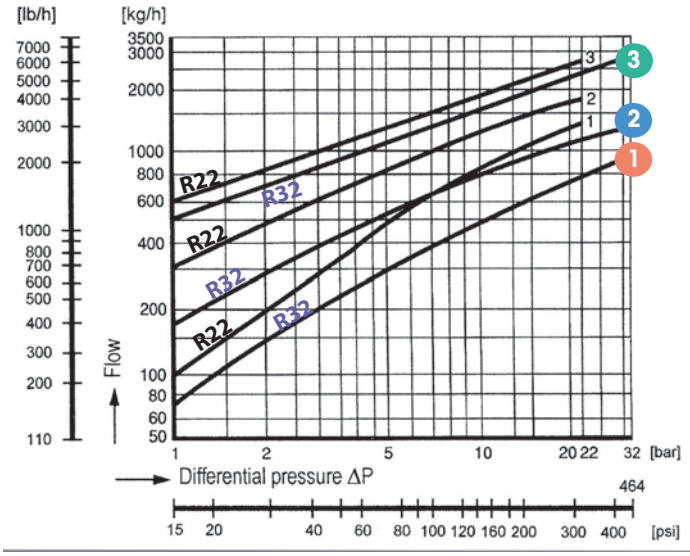
Curve 1 Flow of Condensate at approx. 18°F below boiling temperature.

Curve 2 Flow of Sub-Cooled Condensate at approx. 54°F below boiling temperature.

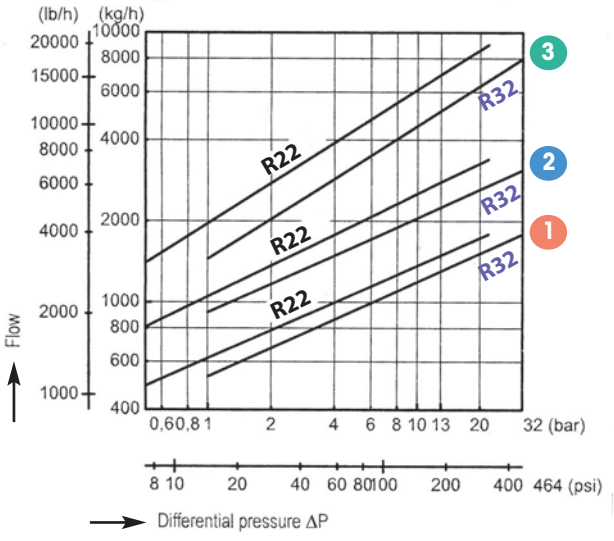
Curve 3 Flow of Cold Condensate at about 68°F (during start-up of a cold system).

Cooler temperatures cause the seat in the controller to open wider; therefore, trap capacity will increase when colder condensate is in contact with the Bi-metal element. Trap capacity is given at different temperatures below saturated steam temperature

WPN-40 with R22 & R32 Controller
1/2", 3/4", 1"

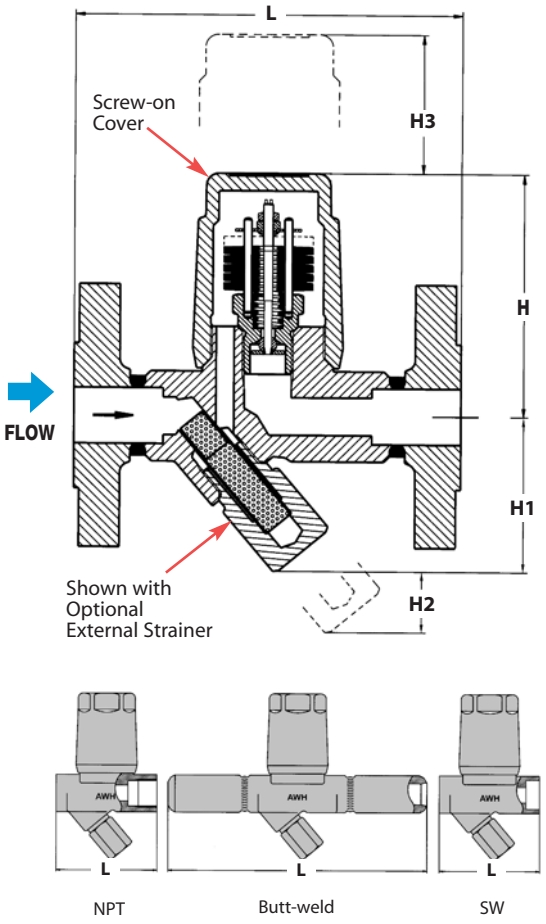


WPN-40 with R22 & R32 Controller
1 1/2", 2"



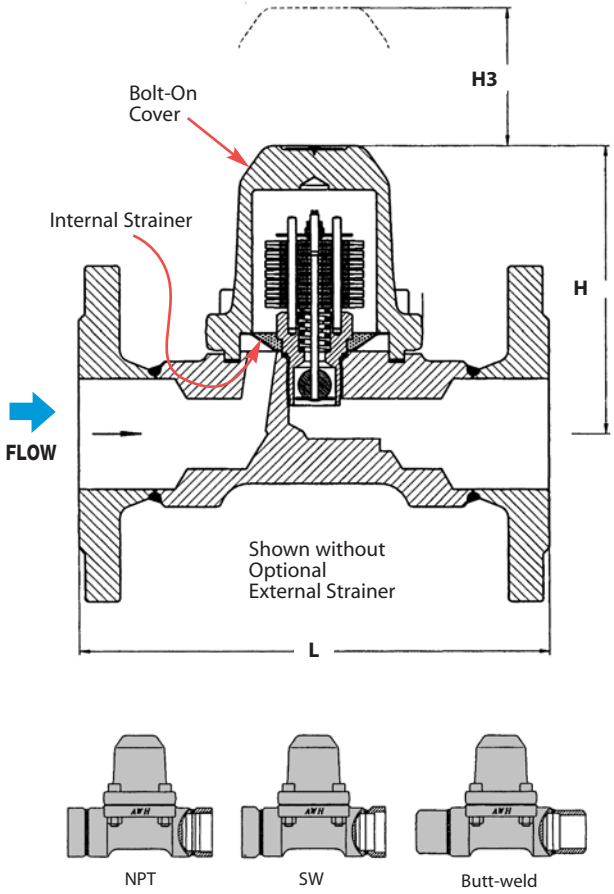
WPN-40 with **R22** or **R32** Controller **(screw-on cover)**

1/2", 3/4", 1"



WPN-40 with **R22** or **R32** Controller **(bolt-on cover)**

1 1/2", 2"



DIMENSIONS & WEIGHTS – *inches*

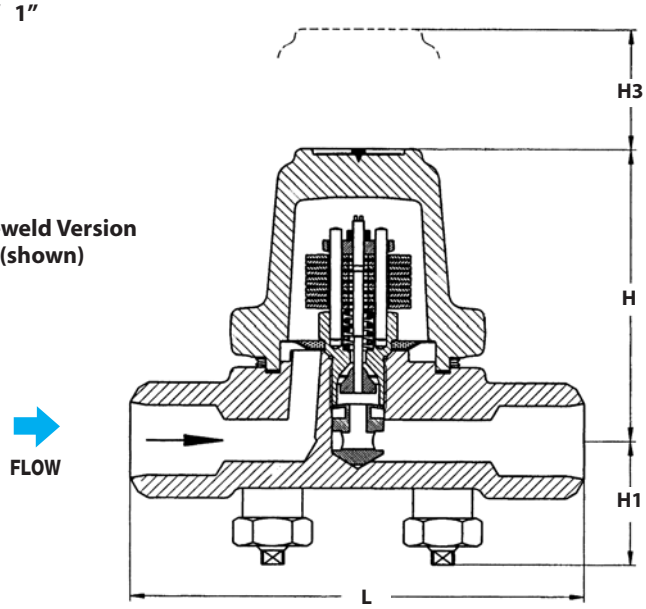
Model	Size	Connection	L	H	H1	H2	H3	Weight (lbs)
WPN-40	1/2", 3/4"	150#/300# FLG	5.90	3.92	2.44	1.20	2.8	7.7
	1"	150#/300# FLG	6.30	3.92	2.44	1.20	2.8	9.2
	1 1/2", 2"	150#/300# FLG	9.05	5.76	2.67	1.97	3.6	25.0
	1/2", 3/4"	NPT, SW	3.74	3.92	2.44	1.20	2.8	3.7
	1"	NPT, SW	3.74	4.12	2.16	1.20	2.8	4.6
	1 1/2"	NPT	6.30	5.76	2.67	1.97	3.6	17.6
	1 1/2"	SW	5.12	5.76	2.67	1.97	3.6	17.6
	2"	NPT, SW	8.27	5.76	2.67	1.97	3.6	17.6
	1/2", 3/4", 1"	Butt-weld	9.84	3.92	2.44	1.20	2.8	5.0
	1 1/2", 2"	Butt-weld	9.84	5.76	2.67	1.97	3.6	21.0

Model	WPN-63*	WPN-100	WPN-160	WPN-250
Sizes	1/2", 3/4", 1"	1/2", 3/4", 1"	1/2", 3/4", 1"	1/2", 3/4", 1"
Connections	300# FLG, SW, Butt-weld	600# FLG, SW, Butt-weld	900# FLG, SW, Butt-weld	1500# FLG, SW, Butt-weld
Body & Cover Material	Alloy Steel (A182-F12CL2)	Alloy Steel (A182-F12CL2)	Alloy Steel (A182-F12CL2)	Alloy Steel (A182-F22CL3)
Body Rating	ANSI 400	ANSI 600	ANSI 900	ANSI 1500
PMA Max. Allowable Pressure	810 PSIG up to 592°F	1200 PSIG up to 610°F	1600 PSIG up to 750°F	2180 PSIG up to 905°F
TMA Max. Allowable Temperature	1000°F @ 261 PSIG	1000°F @ 441 PSIG	1000°F @ 595 PSIG	1000°F @ 1305 PSIG
TMO Max. Operating Temperature	572°F	842°F	932°F	932°F
Pressure Controller	R56	R90	R130	R150
PMO Max. Operating Diff. Pressure of Pressure Controller	810 PSI	1200 PSI	1600 PSI	2230 PSI

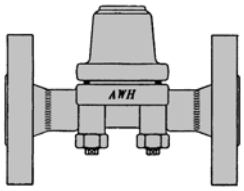
WPN-63 / WPN-100 / WPN-160 / WPN-250

1/2", 3/4", 1"

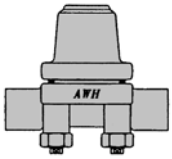
Butt-weld Version (shown)



FLG



SW



DIMENSIONS & WEIGHTS – *inches*

Model	Size	Connection	L	H	H1	H3	Weight (lbs)
WPN-63, WPN-100, WPN-160, WPN-250	1/2", 3/4"	FLG*	8.26	4.16	1.68	2.8	17.6
	1"	FLG*	9.05	4.16	1.68	2.8	17.6
	1/2", 3/4", 1"	SW	6.30	4.16	1.68	2.8	10.0
		Butt-weld	6.30	4.16	1.68	2.8	10.0

* WPN-63: 300# FLG
WPN-100: 600# FLG
WPN-160: 900# FLG
WPN-250: 1500# FLG

The capacity charts show the maximum flow at factory setting.

Curve 1 Maximum Flow quantity of Condensate at approximately 18 & 27°F below boiling temperature.

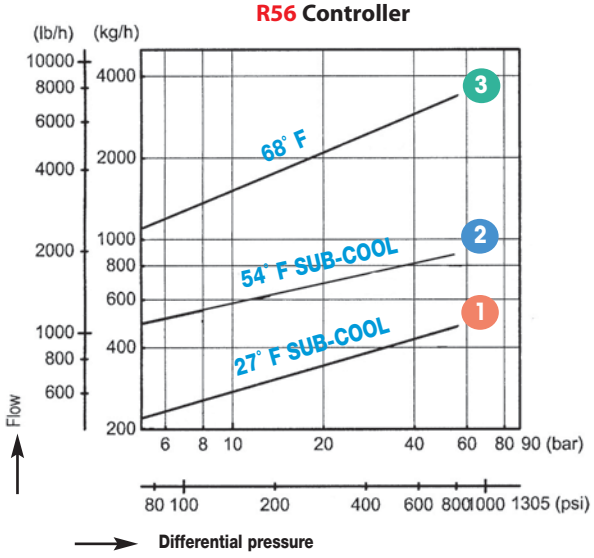
Curve 2 Maximum Flow of Sub-Cooled condensate at approx. 54°F below boiling temperature (through back up of condensate).

Curve 3 Maximum Flow quantity of Cold Condensate at about 68°F (during start-up of a cold system).

Cooler temperatures cause the seat in the controller to open wider; therefore, trap capacity will increase when colder condensate is in contact with the Bi-metal element. Trap capacity is given at different temperatures below saturated steam temperature.

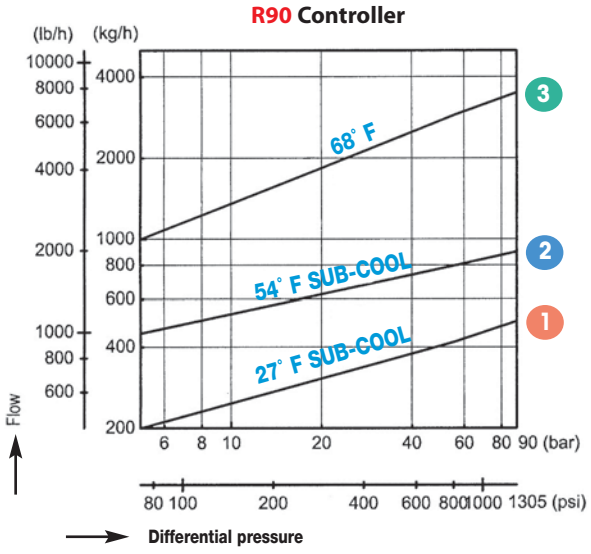
WPN-63 • 1/2", 3/4", 1"

R56 Controller



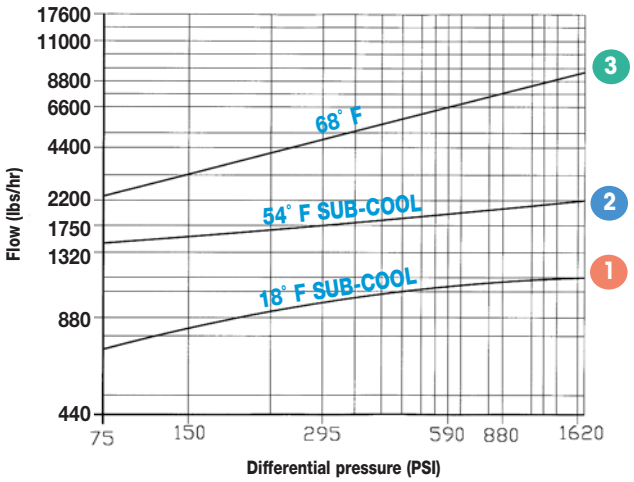
WPN-100 • 1/2", 3/4", 1"

R90 Controller



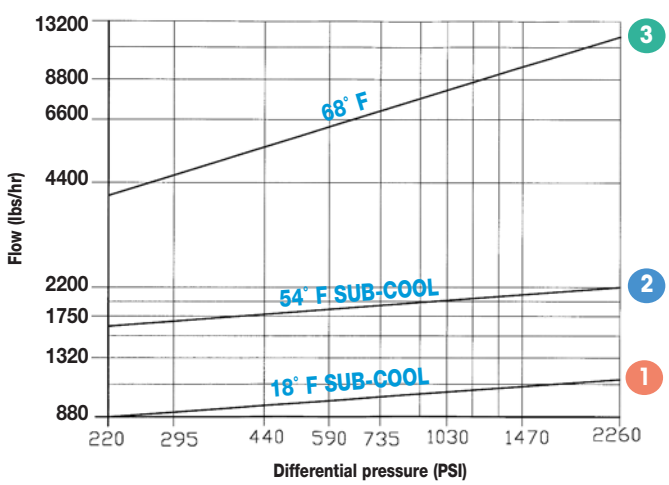
WPN-160 • 1/2", 3/4", 1"

R130 Controller



WPN-250 • 1/2", 3/4", 1"

R150 Controller



Fabricated Carbon Steel • Forged Steel

Model	FM	FSM
Sizes	1/2", 3/4"	1/2", 3/4"
Connections	NPT, SW	NPT, SW
Body Material	Fabricated Carbon Steel	Forged Steel
PMO Max. Operating Pressure	720 PSIG	600 PSIG
Pressure/Temperature Rating	720 PSIG @ 508°F	600 PSIG @ 500°F

Typical Applications

FM / FSM manifolds are used for steam distribution TO the tracing system and for condensate collection FROM the tracing system. Commonly used in chemical and petrochemical facilities as well as in other industrial plants that have multiple tracing applications. Manifolding the steam distribution and condensate collection system not only cuts down on installation and maintenance costs, but also provides freeze protection. FSM Series manifolds have integral isolation valves.

Description FM

The **FM** manifold is fabricated from carbon steel and available with either NPT or Socket-weld connections. Condensate collection type are provided with a built-in siphon tube to minimize bi-phase flow, which reduces water hammer and allows flash steam space to prevent freeze damage.

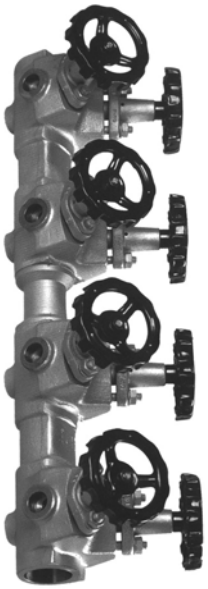
Description FSM

The **FSM** manifold is manufactured from forged steel and is equipped with integral piston style valves. The unique sealing system of the valves utilize an austenitic stainless steel piston that slides into two rings composed of reinforced graphite ring stainless steel plates.

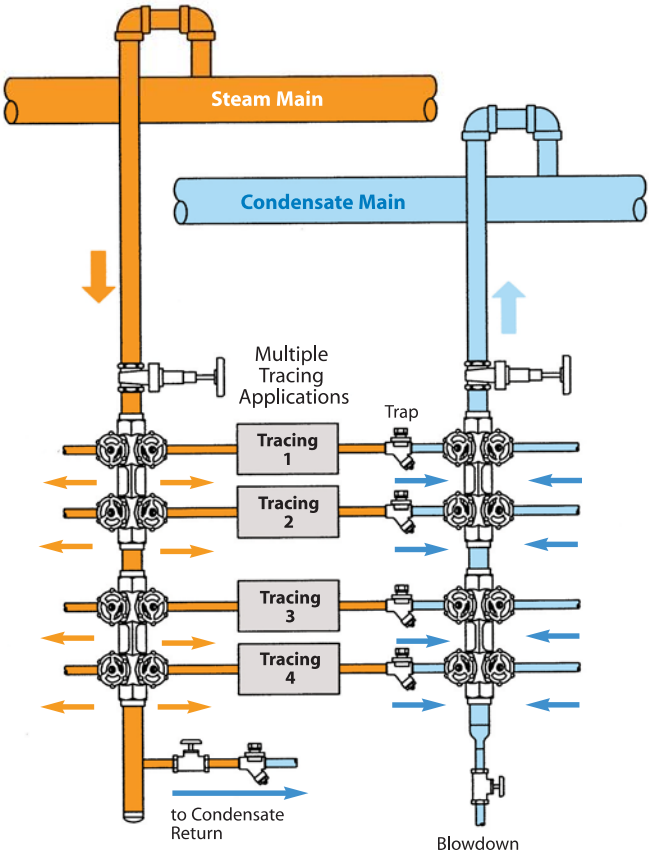
Features

- Compact design saves valuable plant space
- Available in 4, 6, 8 & 12 branch designs
- Available with pre-assembled steam trap stations
- Standard designs or custom built manifolds available
- Provides freeze protection
- Reduces installation and maintenance time
- On FSM Model valve bonnets are long neck type to allow for installation of insulation, keeping surface temperatures low for protection of personnel

FM Manifold
(Carbon Steel)



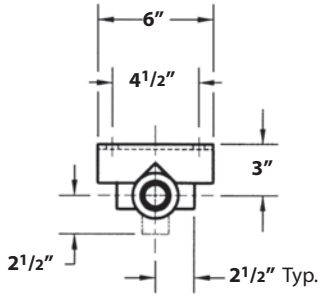
FSM Manifold
(Forged Steel)

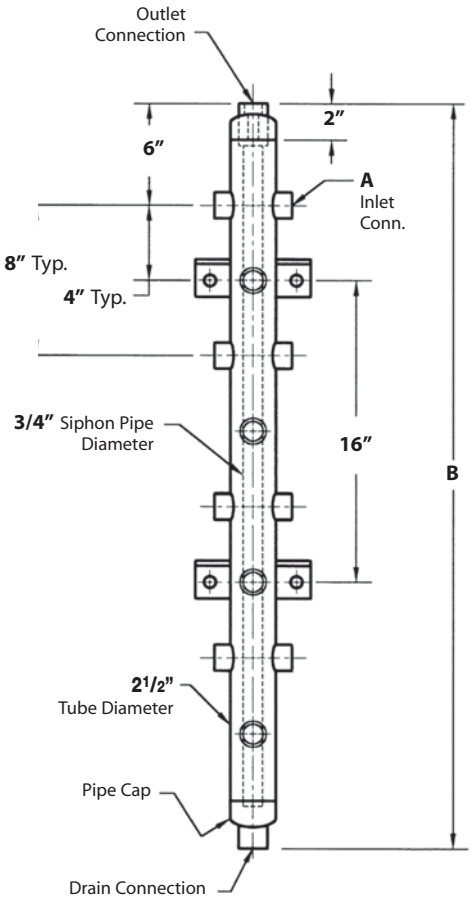


FSM Steam Distribution Manifold
Distributes Steam TO Tracing Applications

FSM Condensate Collection Manifold
Collects Condensate FROM Tracing Applications

Fabricated Carbon Steel





Description Vertical Mount	Model Code	Inlet (A) Size	Inlet (A) Type	# Front Conn.	# Side Conn.	Conn. Total	B Length (in)	Wt.. (lbs)
Condensate Collection (C) Manifolds								
4 side conn.	**FM4-12-N-C**	1/2″	NPT	4	0	4	24	25
4 side conn.	**FM4-13-N-C**	3/4″	NPT	4	0	4	24	27
4 side/2 front conn.	**FM6-12-N-C**	1/2″	NPT	4	2	6	24	27
4 side/2 front conn.	**FM6-13-N-C**	3/4″	NPT	4	2	6	24	29
8 side conn.	**FM8-12-N-C**	1/2″	NPT	8	0	8	40	40
8 side conn.	**FM8-13-N-C**	3/4″	NPT	8	0	8	40	42
8 side/4 front conn.	**FM12-12-N-C**	1/2″	NPT	8	4	12	40	46
8 side/4 front conn.	**FM12-13-N-C**	3/4″	NPT	8	4	12	40	48
12 side conn.	**FM12A-12-N-C**	1/2″	NPT	12	0	12	56	56
12 side conn.	**FM12A-13-N-C**	3/4″	NPT	12	0	12	56	58
Steam Distribution (D) Manifolds								
4 side conn.	**FM4-12-N-D**	1/2″	NPT	4	0	4	24	25
4 side conn.	**FM4-13-N-D**	3/4″	NPT	4	0	4	24	27
4 side/2 front conn.	**FM6-12-N-D**	1/2″	NPT	4	2	6	24	27
4 side/2 front conn.	**FM6-13-N-D**	3/4″	NPT	4	2	6	24	29
8 side conn.	**FM8-12-N-D**	1/2″	NPT	8	0	8	40	40
8 side conn.	**FM8-13-N-D**	3/4″	NPT	8	0	8	40	42
8 side/4 front conn.	**FM12-12-N-D**	1/2″	NPT	8	4	12	40	46
8 side/4 front conn.	**FM12-13-N-D**	3/4″	NPT	8	4	12	40	48
12 side conn.	**FM12A-12-N-D**	1/2″	NPT	12	0	12	56	56
12 side conn.	**FM12A-13-N-D**	3/4″	NPT	12	0	12	56	58

Connection Codes: **N** = NPT, **SW** = Socket Weld

For Socket Weld Connectionss: change **N** in Model code to **SW**. Example: **FM4-12-SW-C**

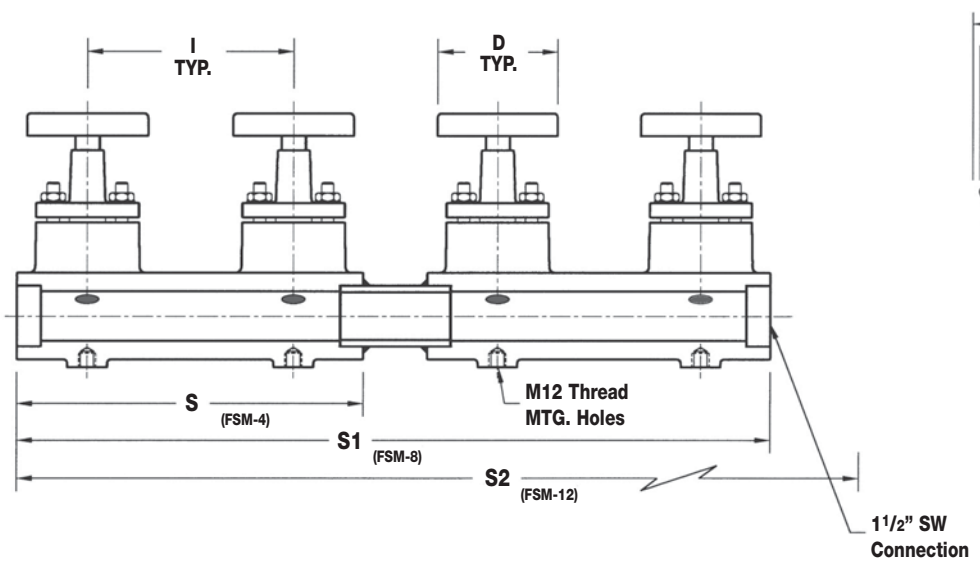
MATERIALS – FM	
Body	Fabricated Carbon Steel

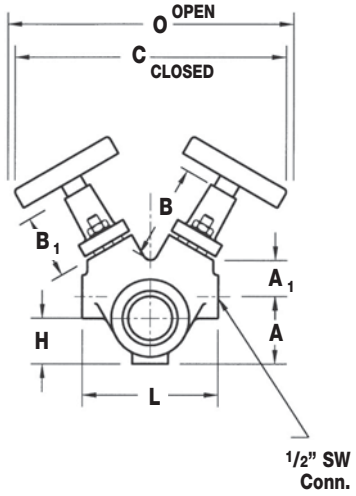
Steam Traps
Steel Manifolds
Forged Steel

FSM Series
Manifolds

DIMENSIONS & WEIGHTS – *inches*

Model	L	H	D	C	O	I	S	S1	S2	A	A1	B	B1	No. of Valves	No. of Holes	Weight (lbs)
FSM-4	4.33"	1.61"	3.94"	8.97"	10.63"	6.30"	13.03"	-	-	2.79"	1.22"	3.23"	2.79"	4	2 (M12)	23
FSM-8	4.33"	1.61"	3.94"	8.97"	10.63"	6.30"	-	28.1"		2.79"	1.22"	3.23"	2.79"	8	4 (M12)	49
FSM-12	4.33"	1.61"	3.94"	8.97"	10.63"	6.30"	-	-	36.22"	2.79"	1.22"	3.23"	2.79"	12	6 (M12)	72





Description	Model Code	Connection Size	Connection Type	# of Branches
Condensate Collection (C) Manifolds				
4 Branches/4 Valves	**FSM4-12-N-C**	1/2"	NPT	4
4 Branches/4 Valves	**FSM4-13-N-C**	3/4"	NPT	4
8 Branches/8 Valves	**FSM8-12-N-C**	1/2"	NPT	8
8 Branches/8 Valves	**FSM8-13-N-C**	3/4"	NPT	8
12 Branches/12 Valves	**FSM12-12-N-C**	1/2"	NPT	12
12 Branches/12 Valves	**FSM12-13-N-C**	3/4"	NPT	12
Steam Distribution (D) Manifolds				
4 Branches/4 Valves	**FSM4-12-N-D**	1/2"	NPT	4
4 Branches/4 Valves	**FSM4-13-N-D**	3/4"	NPT	4
8 Branches/8 Valves	**FSM8-12-N-D**	1/2"	NPT	8
8 Branches/8 Valves	**FSM8-13-N-D**	3/4"	NPT	8
12 Branches/12 Valves	**FSM12-12-N-D**	1/2"	NPT	12
12 Branches/12 Valves	**FSM12-13-N-D**	3/4"	NPT	12

Connection Codes: **N** = NPT, **SW** = Socket Weld

For Socket Weld Connectionss: change **N** in Model code to **SW**.

Example: **FSM4-12-SW-C**

CAPACITIES

Pressure (PSIG)	Condensate (lbs/hr) [1]	Steam (lbs/hr) [2]
25	1850	160
50	1000	310
75	840	460
100	610	730
125	660	760
150	620	900
200	570	1200
250	535	1500
300	510	1800
400	470	2350
500	460	3000
600	440	3550

[1] *Saturated condensate discharging into 20 PSI back pressure*

[2] *Saturated Steam flow @ 5000 ft/min velocity*

MATERIALS – FSM

Body	Forged Steel, A105
Hand Wheel	Sheet Metal
Bonnet	Forged Steel, A105
Valve ring above	Graphite
Valve ring below	Graphite/Stainless Steel
Piston	Stainless Steel, A304

Condensate Return System

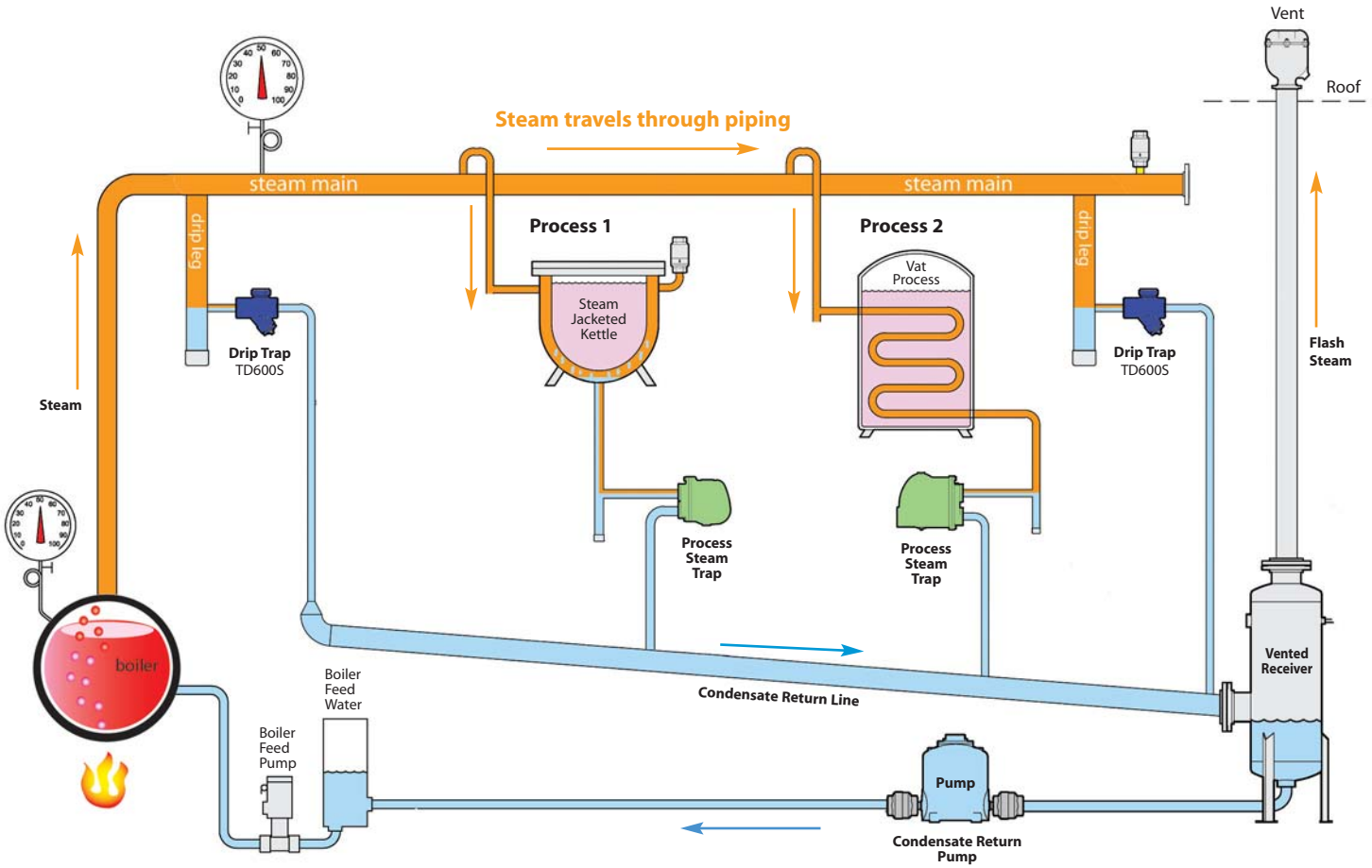
Shown below is a simplified view of a steam system from steam generation to condensate return. Steam generated by the boiler travels through the steam distribution lines supplying steam to various pieces of process equipment. The steam flowing to this equipment is separated from the condensate return lines by steam traps.

Relatively small steam traps, referred to as “Drip traps,” are used for optimization and protection of steam systems by draining condensate from steam distribution lines into the condensate return line.

Process Applications refer to draining condensate from the actual process using the steam into the condensate return line. The steam traps used in these applications have relatively high condensate capacity and are referred to as “Process traps”.

A large plant may have many separate pieces of process equipment and thousands of drip traps discharging condensate into the condensate return lines. On efficiently run steam systems, this condensate is returned back to the boiler for reuse.

Steam Distribution & Condensate Return System



What are Condensate Return Pumps & when are they required?

In certain cases, the steam pressure of the system may be sufficient to push the condensate through the steam traps and condensate return lines, back to the condensate holding tank in the boiler room. In most practical situations, however, one or more condensate return pumps are required to assist in overcoming gravity, pressure drops from long piping runs, and back pressures in return lines. Condensate Return Pumps are either electrically-driven centrifugal pumps or non-electric mechanical pumps that use steam pressure as the motive force to pump the condensate. Non-electric pumps are referred to as Pressure Motive Pumps (PMPs).

What is a Boiler Feed Pump? A facility will often have a separate area that contains various components required for the generation of steam, such as a boiler, condensate holding or deaerator (DA) tank, boiler feed pump, water treatment, etc. Regulated by the boiler control system, the boiler feed pump sends condensate from the holding tank back to the boiler.

What are Pressure Motive Pumps (PMPs)?

Pressure Motive Pumps (PMPs) are non-electric pumps which return condensate back to the boiler room; using steam pressure as the motive force. PMPs can be supplied as stand-alone units – which include a pump tank, the internal operating mechanism, and a set of inlet and outlet check valves, or: as a packaged system – which also includes the vented receiver tank (to collect the condensate) mounted on a common base.

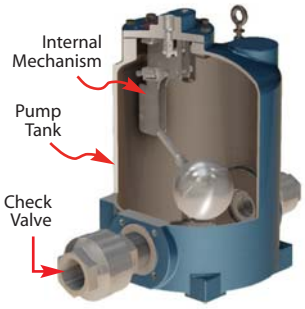
What is the purpose of a Vented Receiver?

Condensate from several different sources, at different pressures, are often discharging into the same return line. The discharge from one of the higher pressure sources could easily increase the pressure in the return line, which would stop the discharge from a critical process application operating at lower pressures.

By connecting the condensate return line to a vented receiver, the pressure in the return line will be effectively equalized to atmospheric pressure, allowing condensate to freely drain from all condensate sources. This is an extremely important and often overlooked aspect of any properly operating steam and condensate return system. The receiver and vent must be adequately sized to allow for the discharge of flash steam without building up excessive pressure. Higher condensate pressures or loads would require larger receiver and vent sizes. Condensate then flows by gravity from the vented receiver to the condensate return pump and is then returned back to the boiler room.

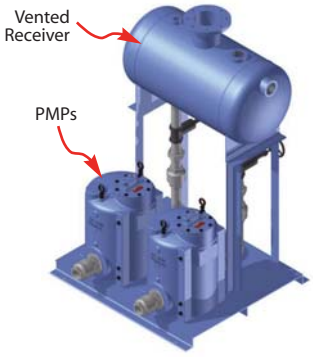
Mechanical & Electric Condensate Return Pumps

PMP
(stand-alone pump)



Mechanical stand-alone Pressure Motive Pumps (PMPs)

A stand-alone Pressure Motive Pump (PMP) consists of a pump tank with internal operating mechanism, and a set of inlet and outlet check valves. Pump tanks can be made from ductile iron (PMPC), fabricated steel (PMPF) or stainless steel (PMPSS). A PMP requires some form of a separate vented receiver tank that collects the condensate prior to entering the pump. This vented receiver is required to neutralize the pressure in the condensate return line by venting the flash steam to the atmosphere.



Pumps with Receiver Tanks (Standard Skid Systems)

Simplex, Duplex, and Triplex packaged systems include stand alone pumps and check valves with a vented receiver tank, mounted on a steel base and frame. Multiple pumping units can be used for increased capacity or for system redundancy. The stand-alone pumps are available in ductile iron, carbon steel and stainless steel; options include sight glasses, insulation jackets, cycle counters, motive and vent piping, pressure regulators, steam traps, strainers and ASME code stamp. All components of the system are properly sized and pre-piped together; requiring only four connections to be made in the field.

Electric Pumps

Electric Condensate Return Pumps are designed to work intermittently, discharging condensate only when the receiver tank is nearly full. This is accomplished with a float switch. A float connected to the switch assembly rises when condensate enters the tank. Once it rises above a set point, the switch energizes the motor on the pump, which runs until the water level drops below the bottom position of the float switch. The switch then de-energizes the motor to shut off the pump. Watson McDaniel electric pumps are offered in Simplex and Duplex models.

Why choose a PMP instead of an electric (centrifugal) condensate return pump?

Reliability is the primary purpose for selecting Mechanical type PMP's instead of Electric condensate pumps.

Electric pumps require a mechanical seal to prevent the leakage of liquid around the rotating shaft that drives the impeller. The liquid being pumped acts as a lubricant so the seal faces of the mechanical seal may rotate freely against each other. When the liquid remains relatively cool, the mechanical seal could last for many years. However, hot condensate can flash to steam between the seal faces leading to seal failure.

A centrifugal pump creates a low pressure zone at the eye of the impeller which draws the fluid into the pump. Hot condensate can flash into steam in the low pressure zone causing Cavitation. Cavitation happens when bubbles form in the liquid on the inlet side of the pump that will re-compress on the outlet side, causing erosion of the impeller and pump housing. When a pump cavitates, it often sounds like marbles or sand is being pumped. This flashing also blocks the flow of incoming condensate; causing the pump to run dry which decreases performance and also leads to seal failure.

1) PMP's do not have any seals to fail.
2) No cavitation can occur because the body of the pump is filled by the natural flow due to gravity from a vented receiver, and then discharged by steam pressure.

Therefore, Pressure Motive pumps are much more forgiving than centrifugal pumps when pumping hot condensate.

Installation of mechanical type PMP's vs. Electric pumps:

Standard **Electric Pumps** are supplied with a receiver tank and are intended for lower pressure steam systems. In these instances, the vent size on the receiver tank should be adequate to vent minimal flash steam, allowing condensate to freely enter the receiver and to adequately cool prior to being pumped. In higher pressure steam systems, the condensate temperature is hotter, resulting in more flash steam as the condensate is discharged through steam traps and into the return line. Additional options may be required for the electric pumps if condensate does not cool to suitable temperatures.

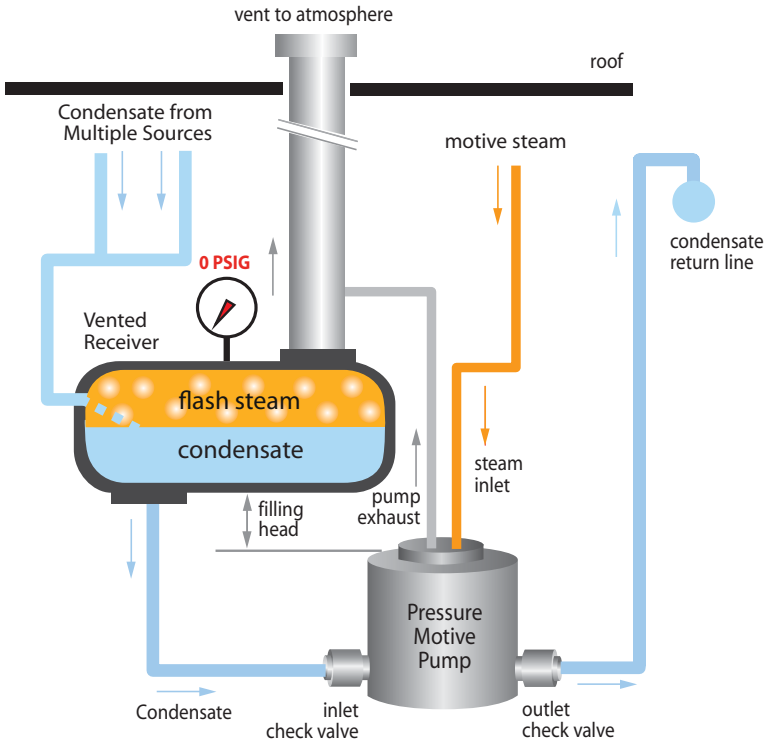
PMPs discharge high temperature condensate that drains from vented receivers. A **stand-alone PMP** pump tank cannot be used as the vented receiver since it is intermittently pressurized with steam or air to pump the condensate. PMPs require a separate vented receiver to collect the condensate and to vent the flash steam to atmosphere. The Simplex, Duplex or Triplex packaged systems include the separate vented receiver tank mounted on a common base along with the PMP(s).

Vented Receivers should generally be sized to maintain 0 psig in both the receiver and condensate return line upstream of the receiver. This helps ensure free drainage of condensate from sources that may be operating at both high and low pressure. Sizing criteria is based on condensate pressure and the amount of the flash steam created. Undersizing the receiver or the vent will increase the pressure in the receiver and condensate return line, possibly causing issues with condensate drainage from process equipment upstream. Undersizing of the vent will increase the velocity of flash steam in the pipe which could possibly draw condensate from the receiver and discharge it out of the vent.

Pump (PMP) with a Vented Receiver

A Vented Receiver (or Flash Tank) is used to collect the condensate generated from one or several different sources (drip & process applications) in the facility.

Pressure from the Flash steam generated by the hot condensate is vented to the atmosphere to maintain atmospheric pressure (0 PSIG) in the receiver tank. This assures that condensate will freely flow by gravity to the receiver tank and then to the pump tank, avoiding potential condensate back-up.

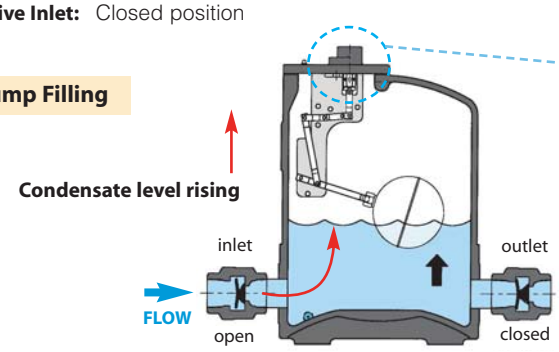


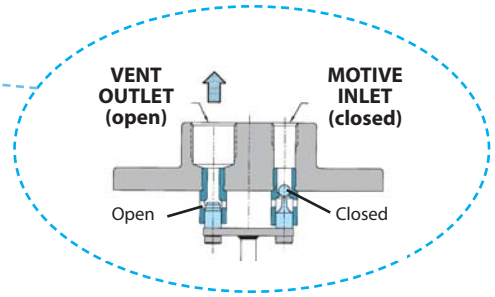
Operation of PMP Pressure Motive Pump

Vent Outlet: Open position, allowing any pressure in the pump tank to vent out and water to freely enter pump by gravity.

Motive Inlet: Closed position

Pump Filling





1 Condensate flows from the receiver tank through the inlet check valve and fills the pump tank. During the filling cycle the float inside the tank rises.

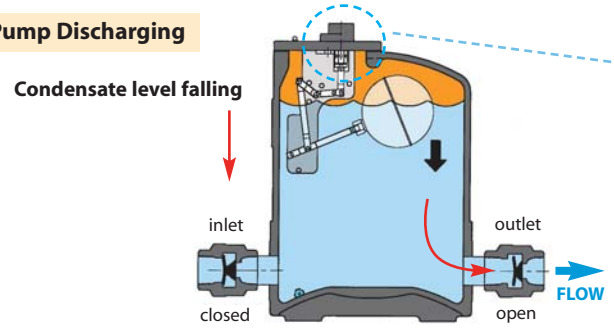
The positions of the **Vent** and **Motive** valves control the filling and discharge of the pump. The Vent valve must be open during the filling cycle to allow air or steam in the pump tank to be displaced as water enters the pump. Since water flows into the pump tank by force of gravity, the pump tank pressure must be neutralized for the pump tank to fill.

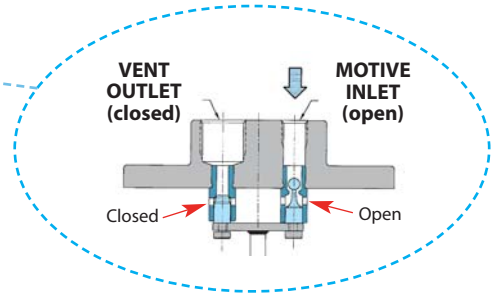
When the pump tank reaches its fill point the vent valve closes and the motive valve opens. The incoming steam pressure rapidly forces the water out of the pump tank through the outlet check valve. When the pump tank empties, the vent valve opens and motive inlet valve closes.

Vent Outlet: Closed

Motive Inlet: Open; steam pressure enters tank and discharges condensate

Pump Discharging



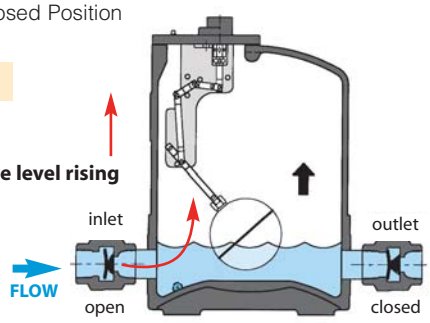


2 When the pump tank has filled to the trip point, the mechanism triggers, opening the motive gas inlet valve and simultaneously closing the vent valve. This allows motive pressure to enter the pump body, which drives the condensate thru the outlet check valve into the condensate return line. During the discharge cycle, the liquid level and the float inside the pump tank drop.

Vent Outlet: Open position, allowing any pressure in the pump tank to vent out and water to freely enter pump by gravity.

Motive Inlet: Closed Position

Pump Filling



3 At the lower trip point, the mechanism triggers and the motive gas inlet valve to the pump tank closes and simultaneously the vent valve opens. The fill and discharge cycle then repeats.

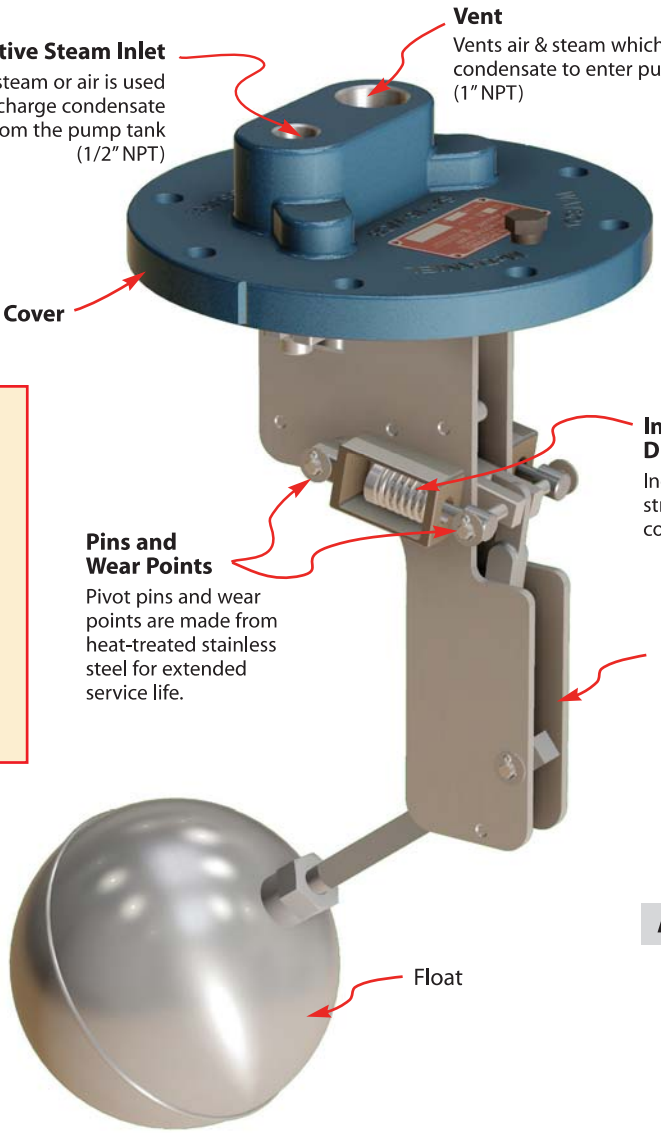
Check Valves

The inlet check valve on the PMP system must have a very low cracking pressure (opening pressure) so that the liquid will freely enter the pump tank. The proper check valve is very critical to the proper operation of the PMP system. Watson McDaniel recommends using spring-loaded stainless steel check valves with ¼ PSI cracking pressure.

The Internal Working Mechanism

The heart of the PMP is the internal working mechanism, which features the **Patented SNAP-ASSURE™** Design. This feature, exclusive to Watson McDaniel's PMPs, **Guarantees to extend pump life** even in the most demanding applications.

The environment inside a pump tank can be extremely harsh and volatile. Hot condensate can be very aggressive and may even corrode stainless steel springs when they are under tension or compression (high stress). This is known as stress corrosion-cracking. Additionally, condensate systems normally contain fine particles of rust and other contaminants, such as pipe scale, further aggravating mechanical components. The Watson McDaniel Pump Mechanism has been refined and developed over many years and has proven itself in its performance and reliability.



The Patented Snap-Assure Feature stops dirt and abrasive iron oxide particles from jamming the mechanism. The Snap-Assure Feature forces the internal toggle action to trigger ("**snap**") between vent and motive, "**assuring**" that fill and discharge cycles occur properly. Without Snap-Assure, the added friction of abrasive particles or worn components can inhibit a pump from operating.

All STAINLESS STEEL Internals

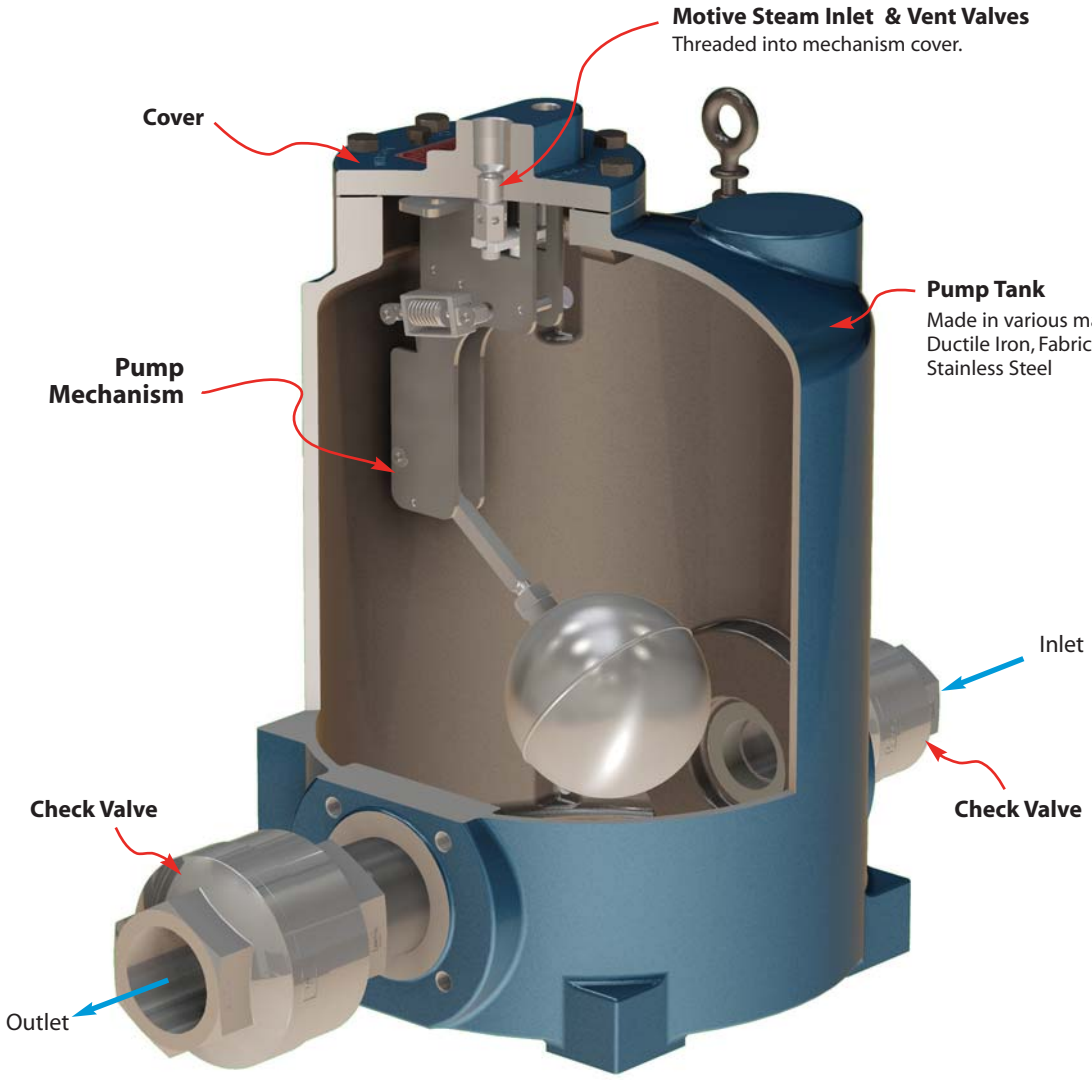
Snap-Assure
U.S. Patent No. 6572340

Internal Mechanism Features

- Equipped with Watson McDaniel's patented "Snap-Assure" feature, which extends the useful life of the pump by assuring that the internal toggle action triggers at every fill and discharge cycle
- All Stainless Steel components minimize corrosion (spring material is Inconel-X-750)
- Hard chrome-plated pivot pins and wear points substantially reduce the rate of wear on critical components
- 17-4 heat-treated stainless steel inlet and vent valve (Hardened seats have proven themselves to last years)
- Dual-compression springs, made from Inconel-X-750, eliminate the effects of stress corrosion-cracking and are designed to last indefinitely
- Precision manufactured mechanisms never require field adjustments
- Watson McDaniel "Snap-Assure" mechanisms can be purchased separately and will fit other manufacturers' pump tanks

Snap-Assure Pump Mechanism

1) Cover & mechanism bolt to top of pump tank.
2) Mechanism is field-repairable by replacing any of the functioning components such as springs and valve seats.
3) Mechanism can fit other manufacturers' pump tanks.



Check Valves

The inlet check valve on the PMP system must have a very low cracking pressure (opening pressure) so that the liquid will freely enter the pump tank. The proper check valve is very critical to the proper operation of the PMP system. Watson McDaniel recommends using spring-loaded stainless steel check valves with ¼ PSI cracking pressure.

Mechanical Condensate Return Pumps are available as:

1) PMP (Pressure Motive Pump - Stand-Alone Unit) or
2) Pump System (Pumps with Vented Receiver Tanks):

Mechanical PMP Stand-Alone Pumps

Watson McDaniel's **Pressure Motive Pump** (**PMP** stand-alone unit) consists of the pump tank, which is made from ductile iron, fabricated steel, or stainless steel, and Watson McDaniel's patented "Snap-Assure" internal operating mechanism, along with a set of inlet and outlet check valves. An additional vented receiver or flash tank is required to collect the condensate before it enters the pump.

Watson McDaniel offers a full line of PMP accessories, including custom tanks, insulation jackets, gauge glasses, cycle counters, pre-piped accessories, pump mechanisms, check valves and anything else you may need to maintain your system.

Several choices of pump body materials, types and configurations are available to meet specific customer applications:

Ductile Iron Pump Tanks
Ductile Iron is far superior to cast iron in handling higher pressures and temperatures. Ductile iron is also extremely corrosion resistant to condensate and water and can last in excess of 50 years before tank replacement is required. Our ductile iron tanks can be ASME coded on request.

Fabricated Carbon Steel Pump Tanks
Carbon steel tanks are required in certain industrial facilities such as chemical and petrochemical refineries. However, fabricated cast steel is much less corrosion-resistant to condensate than ductile iron. Our carbon steel tanks are standard ASME coded.

Fabricated Stainless Steel Pump Tanks
Stainless steel (304L) tanks are extremely corrosion-resistant, giving increased longevity and can serve as a substitute for fabricated carbon steel tanks.

Low Profile Pump Tanks
Low-profile tanks are required when vertical space for adequate filling head of the pump is limited.

Stand-Alone Units - Pressure Motive Pumps

PMPC
Cast Ductile Iron

Significantly more corrosion-resistant to condensate when compared to carbon steel.

PMPF
Fabricated Carbon Steel

Carbon Steel may be required by code in Chemical and Petro-Chemical industries (required in certain industries).

PMPSS
304L Stainless Steel (Corrosion Resistant)

Can serve as a substitute for fabricated carbon steel tanks for extended life or when Stainless Steel is required.

PMPLS
Fabricated Carbon Steel (Reduced-Profile)

Lower in height than PMPF. Required when vertical space for adequate filling head of the pump is limited.

PMPBP
Carbon Steel (High-Capacity)

For applications requiring large transfer rates of condensate or other liquids.

PMPNT
Ductile Iron or Stainless Steel (Low-Profile)

For lower capacity applications.

PMPSP Sump Drainer (non-electric sump pump)

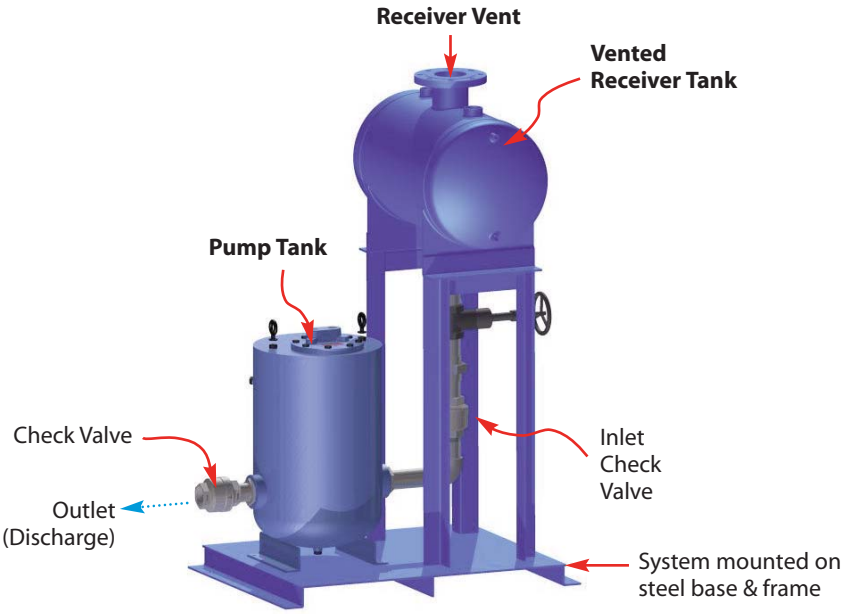
Sump drainers are used to pump water from pits or sumps using steam or air pressure. They are similar to the standard PMP models except that they discharge vertically upwards. This piping configuration allows them to be lowered into a sump or pit.

Pump Systems (Pumps with Receiver Tanks)

The **PMPC**, **PMPF** & **PMPLS** pump units are also available with a Vented Receiver mounted on a common base. The vented receiver is needed to collect the condensate which then drains by gravity into the pump tank. These standard **Simplex, Duplex** and **Triplex** packaged systems include stand-alone pump(s) and check valves with a vented receiver tank mounted on a steel base and frame. Multiple pumping units can be used for increased capacity or for system redundancy. The pump units are available in ductile iron (**PMPC**) or carbon steel (**PMPF**). Additional options include sight glasses, insulation jackets, cycle counters, motive and vent piping, pressure regulators, steam traps, strainers, ASME code stamps, etc.

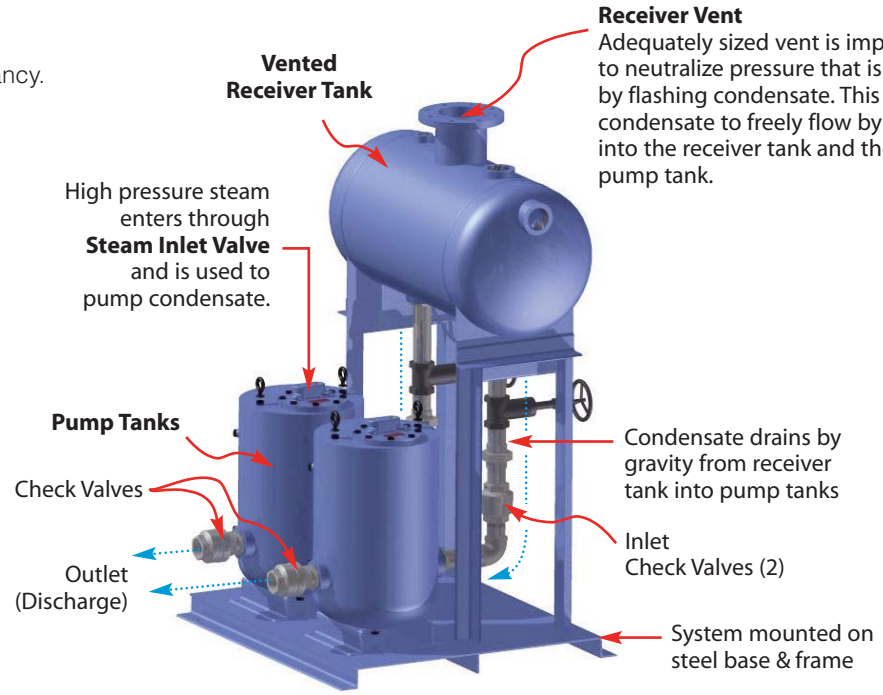
Simplex Pumping System (shown)

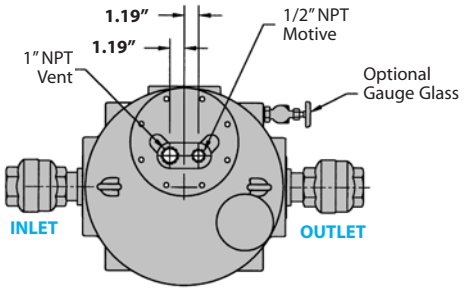
Single pump with receiver tank mounted on a common base.

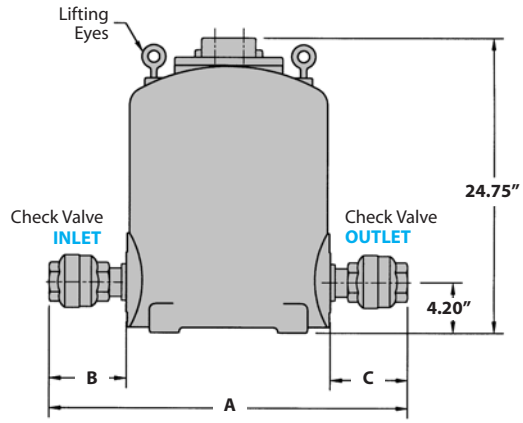


Duplex Pumping System (shown)

More than one pump can be used for increased capacity or system redundancy.







Model	**PMPC**
Body	**Ductile Iron**
Cover	**Ductile Iron**
Check Valves	**Stainless Steel**
PMO Max. Operating Pressure	**200 PSIG**
TMO Max. Operating Temperature	**388°F**
PMA Max. Allowable Pressure	**200 PSIG @ 650°F**
TMA Max. Allowable Temperature	**650°F @ 200 PSIG**

Typical Applications

The **PMPC** model **Ductile Iron** non-electric pressure motive pump is typically used when liquids must be moved to higher elevation, higher pressure or extended distances. This stand-alone pump is capable of operating with a maximum motive pressure of 200 PSIG provided by steam, air or other gas supply. **ASME "UM" code stamp is available.**

Features

- Equipped with our **Patented "Snap-Assure"** Mechanism which **extends the useful life of the pump**
- Mechanism incorporates **heat-treated stainless steel wear items**
- All stainless steel internals for ultimate corrosion resistance
- Dual compression springs made from Inconel-X-750 for high-temperature corrosive service
- Operates using steam, air, nitrogen or other pressurized gases as the motive force
- **Non-Electric** – can be used in remote locations or NEMA 4, 7, 9 and hazardous areas

Sample Specification

The non-electric pressure powered pump shall be capable of operating with a maximum motive pressure of 200 PSIG provided by steam, air or other gas supply. The pump body shall be cast ASTM A-395 Ductile Iron capable of an ASME "UM" code stamp if requested. The pump mechanism shall be float operated with a patented "Snap-Assure" feature constructed of all stainless steel materials with all load bearing points hardened for extended service life. The mechanism shall feature two Inconel springs used in compression with motive & vent valves hardened to 40c Rockwell.

DIMENSIONS – *inches*

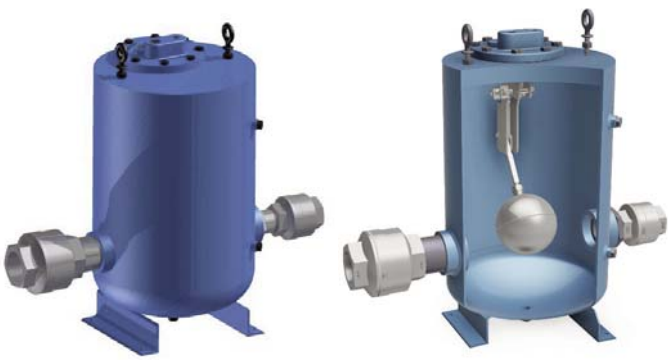
Size (Inlet x Outlet)	Model Code	A	B	C	Weight (lbs)
1" x 1"	PMPC-1X1-N-SS	29 1/2	6	6	360
1 1/2" x 1"	PMPC-1.5X1-N-SS	30 3/4	7 1/2	6	365
1 1/2" x 1 1/2"	PMPC-1.5X1.5-N-SS	31 1/4	7 1/2	7 1/2	367
2" x 1"	PMPC-2X1-N-SS	31	8	6	370
2" x 1 1/2"	PMPC-2X1.5-N-SS	32 1/2	8	7 1/2	380
2" x 2"	PMPC-2X2-N-SS	32 3/4	8	8	385
3" x 2"	PMPC-3X2-N-SS	35 1/4	9 1/4	8	390

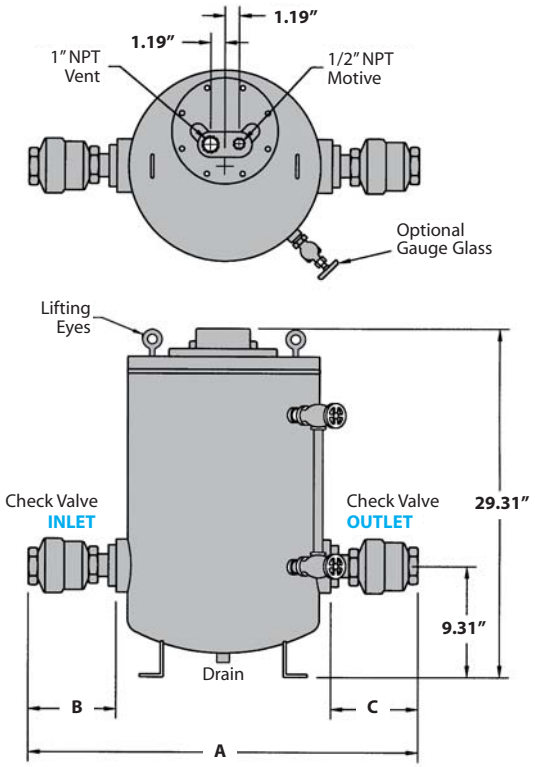
The PMPC Stand Alone Pump consists of pump tank, internal mechanism, and inlet and outlet stainless steel check valves.

MATERIALS

Body & Cover	**Ductile Iron**
Cover Gasket	Grafoil
Cover Bolts	Steel
Inlet Valve	Hardened Stainless Steel 40 Rc
Vent Valve	Hardened Stainless Steel 40 Rc
Mechanism Yoke	304 Stainless Steel
Ball Float	304 Stainless Steel
Check Valves	Stainless Steel
Springs	Inconel-X-750
Other Internal Components	Stainless Steel

Snap-Assure U.S. Patent No. 6572340





Model	**PMPF**
Body	**Carbon Steel**
Cover	**Carbon Steel**
Check Valves	**Stainless Steel**
PMO Max. Operating Pressure	**200 PSIG**
TMO Max. Operating Temperature	**388°F**
PMA Max. Allowable Pressure	**250 PSIG @ 650°F**

Typical Applications

The **PMPF** model **Carbon Steel** non-electric pressure motive pump is typically used when liquids must be moved to higher elevation, higher pressure or extended distances. This stand-alone pump is capable of operating with a maximum motive pressure of 200 PSIG provided by steam, air or other gas supply. These tanks are fabricated with 1/8" corrosion allowance and receive the ASME "UM" code stamp.

Features

- Equipped with our **Patented "Snap-Assure"** Mechanism which **extends the useful life of the pump**
- Mechanism incorporates **heat-treated stainless steel wear items**
- All stainless steel internals for ultimate corrosion resistance
- Dual compression springs made from Inconel-X-750 for high-temperature corrosive service
- Operates using steam, air, nitrogen or other pressurized gases as the motive force
- **Non-Electric** – can be used in remote locations or NEMA 4, 7, 9 and hazardous areas

Sample Specification

The non-electric pressure powered pump shall be capable of operating with a maximum motive pressure of 200 PSIG provided by steam, air or other gas supply. The pump body shall be fabricated carbon steel and certified with the ASME "UM" code stamp. The pump mechanism shall be float operated with a patented "Snap-Assure" feature constructed of all stainless steel materials with all load bearing points hardened for extended service life. The mechanism shall feature two Inconel springs used in compression with motive & vent valves hardened to 40c Rockwell.

DIMENSIONS – *inches*

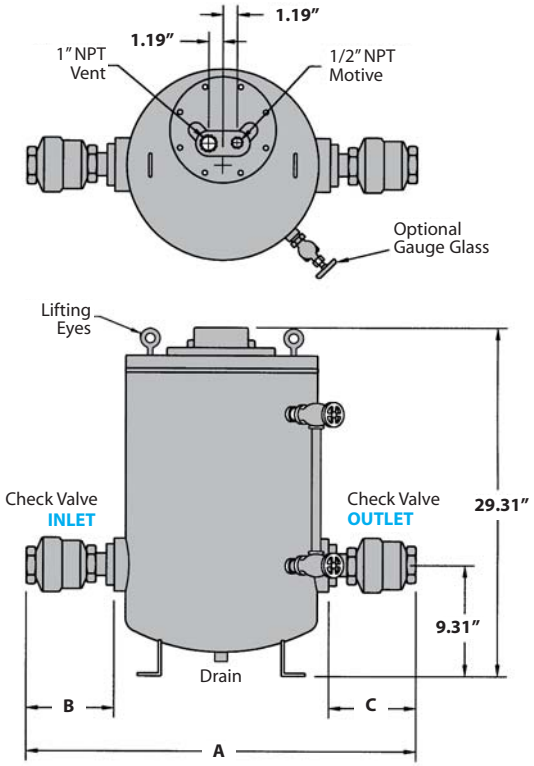
Size (Inlet x Outlet)	Model Code	A	B	C	Weight (lbs)
1" x 1"	PMPF-1X1-N-SS	30 1/2	6	6	215
1 1/2" x 1"	PMPF-1.5X1-N-SS	31 3/4	7 1/2	7 1/2	220
1 1/2" x 1 1/2"	PMPF-1.5X1.5-N-SS	32 1/4	7 1/2	6	223
2" x 1"	PMPF-2X1-N-SS	32	8	6	225
2" x 1 1/2"	PMPF-2X1.5-N-SS	33 1/2	8	7 1/2	230
2" x 2"	PMPF-2X2-N-SS	33 3/4	8	8	235
3" x 2"	PMPF-3X2-N-SS	35 1/4	9 1/4	8	240

The PMPF Stand Alone Pump consists of pump tank, internal mechanism, and inlet and outlet stainless steel check valves.

MATERIALS

Body & Cover	**Carbon Steel**
Cover Gasket	Grafoil
Cover Bolts	Steel
Inlet Valve	Hardened Stainless Steel 40 Rc
Vent Valve	Hardened Stainless Steel 40 Rc
Mechanism Yoke	304 Stainless Steel
Ball Float	304 Stainless Steel
Check Valves	Stainless Steel
Springs	Inconel-X-750
Other Internal Components	Stainless Steel

Snap-Assure U.S. Patent No. 6572340



Model	PMPSS
Body	304L Stainless Steel *
Cover	304L Stainless Steel *
Check Valves	Stainless Steel
PMO Max. Operating Pressure	150 PSIG
TMO Max. Operating Temperature	366 °F
PMA Max. Allowable Pressure	150 PSIG @ 650°F

* For special 316L SS, consult factory.

Typical Applications

The **PMPSS** model **Stainless Steel** non-electric pressure motive pump can be used in harsh and corrosive environments or as a substitute for fabricated carbon steel tanks for increased longevity. This stand-alone pump is capable of operating with a maximum motive pressure of 150 PSIG provided by steam, air or other gas supply. These pumps receive the ASME "UM" code stamp.

Features

- Equipped with our **Patented "Snap-Assure"** Mechanism which **extends the useful life of the pump**
- Mechanism incorporates **heat-treated stainless steel wear items**
- All stainless steel internals for ultimate corrosion resistance
- Dual compression springs made from Inconel-X-750 for high-temperature corrosive service
- Operates using steam, air, nitrogen or other pressurized gases as the motive force
- **Non-Electric** – can be used in remote locations or NEMA 4, 7, 9 and hazardous areas

Sample Specification

The non-electric pressure powered pump shall be capable of operating with a maximum motive pressure of 150 PSIG provided by steam, air or other gas supply. The pump body shall be 304L Stainless Steel and certified with the ASME "UM" code stamp. The pump mechanism shall be float operated with a patented "Snap-Assure" feature constructed of all stainless steel materials with all load bearing points hardened for extended service life. The mechanism shall feature two Inconel springs used in compression with motive and vent valves hardened to 40c Rockwell.

DIMENSIONS – *inches*

Size (Inlet x Outlet)	Model Code	A	B	C	Weight (lbs)
1" x 1"	PMPSS-1X1-N-SS	30 1/2	6	6	215
1 1/2" x 1"	PMPSS-1.5X1-N-SS	31 3/4	7 1/2	7 1/2	220
1 1/2" x 1 1/2"	PMPSS-1.5X1.5-N-SS	32 1/4	7 1/2	6	223
2" x 1"	PMPSS-2X1-N-SS	32	8	6	225
2" x 1 1/2"	PMPSS-2X1.5-N-SS	33 1/2	8	7 1/2	230
2" x 2"	PMPSS-2X2-N-SS	33 3/4	8	8	235
3" x 2"	PMPSS-3X2-N-SS	35 1/4	9 1/4	8	240

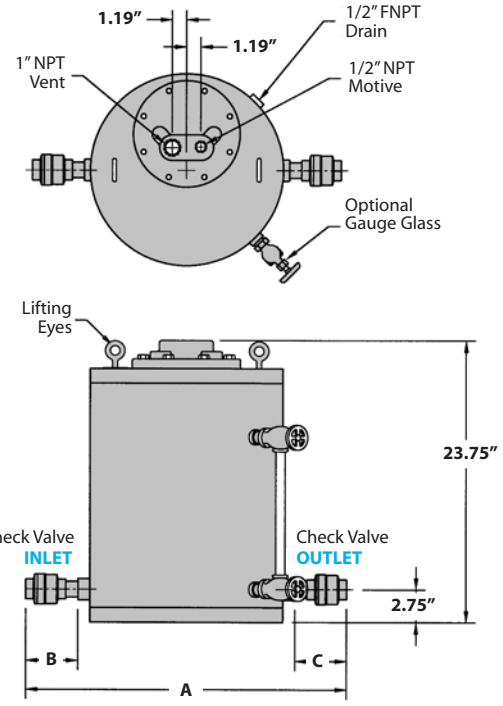
The PMPSS Stand Alone Pump consists of pump tank, internal mechanism, and inlet and outlet stainless steel check valves.

MATERIALS

Body & Cover	**304L Stainless Steel**
Cover Gasket	Grafoil
Cover Bolts	Steel
Inlet Valve	Hardened Stainless Steel 40 Rc
Vent Valve	Hardened Stainless Steel 40 Rc
Mechanism Yoke	304 Stainless Steel
Ball Float	304 Stainless Steel
Check Valves	Stainless Steel
Springs	Inconel-X-750
Other Internal Components	Stainless Steel

Snap-Assure U.S. Patent No. 6572340

PMPLS
Pressure Motive Pump



Model	**PMPLS**
Body	**Carbon Steel**
Cover	**Carbon Steel**
Check Valves	**Stainless Steel**
PMO Max. Operating Pressure	**150 PSIG**
TMO Max. Operating Temperature	**366°F**
PMA Max. Allowable Pressure	**150 PSIG @ 650°F**

Note: Optional 200 PSIG PMA/PMO. Consult Factory.

Typical Applications

The **PMPLS** model **Carbon Steel** non-electric pressure motive pump is a lower profile than the standard PMPF model. It is sometimes required when draining condensate from process equipment that is positioned close to the ground, which limits the filling head of the pump. This stand-alone pump is capable of operating with a maximum motive pressure of 150 PSIG provided by steam, air or other gas supply. These pumps receive the ASME "UM" code stamp.

Features

- Equipped with our **Patented "Snap-Assure"** Mechanism which **extends the useful life of the pump**
- Mechanism incorporates **heat-treated stainless steel wear items**
- All stainless steel internals for ultimate corrosion resistance
- Dual compression springs made from Inconel-X-750 for high-temperature corrosive service
- Operates using steam, air, nitrogen or other pressurized gases as the motive force
- **Non-Electric** – can be used in remote locations or NEMA 4, 7, 9 and hazardous areas

Sample Specification

The non-electric pressure powered pump shall be capable of operating with a maximum motive pressure of 150 PSIG provided by steam, air or other gas supply. The pump body shall be fabricated carbon steel and certified with the ASME "UM" code stamp. The pump mechanism shall be float operated with a patented "Snap-Assure" feature constructed of all stainless steel materials with all load bearing points hardened for extended service life. The mechanism shall feature two Inconel springs used in compression with motive and vent valves hardened to 40c Rockwell.

DIMENSIONS – *inches*

Size (Inlet x Outlet)	Model Code	A	B	C	Weight (lbs)
1" x 1"	**PMPLS-1X1-N-SS**	29 1/2	5 5/8	5 5/8	200
1 1/2" x 1"	**PMPLS-1.5X1-N-SS**	30 3/4	7	5 5/8	205
1 1/2" x 1 1/2"	**PMPLS-1.5X1.5-N-SS**	32 1/8	7	7	210

The PMPLS Stand Alone Pump consists of pump tank, internal mechanism, and inlet and outlet stainless steel check valves.

MATERIALS

Body & Cover	**Carbon Steel**
Cover Gasket	Grafoil
Cover Bolts	Steel
Inlet Valve	Hardened Stainless Steel 40 Rc
Vent Valve	Hardened Stainless Steel 40 Rc
Mechanism Yoke	304 Stainless Steel
Ball Float	304 Stainless Steel
Check Valves	Stainless Steel
Springs	Inconel-X-750
Other Internal Components	Stainless Steel

Snap-Assure U.S. Patent No. 6572340

PMPNT
Pressure Motive Pump

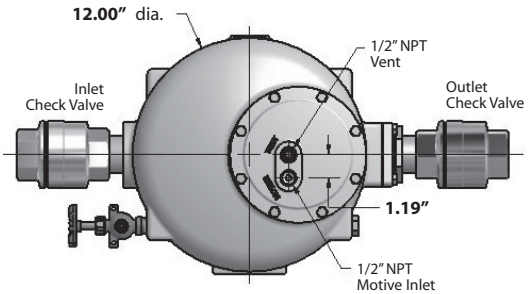
Model	PMPNT	PMPNTS
Body	Ductile Iron	Stainless Steel
Cover	Stainless Steel	Stainless Steel
Sizes	1", 1 1/2" NPT	1 1/2" FLG or NPT
Check Valves	Stainless Steel	Stainless Steel
PMO Max. Operating Pressure	125 PSIG	125 PSIG
TMO Max. Operating Temperature	366°F	366°F
PMA Max. Allowable Pressure	150 PSIG @ 450°F	150 PSIG @ 450°F

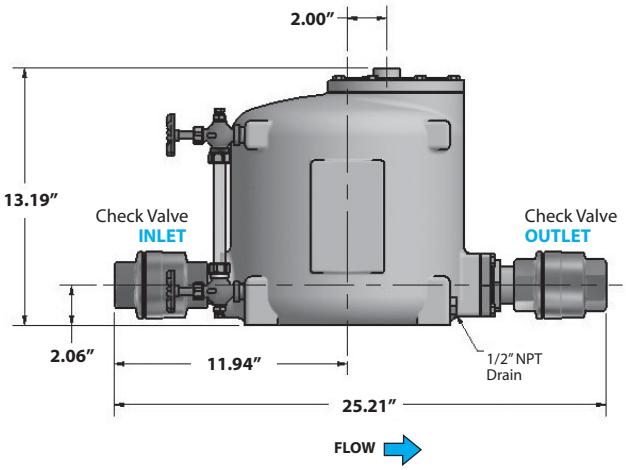
Typical Applications

The **PMPNT(S)** non-electric pressure motive pumps are light in weight and have an extremely low-profile. This stand-alone pump is capable of operating with a maximum motive pressure of 125 PSIG provided by steam, air or other gas supply. ASME Code Stamp available upon request.

Features

- Equipped with our proven, **Patented "Snap-Assure"** mechanism which **extends the useful life of the pump**
- Internal mechanism can be removed from the top of the pump while pump remains piped in line
- Mechanism incorporates **heat-treated stainless steel wear items** for ultimate corrosion resistance
- Dual compression springs made from Inconel-X-750 for high-temperature, corrosive service
- **Non-Electric** – can be used in remote locations or NEMA 4, 7, 9 and hazardous areas
- Operates using steam, air, nitrogen or other pressurized gas as the motive force





MATERIALS	
Body PMPNT	**Ductile Iron SA-395**
Body PMPNTS	**Stainless Steel CF3M**
Cover	Stainless Steel CF8
Cover Gasket	Garlock
Cover Bolts	Steel
Inlet Valve	Hardened Stainless Steel 40 Rc
Vent Valve	Hardened Stainless Steel 40 Rc
Ball Float	300 Stainless Steel
Check Valves	Stainless Steel 316SS CF3
Springs	Inconel-X-750
Other Internal Components	Stainless Steel

Size	Model Code	PMO PSI	Weight lbs
Ductile Iron Pump Body (NPT)			
1" x 1"	**PMPNT-1X1-N-SS**	125	85
1 1/2" x 1 1/2"	**PMPNT-1.5X1.5-N-SS**	125	95
Stainless Steel Pump Body (NPT or 150# FLG)			
1 1/2" x 1 1/2"	**PMPNTS-1.5X1.5-N-SS**	125	95
1 1/2" x 1 1/2"	**PMPNTS-1.5X1.5-F150-SS**	125	98

The PMPNT Stand Alone Pump consists of pump tank, internal mechanism, and inlet and outlet stainless steel check valves.

CAPACITIES – *Condensate (lbs/hr)*

Motive Pressure (PSIG)	Back Pressure (PSIG)	6" Filling Head	
		Steam Motive 1" x 1"	Steam Motive 1 1/2" x 1 1/2"
5	2	1225	2131
10	5	1204	2093
10	2	1391	2419
25	15	1171	2037
25	5	1458	2535
50	40	987	1716
50	10	1491	2593
75	60	992	1726
75	40	1262	2195
75	15	1505	2617
100	80	995	1731
100	60	1209	2102
100	15	1545	2687
125	100	997	1734
125	80	1174	2042
125	60	1316	2288
125	15	1570	2731

Note: Multiply Capacity by 1.16 for **12"** Fill Head.
Multiply Capacity by 1.28 for **18"** Fill Head.

PMPBP
Pressure Motive Pump

Model	**PMPBP**
Body	**Carbon Steel**
Cover	**Carbon Steel**
Check Valves	**Stainless Steel & Steel**
PMO Max. Operating Pressure	**150 PSIG**
TMO Max. Operating Temperature	**366°F**
PMA Max. Allowable Pressure	**150 PSIG @ 470°F**

Typical Applications

The **PMPBP** model non-electric **Carbon Steel** pressure motive pump is extremely high-capacity for applications requiring large transfer of condensate or other liquids. This stand-alone pump is capable of operating with a maximum motive pressure of 150 PSIG provided by steam, air, nitrogen or other pressurized gases as the motive force. ASME "U" Code Stamp available upon request.

Features

- All stainless steel internals for ultimate corrosion resistance
- Operates using steam, air, nitrogen or other pressurized gas as the motive force
- **Non-Electric** – can be used in remote locations or NEMA 4, 7, 9 and hazardous areas

Options

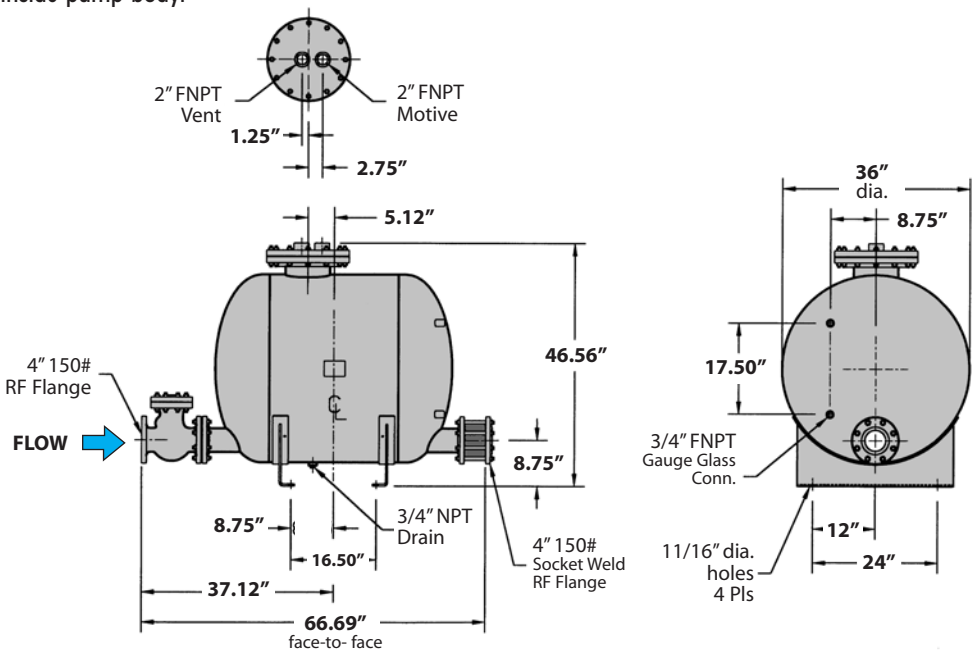
- Cycle counter for measuring the amount of condensate flow through the pump.
- Insulation jackets are available to stop heat losses through the pump body.
- Sight glass for monitoring liquid level inside pump body.

MATERIALS

Body & Cover	**Carbon Steel**
Cover Gasket	Non-Asbestos
Cover Bolts	Steel
Inlet Valve	Stainless Steel
Vent Valve	Stainless Steel
Mechanism Yoke	304 Stainless Steel
Ball Float	304 Stainless Steel
Check Valves	Stainless Steel & Steel
Springs	Stainless Steel
Other Internal Components	Stainless Steel

Size (Inlet x Outlet)	Connection	Model Code	PMO PSI	Weight (lbs)
4" x 4"	150#FLG	PMPBP-4X4-F150-SS	150	1050

The PMPBP Stand Alone Pump consists of pump tank, internal mechanism, and inlet and outlet check valves.



PMPSP

PMPSPL

Model	**PMPSP/PMPSPL**
Body	**Carbon Steel**
Cover	**Ductile Iron**
Check Valves	**Stainless Steel**
PMO Max. Operating Pressure	**150 PSIG**
TMO Max. Operating Temperature	**366°F**
PMA Max. Allowable Pressure	**150 PSIG @ 650°F**

Typical Applications

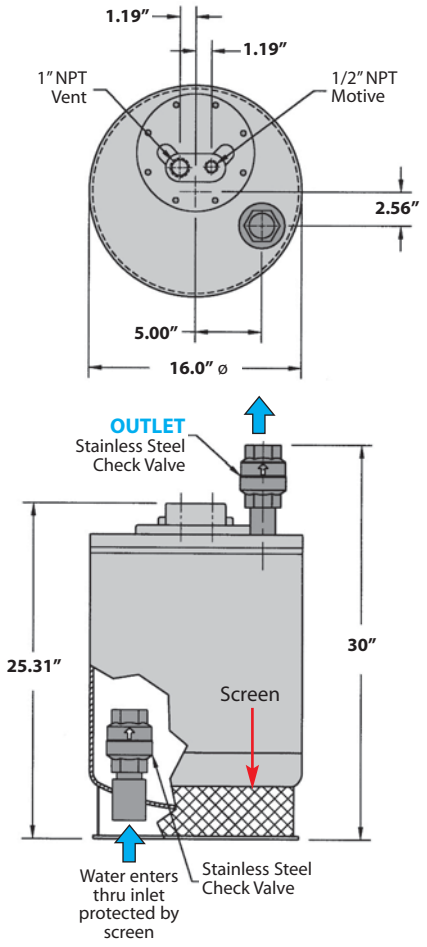
The **PMPSP** Sump Drainer uses the same internal mechanism as the standard PMP models. The piping configuration is such that the liquid is discharged vertically out the top as opposed to horizontally out the side. This allows the unit to be easily positioned inside of a sump area. Condensate or water from the sump enters the tank through a stainless steel low resistance check valve. This unit is capable of operating with a maximum motive pressure of 150 PSIG using steam, air, nitrogen or other pressurized gas as the motive force.

Features

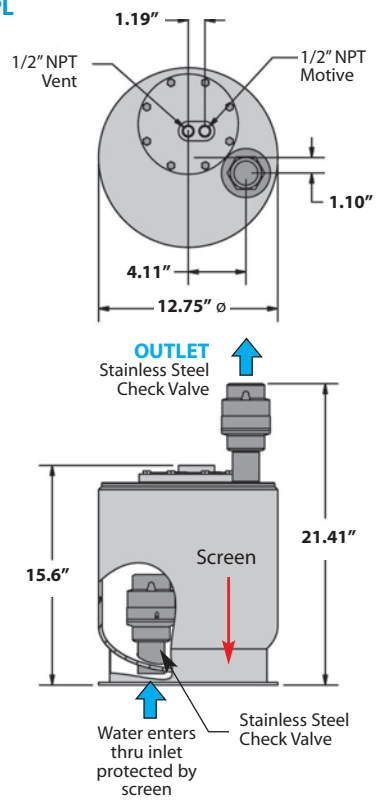
- Equipped with our **Patented "Snap-Assure"** Mechanism which **extends the useful life of the pump**
- Mechanism incorporates **heat-treated stainless steel wear items** for ultimate corrosion resistance
- Dual compression springs made from Inconel-X-750 for high-temperature corrosive service
- Operates using steam, air, nitrogen or other pressurized gas as the motive force
- **Non-Electric** – can be used in remote locations or NEMA 4, 7, 9 and hazardous areas
- Built-in Strainer screen

Snap-Assure U.S. Patent No. 6572340

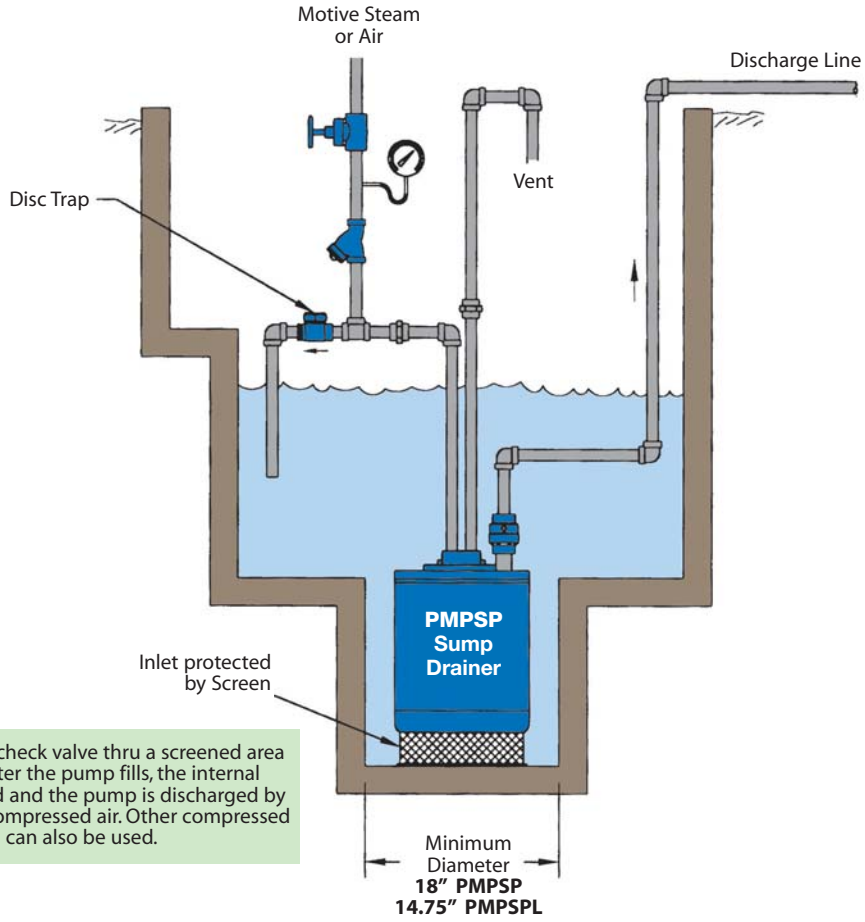
PMPSP



PMPSPL



Typical PMPSP Piping Configuration



Water enters the inlet check valve thru a screened area at bottom of pump. After the pump fills, the internal mechanism is actuated and the pump is discharged by the motive steam or compressed air. Other compressed gases such as nitrogen can also be used.

Size/Connection (Outlet) NPT	Model Code	PMO PSI	Weight lbs
1 1/2"	PMPSPL	150	110
1 1/2"	PMPSP-1	150	230
2"	PMPSP-2	150	270
2"	PMPSP-3	150	290

PMPSP & PMPSPL

PUMP CAPACITIES – *Water (GPM)*

Motive Pressure (PSIG)	Total Back Pressure (PSIG)	PMPSPL 1 1/2"	PMPSP-1 1 1/2"	PMPSP-2 2"	PMPSP-3 2"
10	0	2.8	11.7	22.2	35
20	10	3.1	9.2	17.5	22
20	0	3.3	12.5	23.7	30
40	20	3.2	8.7	16.5	21
40	10	3.4	10.4	19.8	25
40	0	3.5	13.1	25	31.4
70	40	3.2	7.1	12.1	17
70	20	3.4	9.4	15	22.5
70	0	3.6	12.9	20.6	31
100	70	3.2	5.4	8.6	10.8
100	40	3.4	7.5	12	15
100	20	3.4	9.4	15	18.8
100	0	3.5	12.3	19.7	24.6
150	100	-	4.5	7.2	9
150	70	-	5.7	9.1	11.4
150	40	-	7.2	11.5	14.4
150	20	-	8.8	14	17.6
150	10	-	9.5	15.2	19
150	0	-	10.7	17.1	21.4

PMPC & PMPF
Pressure Motive Pumps

Standard Skid Mounted Systems

Package Model	Simplex, Duplex, Triplex	Simplex, Duplex, Triplex
Pump Model (PMP)	**PMPF**	**PMPC**
Pump Body Material	**Carbon Steel**	**Ductile Iron**
Receiver Material	**Carbon Steel**	**Carbon Steel**
Check Valves	**316 Stainless Steel**	**316 Stainless Steel**
PMO Max. Operating Pressure	**200 PSIG**	**200 PSIG**
TMO Max. Operating Temperature	**388°F**	**388°F**
PMA Max. Allowable Pressure	**250 PSIG @ 650°F**	**200 PSIG @ 650°F**
Receiver Pressure Rating	**150 PSIG @ 566°F**	**150 PSIG @ 566°F**

Typical Applications

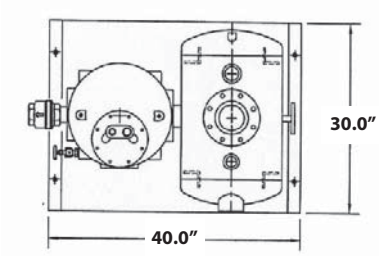
Condensate Return Pressure Motive Pump (PMPs) with a Vented Receiver. Standardized Simplex, Duplex, Triplex, and Quadraplex packaged systems include stand-alone pump(s), check valves and vented receiver, mounted on a steel base and frame. Multiple pumping units can be used for increased capacity or for system redundancy. The PMP units are available in ductile iron, carbon steel and stainless steel. Additional options include sight glasses, insulation jackets, cycle counters, motive and vent piping, pressure regulators, steam traps, strainers, ASME code stamps, etc.

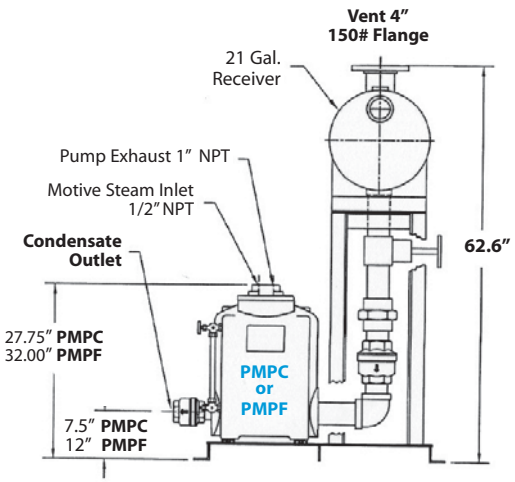
Sample Specifications

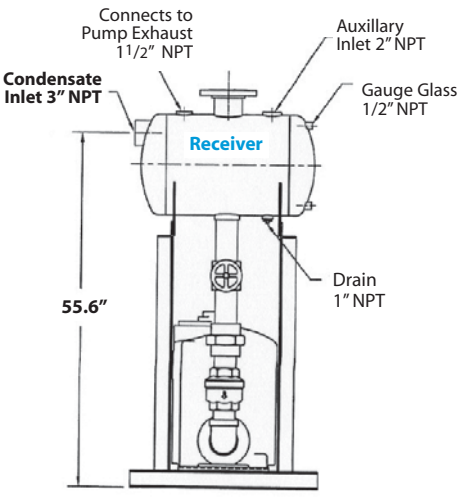
Unit shall be a Watson McDaniel, pre-packaged system to include pressure motive pump(s) with stainless steel check valves, an ASME vented receiver with "UM" code stamp, and interconnecting piping including inlet isolation valve. The carbon steel PMPF shall receive an ASME "UM" code stamp and the ductile iron PMPC shall offer it as an option. The pump mechanism shall be float operated with a patented "Snap-Assure" feature constructed of all stainless steel materials with all load bearing points hardened for extended service life, with no external seals or packing.

Connection NPT Inlet x Outlet	PMPC • Ductile Iron Mode Code	PMPF • Carbon Steel Mode Code	Receiver Size Gallons
Simplex Systems - One Pump with Receiver			
1" x 1"	**S-PMPC-1X1-SS-21**	**S-PMPF-1X1-SS-21**	21
1 1/2" x 1"	**S-PMPC-1.5X1-SS-21**	**S-PMPF-1.5X1-SS-21**	21
2" x 1"	**S-PMPC-2X1-SS-21**	**S-PMPF-2X1-SS-21**	21
2" x 1 1/2"	**S-PMPC-2X1.5-SS-21**	**S-PMPF-2X1.5-SS-21**	21
2" x 2"	**S-PMPC-2X2-SS-21**	**S-PMPF-2X2-SS-21**	21
3" x 2"	**S-PMPC-3X2-SS-21**	**S-PMPF-3X2-SS-21**	21
Duplex Systems - Two Pumps with Receiver			
3" x 2"	**D-PMPC-3X2-SS-48**	**D-PMPF-3X2-SS-48**	48
3" x 2"	**D-PMPC-3X2-SS-75**	**D-PMPF-3X2-SS-75**	75
3" x 2"	**D-PMPC-3X2-SS-116**	**D-PMPF-3X2-SS-116**	116
Triplex Systems - Three Pumps with Receiver			
3" x 2"	**T-PMPC-3X2-SS-75**	**T-PMPF-3X2-SS-75**	75
3" x 2"	**T-PMPC-3X2-SS-116**	**T-PMPF-3X2-SS-116**	116

SIMPLEX Systems







PMPC & PMPF
Pressure Motive Pumps

Standard Skid Mounted Systems

ASME Certified

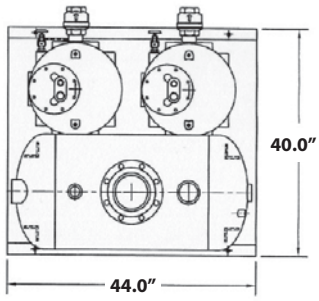
Features

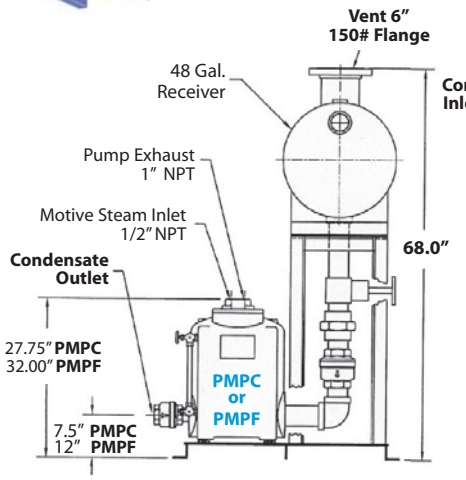
- PMP pump systems reduce installation costs. Only 4 pipe connections are required in the field
- Watson McDaniel ensures that vented receivers and other components are properly sized for optimum system performance
- Watson McDaniel's fully-qualified fabrication facility is ASME code certified. Our engineers can design and build complete custom systems to meet all your requirements

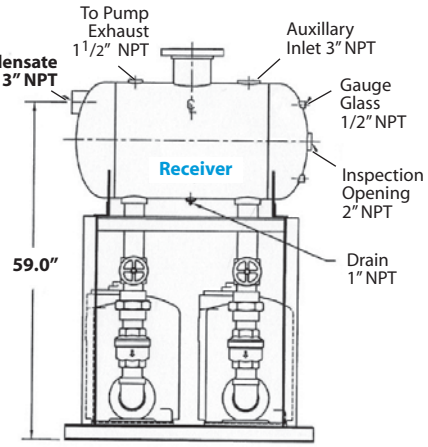
Options

- Gauge glass assembly
- Cycle counter
- Insulation covers
- Motive steam drip trap
- Overflow pipe connection
- Pressure regulator for motive supply line

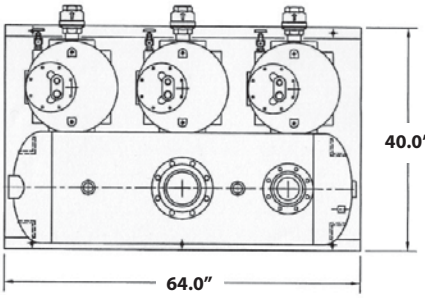
DUPLEX Systems

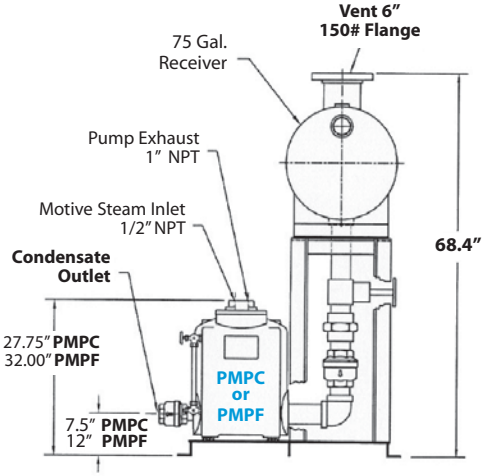


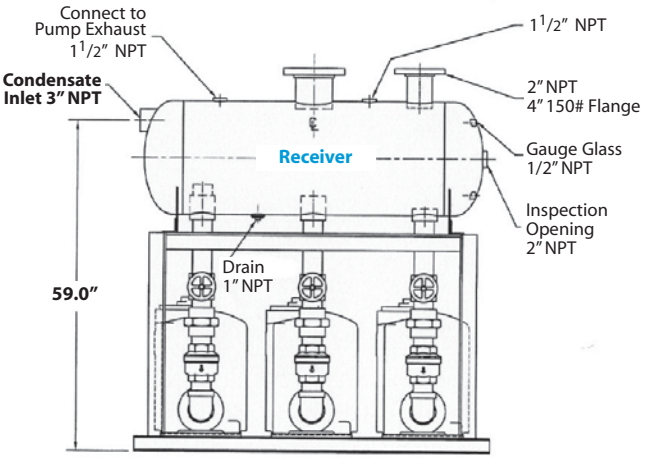




TRIPLEX Systems







Sizing and Selecting a PMP

The Capacity Charts cover both Stand Alone Pumps (PMPC, PMPF, PMPLS, etc.) as well as Pumps with Receiver Tanks (Simplex, Duplex, Triplex). If a stand alone pump is chosen, consideration should be given to the size of the vented receiver that collects the condensate before the PMP (see flash tank vent sizing). If the pump is replacing an existing installation, a vented receiver that is acceptable in size and configuration may already be installed. If required to meet capacity, pre-packaged systems with more than one pump, such as the Duplex or Triplex are available. These units come pre-mounted with the pump(s), a receiver tank as well as other options to optimize the system. A multiple pump unit may also be chosen for reserve capacity or pump redundancy in critical applications.

To select the proper size pressure motive pump requires you to know a few key pieces of information:

1. **Condensate load you need to pump:** Condensate Load is normally expressed in lbs/hr. To convert to GPM flow rate, note that 500 lbs/hr is equivalent to 1 GPM.

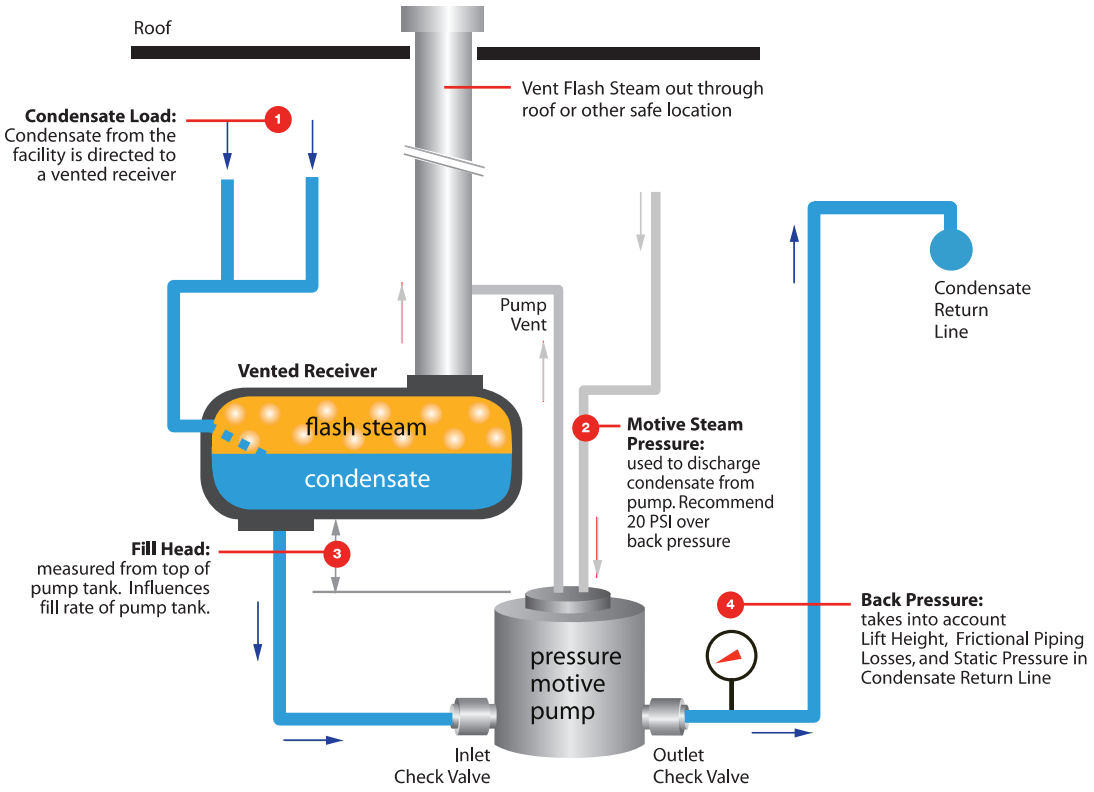
2. **Motive Pressure:** The motive pressure of the steam (or other gas) impacts pump capacity. The sizing chart indicates different flow rates based upon motive steam inlet pressure. It is recommended to regulate the steam inlet pressure to 20 psi above the total back pressure.

3. **Fill head:** Is the height (in inches) of the condensate receiver tank (or flash tank) above the pump tank. This head pressure determines how quickly the pump tank will refill with condensate after its discharge cycle. Therefore, reducing the fill time will increase the overall capacity of the pump. The capacity chart is based on 12" of fill head (PMPLS based on 6" fill head). Increasing fill head height can increase capacity by as much as 20 - 50%. (See Capacity Correction Chart.)

4. **Back Pressure:** Back Pressure is the sum total of condensate return line pressure and the physical height that the condensate needs to be elevated. (See sizing section for guidance on how to calculate back pressure.)

Inlet x Outlet Size:

In addition to body material, pumps are designated by inlet and outlet size. For example, PMPC 3 x 2 has 3" inlet and 2" outlet check valves with a ductile iron tank. Since the pump fills by gravity from the receiver tank located above it, the size of the inlet check valve significantly impacts pump capacity. The larger the check valve, the quicker the condensate will fill the pump tank, allowing it to cycle again. For example, a 3" check valve may have twice the inlet flow rate of a 2" check valve. The size of the outlet (or discharge) check valve also affects capacity but to a lesser extent.



Capacity Charts

Stand Alone Pumps & Systems

Capacity based on 12" Fill Head except as noted

CAPACITIES – *Condensate (lbs/hr)* **Using steam as a motive pressure**

Motive Pressure (PSIG)	Total Back Pressure (PSIG)	PMPLS 6" Fill Head 1" X 1"	PMPC, PMPF, PMPSS* (12" Fill Head)									PMPBP 4" x 4" 24" Head
			1½" X 1"	1½" X 1½"	2" X 1"	2" X 1½"	2" X 2"	3" x 2"	Duplex 3" x 2"	Triplex 3" x 2"	Quadraplex 3" x 2"	
5	2	1,760	1,860	1,920	2,860	3,180	3,540	5,000	10,000	15,000	20,000	16,600
10	5	1,870	2,200	2,450	4,350	4,840	5,380	7,210	14,420	21,630	28,840	19,000
10	2	2,200	3,030	3,370	6,880	7,650	8,500	11,110	22,220	33,330	44,440	22,600
25	15	1,650	3,130	3,480	4,990	5,550	6,170	8,230	16,460	24,690	32,920	33,200
25	10	1,980	3,600	3,990	6,560	7,290	8,100	10,780	21,560	32,340	43,120	40,300
25	5	2,300	4,700	5,200	7,970	8,860	9,850	13,350	26,700	40,050	53,400	46,200
50	40	1,650	2,280	2,530	3,370	3,750	4,170	5,670	11,340	17,010	22,680	33,300
50	25	1,980	4,050	4,500	6,800	7,560	8,440	11,550	23,100	34,650	46,200	40,100
50	10	2,300	4,700	5,240	7,970	8,860	9,850	13,440	26,880	40,320	53,760	47,000
75	60	1,540	2,400	2,660	3,600	4,000	4,440	6,340	12,680	19,020	25,360	32,900
75	40	1,980	3,780	4,190	5,920	6,580	7,320	9,870	19,740	29,610	39,480	39,400
75	15	2,420	5,130	5,700	8,580	9,540	10,600	14,330	28,660	42,990	57,320	47,200
100	80	1,650	2,750	3,060	4,160	4,630	5,150	6,860	13,720	20,580	27,440	27,200
100	60	1,870	3,600	4,000	5,560	6,180	6,870	9,100	18,200	27,300	36,400	35,100
100	40	2,090	4,700	5,210	6,880	7,650	8,500	11,270	22,540	33,810	45,080	42,100
100	15	2,420	5,400	6,010	8,740	9,720	10,800	14,330	28,660	42,990	57,320	48,000
125	115	1,430	2,380	2,640	3,270	3,640	4,050	4,960	9,920	14,880	19,840	19,500
125	100	1,540	2,980	3,330	4,140	4,600	5,130	6,390	12,780	19,170	25,560	25,300
125	80	1,760	3,430	4,100	5,400	6,000	6,670	8,540	17,080	25,620	34,160	32,200
125	60	1,980	4,170	4,850	6,600	7,340	8,160	10,530	21,060	31,590	42,120	38,500
125	40	2,200	5,100	5,950	7,760	8,630	9,590	12,500	25,000	37,500	50,000	44,000
125	15	2,420	5,850	6,660	9,240	10,270	11,420	15,100	30,200	45,300	60,400	49,200
150	120	1,590	2,650	2,940	3,400	3,780	4,200	5,690	11,380	17,070	22,760	21,600
150	100	1,640	3,150	3,490	4,320	4,800	5,350	7,000	14,000	21,000	28,000	29,000
150	80	1,860	3,800	4,230	5,490	6,100	6,770	9,100	18,200	27,300	36,400	34,500
150	60	2,080	4,500	5,000	6,660	7,400	8,240	11,120	22,240	33,360	44,480	40,300
150	40	2,300	5,290	5,870	7,920	8,800	9,780	13,220	26,440	39,660	52,880	44,700
150	15	2,520	6,100	6,820	9,450	10,500	11,680	15,500	31,000	46,500	62,000	49,500
175	140	-	2,600	2,900	3,800	4,200	4,650	6,200	12,400	18,600	24,800	-
175	120	-	3,100	3,400	4,400	4,850	5,400	7,200	14,400	21,600	28,800	-
175	100	-	3,600	4,000	5,100	5,700	6,300	8,400	16,800	25,200	33,600	-
175	60	-	4,850	5,400	6,900	7,700	8,550	11,400	22.800	34.200	45,600	-
175	40	-	6,200	6,900	8,900	9,850	10,950	14,600	29,200	43,800	58,400	-
175	15	-	7,500	8,350	10,600	11,900	13,200	17,600	35,200	52,800	70,400	-
200	160	-	2,400	2,700	3,500	3,800	4,300	5,700	11,400	17,100	22,800	-
200	140	-	3,100	3,400	4,400	4,900	5,400	7,200	14,400	21,600	28,800	-
200	100	-	4,200	4,650	5,950	6,600	7,350	9,800	19,600	29,400	39,200	-
200	80	-	4,700	5,250	6,750	7,500	8,300	11,100	22,200	33,300	44,400	-
200	40	-	6,800	7,550	9,700	10,800	11,950	15,950	31,900	47,850	63,800	-
200	15	-	8,400	9,350	12,000	13,300	14,800	19,700	39,400	59,100	78,800	-

** PMPSS is rated to only 150 PSIG.*

Note: For PMPNT capacity, refer to PMPNT specification page.

Capacity Correction Factors for Alternate Filling Heads

Pump Inlet Size	Filling Head 6"	12"	18"	24"	36"	48"	60"
1"	1.00	1.10	1.20	1.30	1.50		
1½"	0.70	1.00	1.10	1.20	1.35		
2"	0.70	1.00	1.10	1.20	1.35		
3"	0.84	1.00	1.04	1.08	1.20		
4"			0.80	1.00	1.10	1.15	1.20

NOTE: *When the filling head differs from the standard filling height, the capacity of the pressure power pumps are either increased or decreased. For example, a pump with a 3" inlet that has a filling head of 36" as opposed to a standard filling head of 12", will have a capacity increase of 20%. Multiply the value found in the Capacity Table above by 1.2.*

Capacity Correction Factors for Gas as Motive Pressure

Pump Inlet Size	% Back Pressure relative to Motive Pressure 10%	20%	30%	40%	50%	60%	70%	80%	90%
1"	1.00	1.13	1.16	1.20	1.25	1.30	1.35	1.40	1.45
1½"	1.04	1.06	1.08	1.10	1.12	1.15	1.18	1.23	1.28
2"	1.04	1.06	1.08	1.10	1.12	1.15	1.18	1.23	1.28
3"	1.04	1.06	1.08	1.10	1.12	1.15	1.18	1.23	1.28
4"	No Capacity Change								

Note: For low specific gravity applications, consult factory.

Sizing & Selection

Vented Receiver (Open-Loop System)

Pump Size

The models of a Pressure Motive Pump are designated by the size of the inlet and outlet check valves (for example, a 3" x 2" PMPC or PMPF has a 3" Inlet check valve and a 2" outlet check valve). The larger the check valves, the larger the pump capacity.

STAND-ALONE PUMPS include pump tank, internal pumping mechanism, and check valves.

PUMP(S) WITH RECEIVER TANKS includes stand-alone pump(s), and vented receiver tank mounted together on a frame. These are available in Simplex, Duplex, Triplex and Quadraplex systems.

When sizing and selecting a Pressure Motive Pump, Four system conditions are required:

(See Diagram on following page)

1. **Condensate Load:** If condensate from several sources of equipment is required to be pumped, sum up the maximum flow rate of condensate each could produce separately.
2. **Motive Pressure:** Normally steam is used; however, other gases can be used to pump the condensate, including Air or Nitrogen.
3. **Filling Head:** The Filling Head is measured between the bottom of the receiver tank and the top of the pump tank. It has a significant effect on pump capacity.
4. **System Back Pressure:** Pressure in condensate return line that pump will be operating against, as determined by condensate return line pressure and vertical height condensate must be lifted.

Sample System Conditions:

1	**Condensate Load**	**8,000 lbs/hr**
2	**Motive Steam Pressure**	**100 PSIG**
3	**Filling Head**	**12"**
4	**System Back Pressure:**	**40 PSIG**

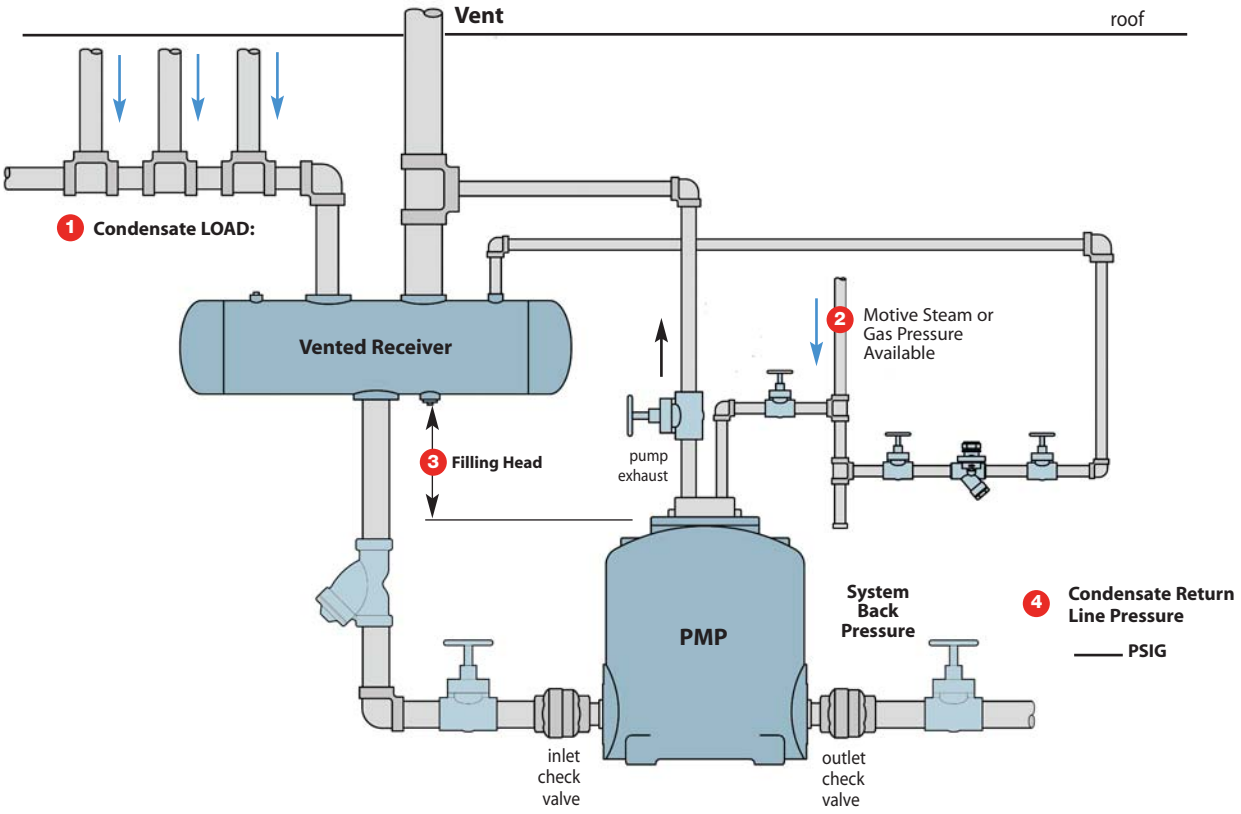
(To find the pressure required to lift condensate in PSIG, multiply Vertical lift in feet by 0.433)

For PMP Selection: Consult PMP Sizing Capacity Chart using 100 PSIG inlet pressure and 40 PSIG back pressure. A 2" x 2" pump has a capacity of 8,500 lbs/hr and is an appropriate selection. Pump choices are models PMPC, PMPF and PMPSS.

How to specify when ordering:	Example:
1) Model	**PMPC**
2) Size of Pump(s)	**2" x 2"**
3) Stand-alone Pump or Pump with Receiver Tank *(Note: Size of Receiver Tank must be specified when ordering Pump with Receiver Tank)*	**Simplex or Duplex**
4) Options	**Gauge glass**
5) When ordering a Customized Skid System, please confirm and specify Receiver size.	

Sizing & Selection

Vented Receiver (Open-Loop System)



Receiver & Vent Sizing

The purpose of the vented receiver is to neutralize the pressure inside the condensate return line so condensate will properly drain from the processes and into the pump tank. An undersized vent will increase the velocity of flash steam in the vent pipe, potentially pulling condensate from the receiver tank out the vent. It may also increase pressure in the receiver and condensate return line upstream of the receiver, possibly causing issues with condensate drainage from the steam traps. The table below lists vent and corresponding receiver sizes based on the amount of flash steam. The amount of flash steam generated is determined by the condensate flow rate and condensate pressure entering the vented receiver.

Determine the amount of condensate in lbs/hr flowing into the vented receiver. The percentage of condensate that will flash into steam is based on the initial condensate pressure and the pressure inside the vented receiver. Since we are trying to achieve 0 psig, reference the 0 psig flash tank pressure to determine % flash steam. Multiply the % flash by the total condensate load.

Example: 10,000 lbs/hr of condensate is generated at an estimated steam pressure of 20 psig. The percent (%) flash steam is **4.9%**. **Quantity of flash steam = .049 x 10,000 = 490 lbs/hr**.

From the table, select a Vent and Receiver size which can handle **600 lbs/hr** of flash steam. (**4”** vent with a **10”** receiver diameter and **36”** length.)

PERCENT (%) FLASH STEAM

Produced when condensate is discharged to atmosphere or into a flash tank controlled at various pressures

Condensate Pressure (PSIG)	Flash Tank Pressure (PSIG)								
	0	5	10	20	30	40	60	80	100
5	**1.6**	0.0							
10	**2.9**	1.3	0.0						
15	**3.9**	2.4	1.1						
20	**4.9**	3.3	2.1	0.0					
30	**6.5**	5.0	3.7	1.7	0.0				
40	**7.8**	6.3	5.1	3.0	1.4	0.0			
60	**10.0**	8.5	7.3	5.3	3.7	2.3	0.0		
80	**11.8**	10.3	9.1	7.1	5.5	4.2	1.9	0.0	
100	**13.3**	11.8	10.6	8.7	7.1	5.8	3.5	1.6	0.0
125	**14.9**	13.5	12.3	10.4	8.8	7.5	5.3	3.4	1.8
150	**16.3**	14.9	13.7	11.8	10.3	9.0	6.8	4.9	3.3

VENTED RECEIVER SIZING *(inches)*

Quantity of Flash Steam (lbs/hr)	Vent Line Diameter	Receiver Diameter	Receiver Length
75	1″	4″	36″
150	2″	6″	36″
300	3″	8″	36″
600	4″	10″	36″
900	6″	12″	36″
1200	6″	16″	36″
2000	8″	20″	60″
3000	8″	24″	60″
4000	10″	26″	60″
5000	10″	28″	60″
6000	12″	30″	72″
7000	12″	32″	72″
8000	14″	36″	72″

Pump & Trap Combinations

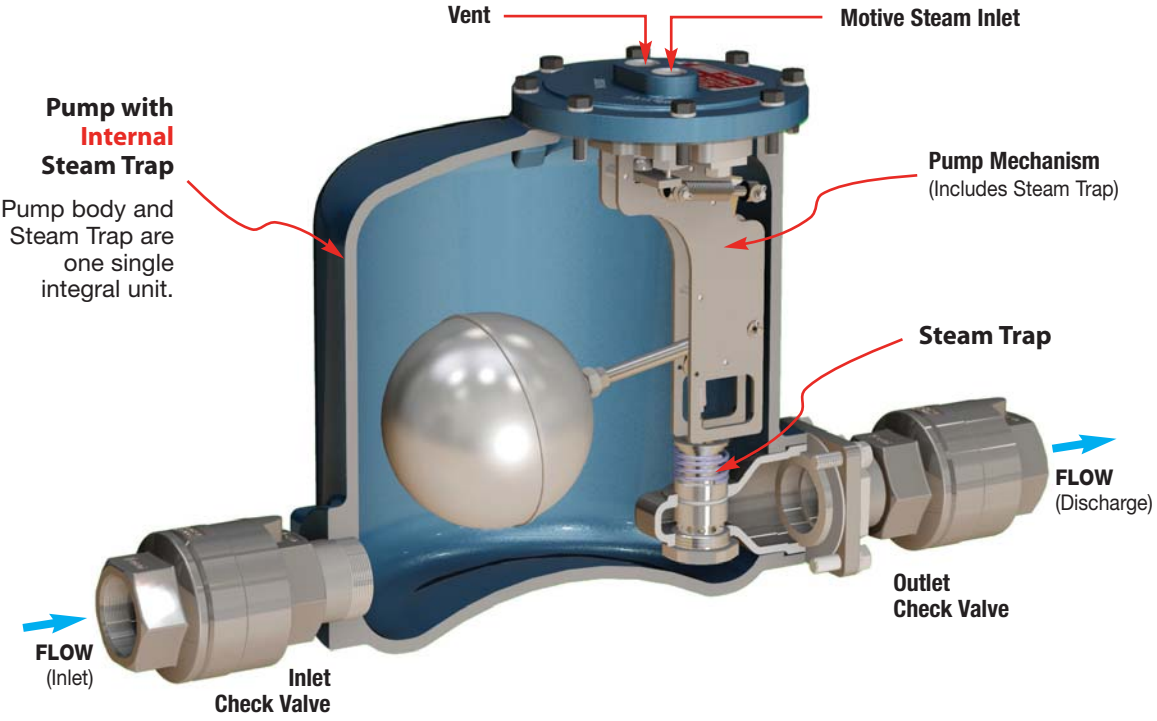
PMPT & WPT

What is a Pump-Trap?

A Pump-Trap is a float-operated steam trap that works in conjunction with a steam powered condensate return pump (Pressure Motive Pump). It is used when system conditions prevent a steam trap from effectively discharging condensate due to excessive back-pressure, or when it is desirable to operate a heat exchanger in vacuum.

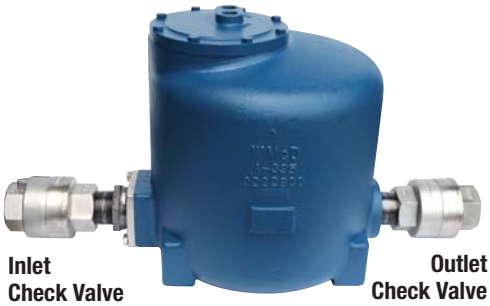
What is a Pump-Trap used for?

A **Pump-Trap** is used in place of a Steam Trap to drain condensate from a process application when the steam pressure in the process is not sufficient to push the condensate thru the steam trap and into the condensate return line. When steam pressure in a Heat Exchanger is less than the back pressure on the discharge side of the steam trap, the condensate backs up, causing inconsistent heat transfer and potential waterhammer. This frequently occurs on applications where a temperature control valve is used to supply steam to a Heat Exchanger based on product temperature and flow rate. The temperature control valve increases and decreases steam flow to the Heat Exchanger to satisfy the temperature set point. When system demand is high, the steam pressure in the Heat exchanger is most likely adequate to overcome system back pressure; however, when system demand decreases, steam pressure to the Heat Exchanger must also decrease and can fall below the back pressure. This condition is referred to as Stall, since it causes condensate to back up into the Heat Exchanger. To prevent condensate backup under stall conditions, a pump-trap must be used in place of a steam trap.



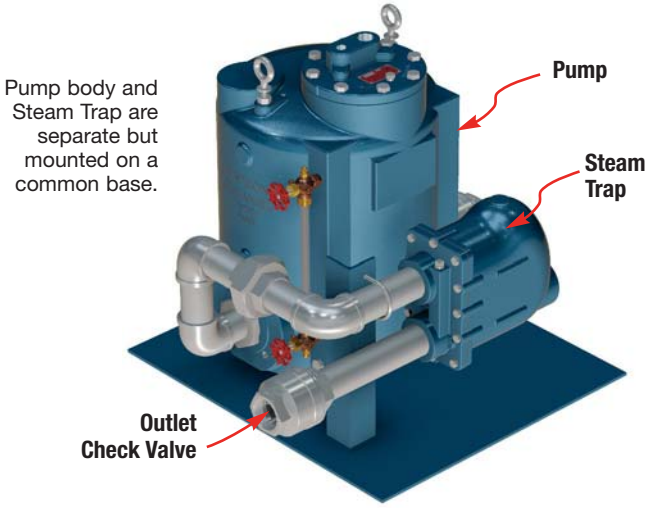
Pump with Internal Steam Trap (PMPT)

The **PMPT** pressure motive pump has an internal steam trap. The compact design makes it a suitable choice for most applications.



Pump with External Steam Trap (WPT)

The **WPT** is a stand-alone pump unit with a separate steam trap mounted on a common base. It is used when capacity requirements exceed that of the PMPT model.



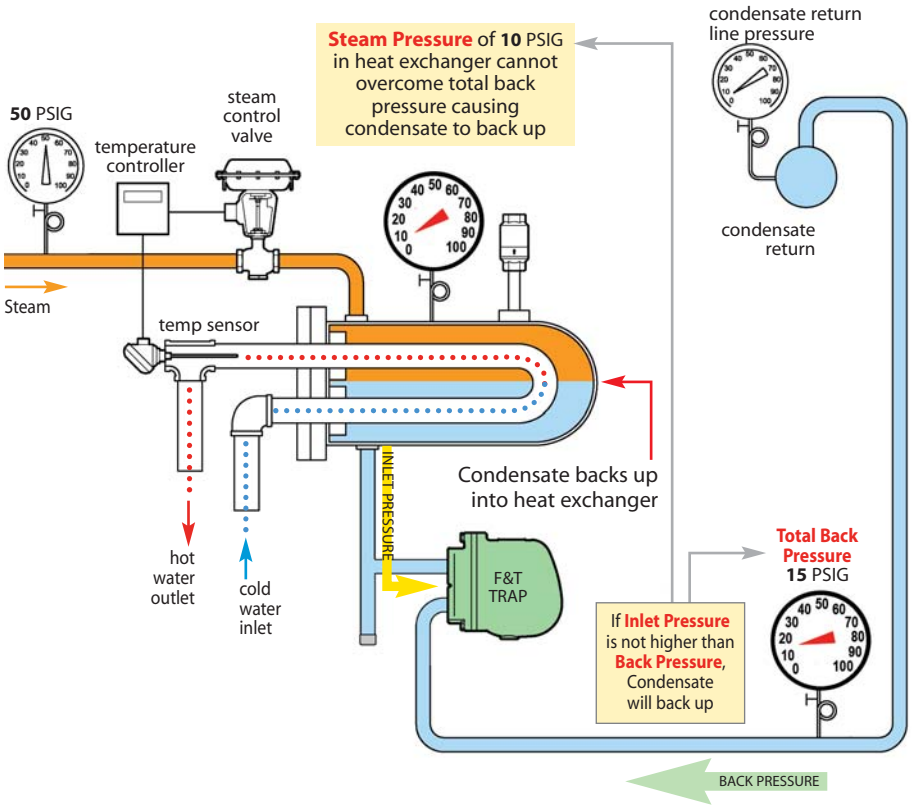
Why use a Pump-Trap?

Problem:

Condensate Backs Up Into Heat Exchanger

The diagram shows a temperature control valve delivering steam to a Heat Exchanger that is using steam to heat water. Condensate formed in the heat exchanger is being discharged through the steam trap into the condensate return line. This particular application demonstrates what happens when the return line is elevated and/or pressurized. The plant steam pressure on the inlet side of the control valve would be adequate to purge (push) the condensate through the trap and into the return line. However, the steam pressure in the heat exchanger is controlled by the valve and is dependent on the demand of the system. When the demand for HOT water is low, the steam pressure in the Heat Exchanger falls below the back pressure and the system backs up with condensate, creating unstable temperature control and waterhammer. This undesirable condition, referred to as Stall, occurs when the steam pressure in the heat exchanger falls to or below the system back pressure due to a decrease in the demand (flow rate) of hot water.

Heat Exchanger System with Steam Trap

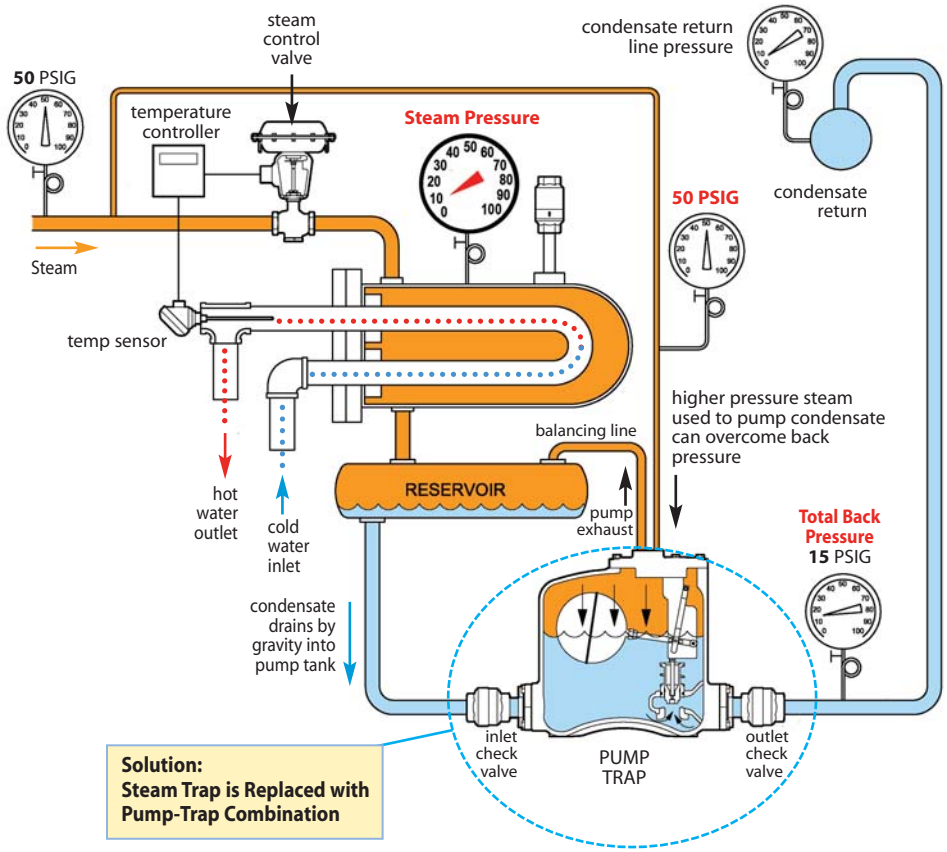


Solution:

Use a Pump-Trap to Avoid Condensate Back-up & Improve Temperature Control

To eliminate condensate backing up (STALL), the standard float trap is replaced with a PUMP-TRAP. When steam pressure in the Heat Exchanger is greater than the back pressure, the steam pressure will push the condensate through the Pump-Trap and it functions like a standard float-operated trap. When the steam pressure to the Heat Exchanger drops below the back pressure, the condensate backs up inside the PUMP-TRAP, raising the float. When the trip point of the mechanism is reached, the high-pressure steam valve will open to drive the condensate out.

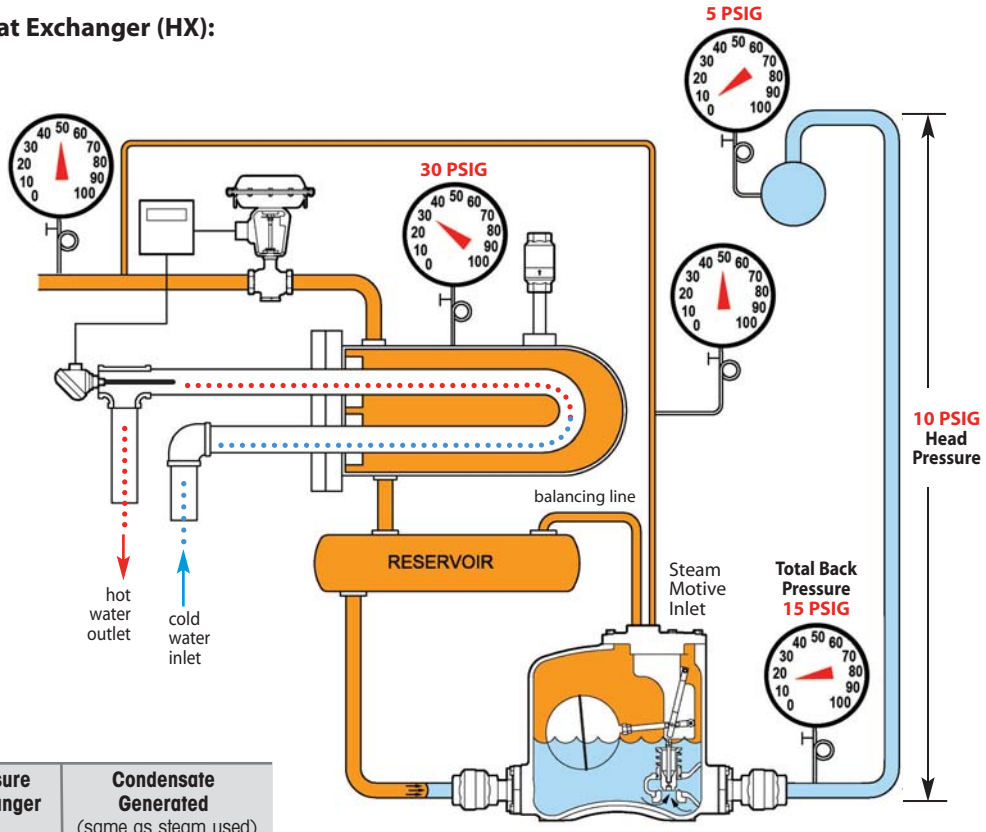
Heat Exchanger System with Pumping Trap



How a Pump-Trap Works

Operation of a PUMP-TRAP with a Heat Exchanger (HX):

The steam pressure to the HX will vary depending on the flow rate of hot water required by the system. Let's assume the HX was sized for a maximum flow rate of 40 GPM of HOT water at 140˚F using 30 PSIG steam. When maximum flow rate of water is required, the 30 PSIG steam pressure is more than adequate to push the condensate generated thru the steam trap against the 15 PSIG back pressure. Now, if the hot water requirement reduces from 40 to 20 GPM, the steam flow (lbs/hr) to the Heat Exchanger must drop by about half. Since it is the same size HX, the steam temperature (steam pressure) must also reduce (see table below).

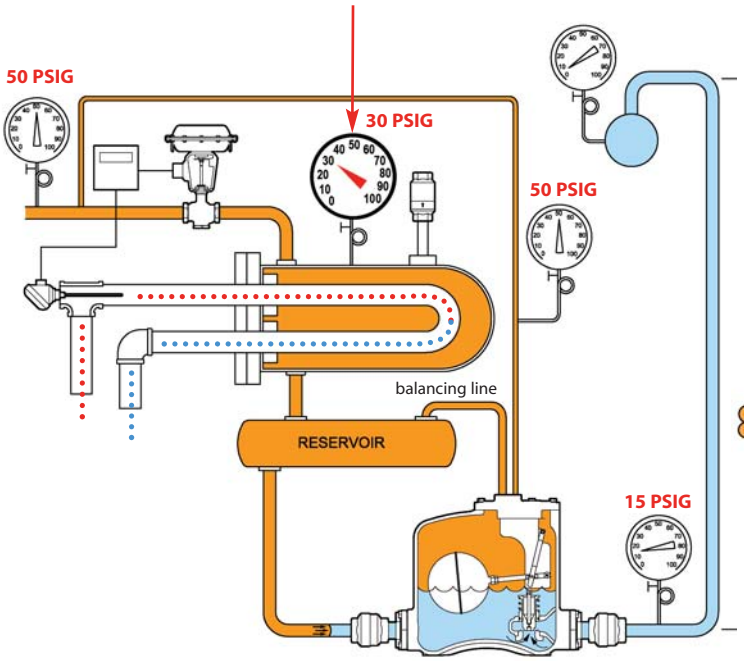


Steam Pressure vs. Hot Water Required

Flow Rate Water (gallons per minute)	Steam Usage (lbs/hr)	Steam Pressure in Heat Exchanger (PSIG)	Condensate Generated (same as steam used)	
40	1,900	30	1,900	Trap Mode
35	1,650	15	1,650	*Stall Point*
32	1,530	10	1,530	Pump Mode
20	950	-6.6 (Vacuum)	950	

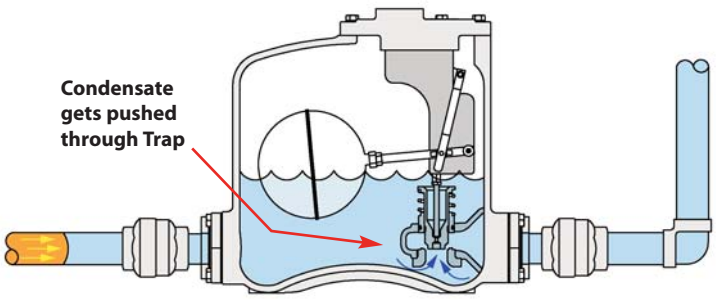
TRAP Mode

The system is operating with **30 PSIG** inlet pressure to the heat exchanger. The Pump-Trap unit functions like a standard float-operated trap. Condensate is pushed thru the pump-trap into the return line by the steam pressure in the HX.



Vent Outlet: Open position, allowing pressure in the pump tank to equal pressure in the heat exchanger, allowing condensate to freely enter Pump-Trap by gravity, even under vacuum.

Motive Inlet: Closed position

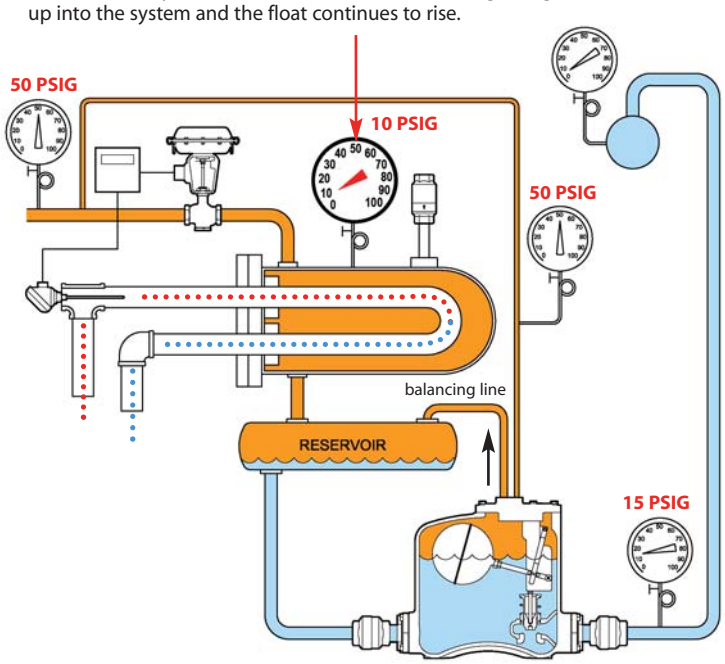


1 TRAPPING Mode: Inlet steam pressure is higher than back pressure. Steam pushes condensate through Pump-Trap.

How a Pump-Trap Works

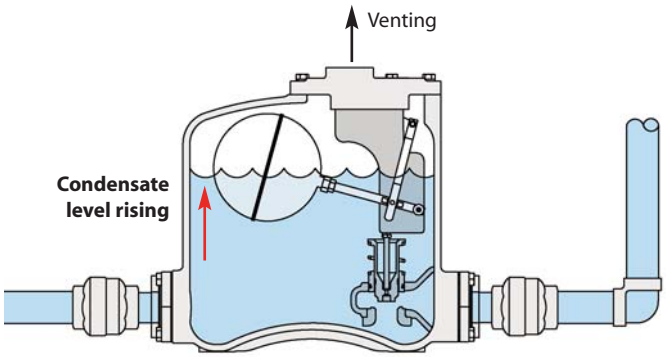
PUMP Mode

The pressure in the HX has now dropped to **10 PSIG**. This was in response to a fall off in demand of hot water. Based on this particular size HX, 10 PSIG steam will heat 32 GPM of water. Since back pressure is 15 PSIG, the system is stalled and condensate is beginning to back up into the system and the float continues to rise.



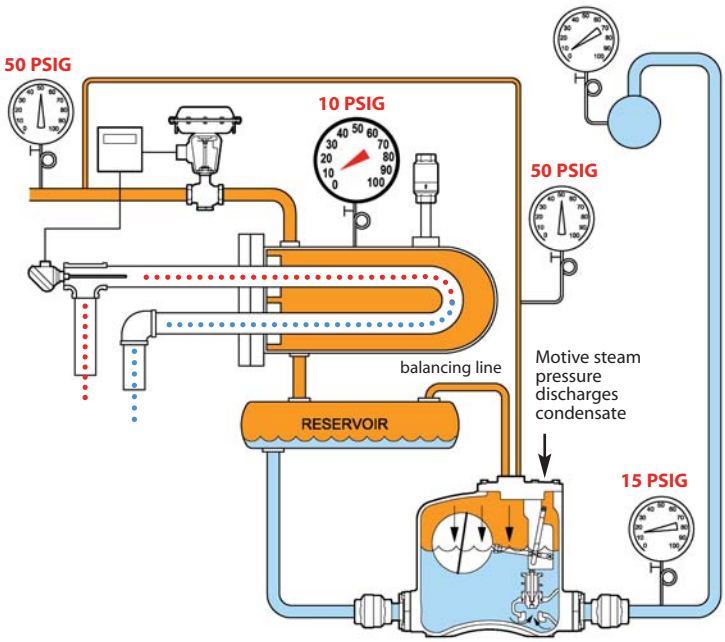
Vent Outlet: Open position, allowing pressure in the pump tank to equal pressure in the heat exchanger, allowing condensate to freely enter Pump-Trap by gravity.

Motive Inlet: Closed position



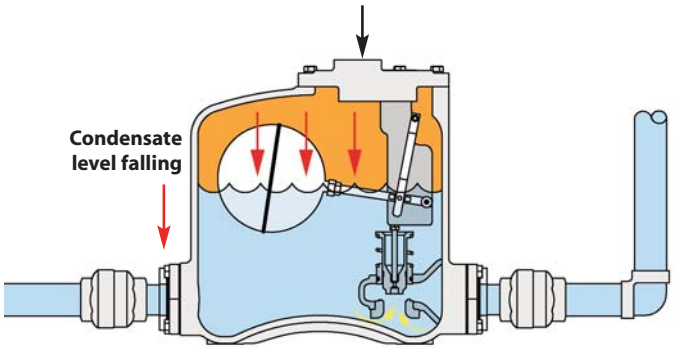
2 PUMP TANK FILLS: Inlet steam pressure falls below back pressure. Steam can no longer push the condensate through the Steam Trap.

Condensate rises to a level that the float triggers the inlet steam valve and closes the vent valve. Full line pressure steam (50 PSIG) enters thru the inlet valve on top of the pump body to discharge the condensate. Because of check valves, condensate will not flow back to HX and is discharged to the condensate return line. Unit will continue to operate and cycle in pump mode as long as pressure in the HX is below back pressure. Pump-Trap will also operate in vacuum conditions.



Vent Outlet: Closed

Motive Inlet: Open; steam pressure (50 PSI) enters tank and discharges condensate.



3 PUMP Mode: Pump is activated. When the pump tank has filled to the trip point, the mechanism triggers, opening the motive gas inlet valve and simultaneously closing the vent valve. This allows motive pressure to enter the pump body, which drives the condensate thru the outlet check valve and into the condensate return line. During the discharge cycle, the liquid level and the float inside the pump tank drop. When the lower trip point is reached, the mechanism closes the motive inlet valve and opens the vent valve so the pump-trap can fill on the next cycle.

Pump & Trap Combination
Internal Steam Trap

PMPT

Model	PMPT	PMPTS
Body	Ductile Iron	Stainless Steel
Cover	Stainless Steel	Stainless Steel
Sizes	1", 1½" NPT	1½" FLG
Check Valves	Stainless Steel	Stainless Steel
PMO Max. Operating Pressure	125 PSIG	125 PSIG
TMO Max. Operating Temperature	366ºF	366ºF
PMA Max. Allowable Pressure	150 PSIG @ 450˚F	150 PSIG @ 450˚F

Steam Trap internal to pump body will function like a normal float trap discharging condensate as its formed. If condensate backs up, the pumping mechanism will use motive steam pressure to discharge the condensate.

Typical Applications

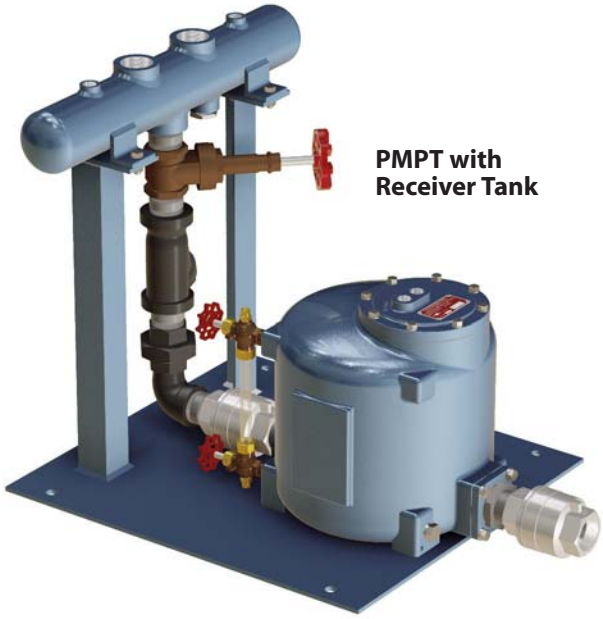
The **PMPT** low-profile pressure motive pump & trap combination has an internal steam trap for draining heat exchangers and other equipment whose steam pressure is modulated by a temperature regulator or a temperature control valve. In these applications the steam pressure in the heat exchanger may not be sufficient to overcome the back pressure in the condensate return line. When this condition occurs, the pressure powered pump takes over and uses high pressure steam supplied to the pump to discharge the condensate. When sufficient pressure does exist, the PMPT functions like a standard steam trap. Its small compact design is perfect for applications with limited space.

Pump-Traps facilitate condensate discharge under all operating conditions, including vacuum.

Features

- Low-profile design allows for condensate drainage of equipment positioned close to the floor
- Equipped with our proven, **Patented "Snap-Assure"** mechanism which extends the useful life of the pump
- Internal mechanism can be removed from the top of the pump while pump remains piped in line
- Mechanism incorporates heat-treated stainless steel wear items
- Dual compression springs made from Inconel-X-750 for high-temperature, corrosive service

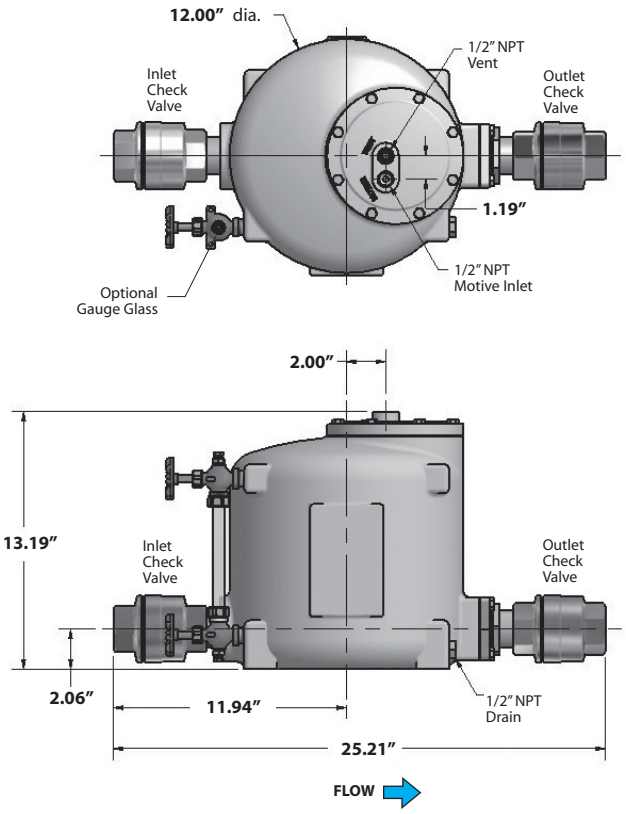
NOTE: Reservoir - Pump-Trap Combination may require a reservoir above the pump to collect condensate generated in the heat exchanger during the discharge cycle of the pump. Consult Reservoir Sizing Guidelines or contact factory for additional information.



PMPT with Receiver Tank

Options

- Horizontal pipe reservoir (recommended)
- Motive and vent piping
- Motive piping components such as steam trap, strainer and regulator
- Packaged systems available with reservoir, base and skid
- Gauge Glass
- Insulation Jacket
- ASME Code Stamp

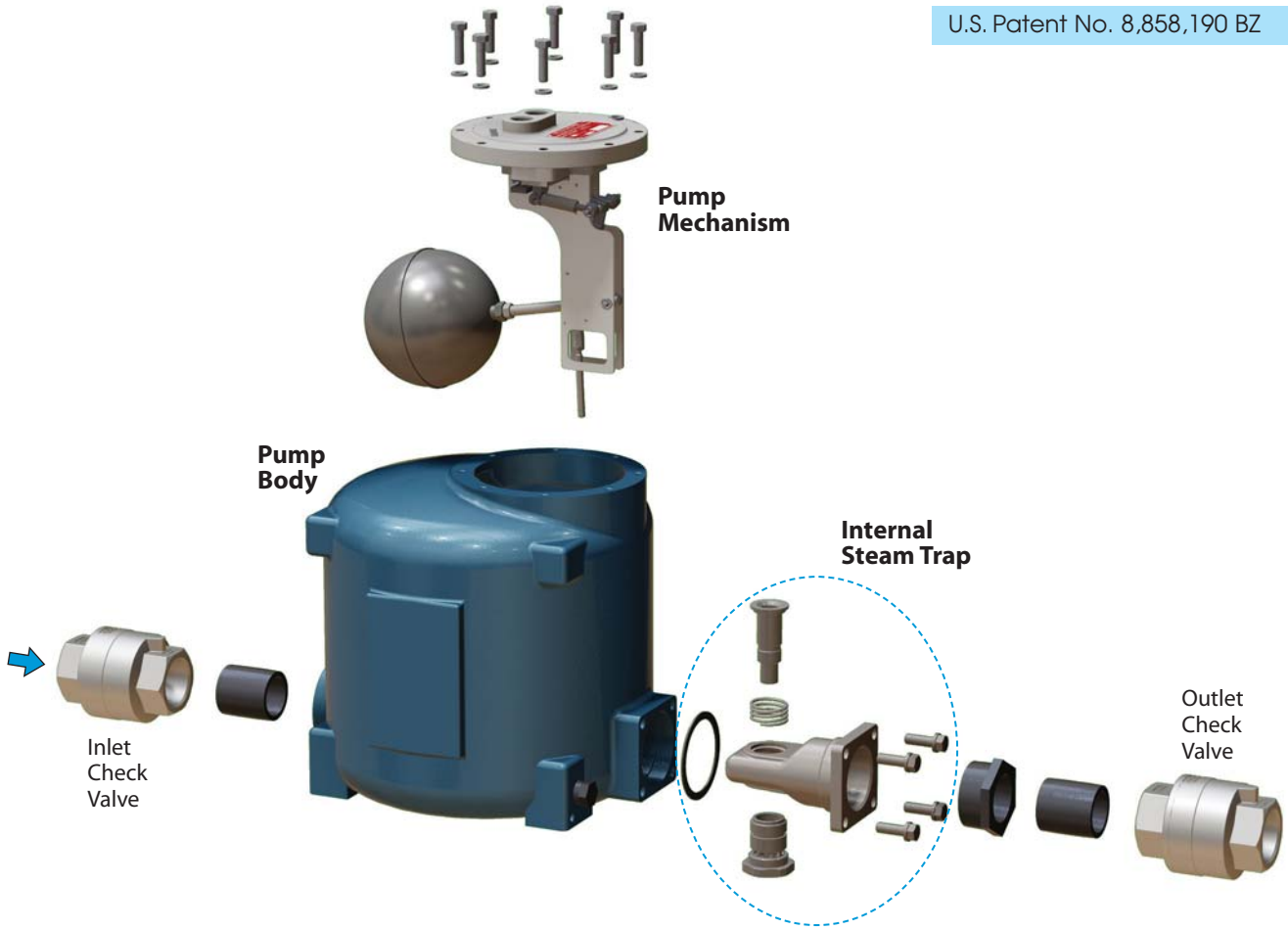


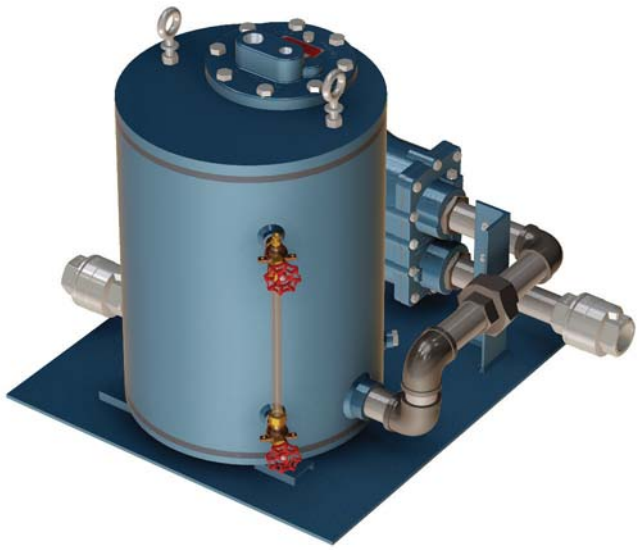
MATERIALS	
Body PMPT	**Ductile Iron SA-395**
Body PMPTS	**Stainless Steel CF3M**
Cover	Stainless Steel CF8
Cover Gasket	Garlock
Cover Bolts	Steel
Inlet Valve	Hardened Stainless Steel 40 Rc
Vent Valve	Hardened Stainless Steel 40 Rc
Ball Float	300 Stainless Steel
Check Valves	Stainless Steel 316SS CF3
Springs	Inconel-X-750
Other Internal Components	Stainless Steel

Size	Model **Code**	PMO **PSI**	Weight **lbs**
Ductile Iron Pump Body (NPT)			
1" x 1"	**PMPT-1X1-N-SS**	125	85
1 1/2" x 1 1/2"	**PMPT-1.5X1.5-N-SS**	125	95
Stainless Steel Pump Body (NPT or 150# FLG)			
1 1/2" x 1 1/2"	**PMPTS-1.5X1.5-N-SS**	125	95
1 1/2" x 1 1/2"	**PMPTS-1.5X1.5-F150-SS**	125	98

The PMPT Pump-Trap consists of pump tank, internal mechanism & trap, and inlet & outlet stainless steel check valves.

U.S. Patent No. 8,858,190 BZ





WPT-Series Pump-Trap Combinations simplify Selection & Installation of Pressure Motive Pumps

- **3 size ranges available**
- **Up to 13,000 lbs/hr of condensate load**

Typical Applications

WPT Pump-Trap Combinations are excellent for draining condensate from heat exchangers and other equipment whose steam pressure is modulated by a temperature regulator or a temperature control valve. In these applications the steam pressure in the heat exchanger may not be sufficient to overcome the back pressure in the condensate return line. When this condition occurs, the pressure powered pump takes over and uses high pressure steam supplied to the pump to discharge the condensate. When sufficient pressure does exist, the WPT functions like a standard steam trap.

Pump-Traps facilitate condensate discharge under all operating conditions, including vacuum.

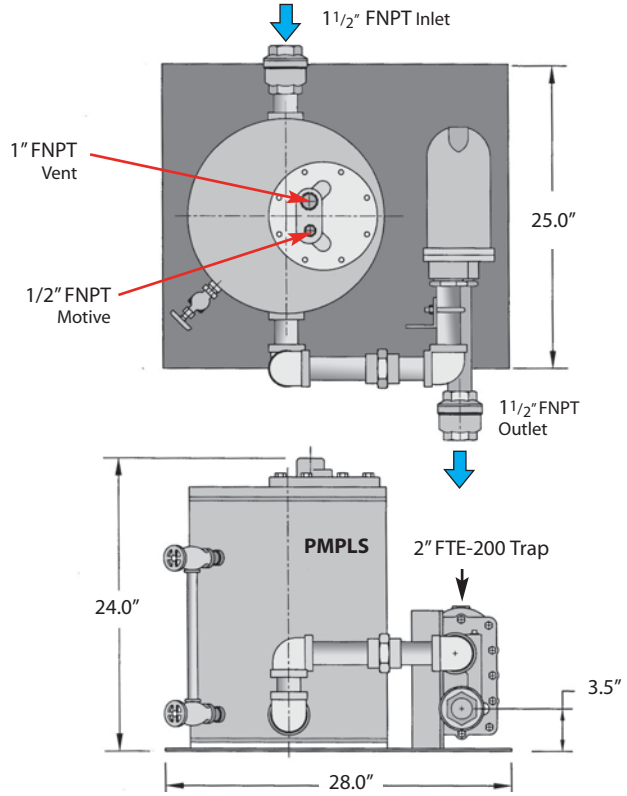
Pump-Trap Features

- Pump and Steam Trap are pre-mounted together on a single base for easy installation
- Higher capacities than Pump-Trap combinations with internal steam traps (PMPT)
- Engineering and selection is simplified using a pre-mounted system

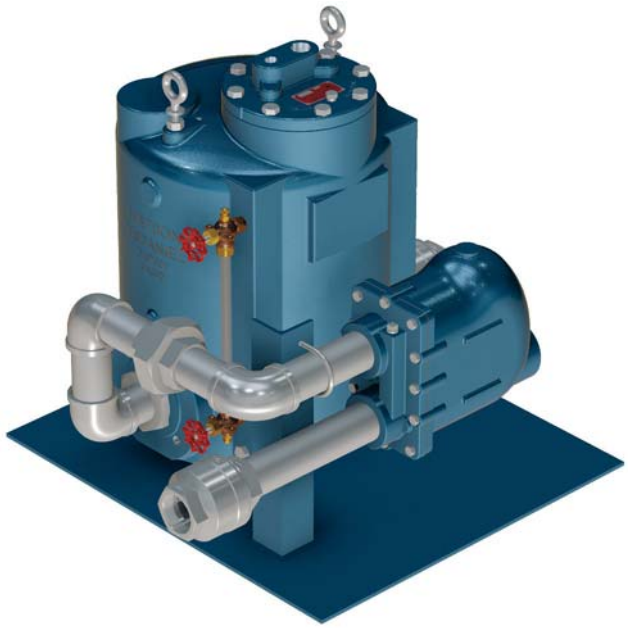
NOTE: Reservoir - Pump-Trap Combination may require a reservoir above the pump to collect condensate generated in the heat exchanger during the discharge cycle of the pump. Consult Reservoir Sizing Guidelines or contact factory for additional information.

WPT3 • 1 1/2 x 1 1/2

(**PMPLS** with 2" FTE-200 Steam Trap)

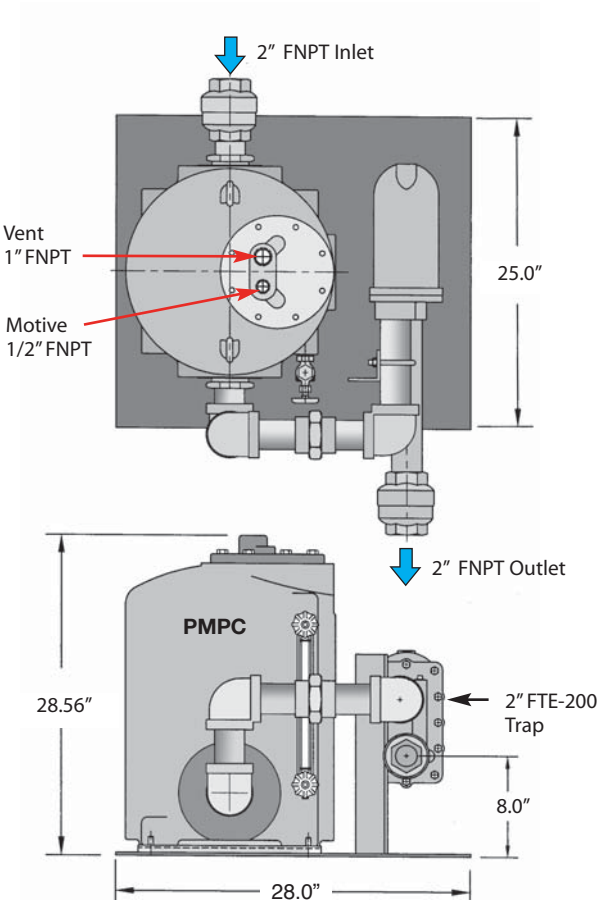


MATERIALS	WPT3		WPT4		WPT5	
	Pump	Trap	Pump	Trap	Pump	Trap
Body	**Carbon Steel**	**Ductile Iron SA-395**	**Ductile Iron SA-395**	**Ductile Iron SA-395**	**Ductile Iron SA-395**	**Ductile Iron SA-395**
Cover	Carbon Steel	Ductile Iron SA-395	Ductile Iron SA-395	Ductile Iron SA-395	Ductile Iron SA-395	Ductile Iron SA-395
Cover Gasket	Garlock	Garlock	Garlock	Garlock	Garlock	Garlock
Cover Bolts	Steel	Steel	Steel	Steel	Steel	Steel
Inlet Valve	17-4 Ph SS 40 Rc	n/a	17-4 Ph SS 40 Rc	n/a	17-4 Ph SS 40 Rc	n/a
Vent Valve	17-4 Ph SS 40 Rc	n/a	17-4 Ph SS 40 Rc	n/a	17-4 Ph SS 40 Rc	n/a
Ball Float	304 SS	304 SS	304 SS	304 SS	304 SS	304 SS
Check Valves	316 SS	n/a	316 SS	n/a	316 SS	n/a
Springs	Inconel-X-750	n/a	Inconel-X-750	n/a	Inconel-X-750	n/a
Other Internal Components	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel



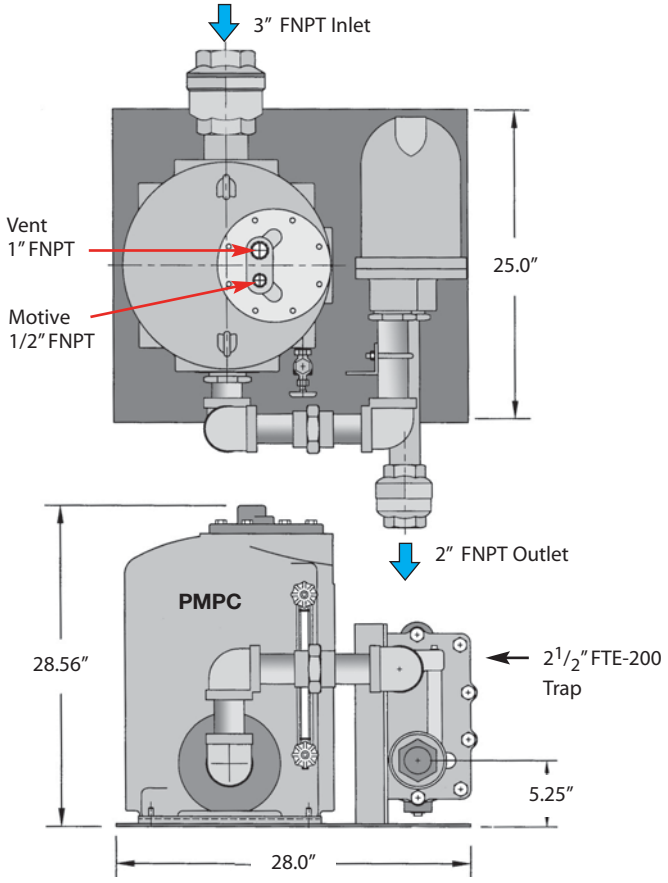
WPT4 • 2″ x 2″

(**PMPC** with 2″ FTE-200 Steam Trap)



WPT5 • 3″ x 2″

(**PMPC** with 2 1/2″ FTE-200 Steam Trap)



PMPT & WPT Pump-Trap Combinations (Operating in **Pump** Mode)

PUMP CAPACITIES – *Condensate (lbs/hr); using steam as a motive pressure*

Motive Pressure (PSIG)	Total Back Pressure (PSIG)	PMPT 1" x 1" 6" Fill Head	PMPT 1 1/2" x 1 1/2" 6" Fill Head	WPT3 1 1/2" x 1 1/2" 12" Fill Head	WPT4 2" x 2" 12" Fill Head	WPT5 3" x 2" 12" Fill Head
5	2	1,064	1,850	1,310	2,320	4,270
10	5	1,049	1,824	1,760	3,740	6,230
10	2	1,200	2,087	2,350	5,640	9,450
25	15	1,026	1,784	2,700	4,690	7,230
25	10	1,151	2,002	3,020	5,970	9,370
25	5	1,257	2,186	3,780	6,850	11,400
50	40	877	1,525	2,090	3,410	5,040
50	25	1,115	1,939	3,620	6,650	10,200
50	10	1,286	2,237	4,080	7,140	11,500
75	60	882	1,533	2,250	3,730	5,660
75	40	1,102	1,916	3,470	6,010	8,770
75	15	1,298	2,257	4,390	7,920	12,400
100	80	884	1,538	2,620	4,390	6,140
100	60	1,058	1,841	3,390	5,780	8,120
100	40	1,192	2,074	4,310	6,940	10,000
100	15	1,331	2,314	4,620	8,000	12,300
125	115	737	1,281	2,280	3,490	4,440
125	100	886	1,541	2,880	4,420	5,720
125	80	1,030	1,792	3,520	5,700	7,630
125	60	1,146	1,992	4,110	6,880	9,390
125	40	1,243	2,161	4,910	7,800	11,100
125	15	1,351	2,350	5,120	8,420	12,900
150	120	-	-	2,560	3,640	5,100
150	100	-	-	3,020	4,610	6,270
150	80	-	-	3,630	5,780	8,140
150	60	-	-	4,230	6,910	9,920
150	40	-	-	4,830	7,930	11,700
150	15	-	-	5,230	8,590	13,300

PMPT & WPT Pump-Trap Combinations (Operating in **Trap** Mode)

TRAP CAPACITIES – *Condensate (lbs/hr)*

Differential Pressure (PSI)	PMPT	WPT3 & WPT4	WPT5
1/4	1,511	2,770	7,200
1/2	2,137	4,100	12,300
1	3,020	5,700	17,400
2	4,030	7,400	25,400
5	4,354	9,900	27,600
10	4,841	11,800	32,600
15	5,150	13,400	36,000
20	5,686	14,400	39,300
30	6,425	16,400	43,100
40	7,711	18,000	46,600
50	8,000	19,000	49,200
75	9,100	21,000	54,700
100	10,334	23,000	58,800
125	11,451	24,500	61,900
200	NA	29,200	74,000

Recommended Reservoir sizes for Pump-Trap Applications

RESERVOIR PIPE LENGTH in feet (ft)

Condensate Load (lbs//hr)	Reservoir Pipe Size (Diameter) 3"	4"	6"	8"	10"
0-500	2'				
1,000	2'				
1,500	3'	2'			
2,000	3.5'	2'	1'		
3,000		3'	2'		
4,000		4'	2'	1'	
5,000		6'	3'	2'	
6,000			3'	2'	
7,000			3'	2'	
8,000			4'	2'	
9,000			4.5'	3'	2'

Pump-Trap Sizing:

When the steam pressure in the heat exchanger is higher than the return line back pressure, the PUMP-TRAP functions like a standard float-operated TRAP, allowing the steam pressure in the heat exchanger to discharge the condensate. Under these conditions, the unit is in TRAP mode. When the steam pressure in the heat exchanger falls below the back pressure, the condensate backs up into the body of the pump-trap, raising the float and opening the motive steam inlet valve, which then pumps the condensate into the return line. Under these conditions, the unit is in PUMP mode. We therefore have two separate and distinct capacities; the **PUMP CAPACITY** (when operating in Pump Mode) and the **TRAP CAPACITY** (when operating in Trap Mode).

In the example below, the system will be analyzed to determine when the Pump-Trap is in Trap Mode and when it is in Pump Mode, and the specific capacity requirement of the pump. If the total back-pressure of the condensate return line is known, the Pump-Trap should be selected with sufficient pump capacity to handle the condensate load at the system stall point. (i.e.; when the steam pressure is equal to the total back-pressure). Alternatively, if the total back-pressure is not known, it is best to select a pump-trap with enough pump capacity to handle the maximum condensate load of the application. (i.e., at maximum steam pressure and flow). Refer to Sizing Charts.

Reservoir Sizing: (Refer to chart on previous page)

When using a Pump-Trap, a condensate holding reservoir should be installed above the pump-trap and below the heat exchanger (shown below). This will enable the condensate to collect while the pump is in the discharge cycle, thus preventing condensate backup. When back pressure against the pump outlet is less than 50% of the steam pressure to the heat exchanger, the pipe lengths given in the chart can be reduced by half.

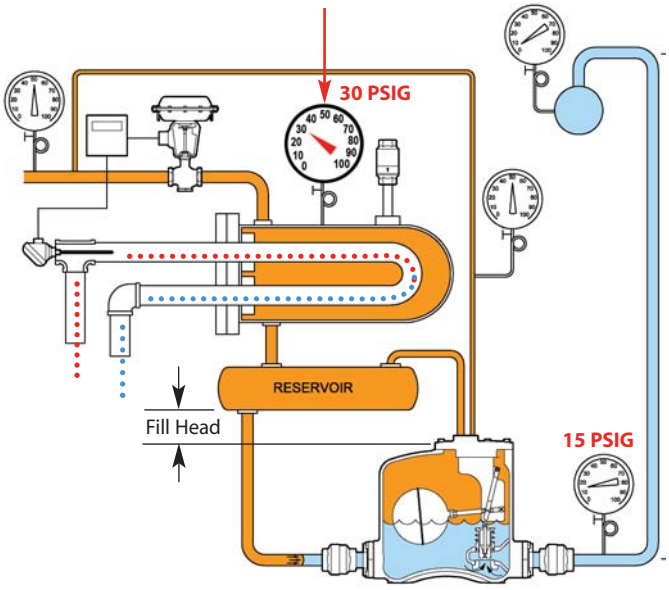
Heat Exchanger (HX) using Steam to heat Hot Water

The following example describes a Heat Exchanger (HX) using Steam to heat domestic hot water for a medium size apartment complex. Note that the hot water usage varies significantly depending on the time of day. The physical size of the heat exchanger needed (sq. ft. of surface area) is based on the following criteria: **(1)** MAXIMUM water usage (GPM), **(2)** the temperature rise of the water, and **(3)** what pressure steam will be used to heat the water during maximum demand.
Note: The selection of the steam pressure (which determines the steam temperature), to heat the water at maximum demand (flow rate), is the primary factor in heat exchanger sizing.

The application is requiring water to be heated from **45˚F** to **140˚F** in a HX using Steam. The maximum flow rate has been determined to be **60 GPM**. The Steam Trap will be discharging into a condensate return line that may have a Total Back Pressure of **15 PSIG** and the flow rate of heated water could be as low as **20 GPM**. The facility engineer has chosen to base the HX size on using **50 PSIG** of steam pressure. Therefore, the size of the heat exchanger was selected based on heating **60 GPM** of water using **50 PSIG** of steam.

TRAP Mode

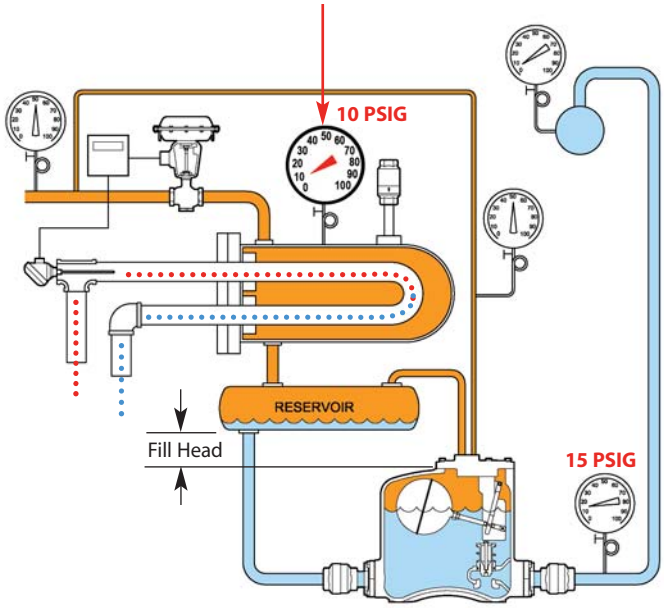
The system is operating with **30 PSIG** inlet pressure to the heat exchanger. The Pump-Trap unit functions like a standard float operated trap. Condensate is pushed thru into the return line by the steam pressure in the HX. Based on this particular size HX, 30 PSIG steam will heat 53 GPM of water.



ΔP Trap = 30 psig - 15 psig
= 15 psi

PUMP Mode

In response to a reduction in demand of hot water, the pressure in the HX has now dropped to **10 PSIG**. Based on this particular size HX, 10 PSIG steam will heat 43 GPM of water. Since back pressure is **15 PSIG**, the system is stalled and condensate backs up into the system; the float will continue to rise to activate the pump and discharge the condensate.



Summary of conditions for a Heat Exchanger (HX) using Steam to heat Water

Set of conditions used to size the Heat Exchanger:

1)	Maximum Flow of Hot Water		=	**60 GPM**
2)	Water temperature required	T_o	=	**140˚F**
3)	Steam Pressure in Heat Exchanger		=	**50 PSIG**
4)	Temperature of 50 PSIG Steam	T_s	=	**298˚F**
5)	Inlet Water Temperature	T_i	=	**45˚F**
6)	Temperature Rise of Water (140˚ F - 45˚F = 95˚ F)		=	**95˚F**

What is the Heat Transfer Rate (E) to heat 60 GPM of water from 45˚to 140˚F?

$$E \left[\frac{Btu}{hr}\right] = \textbf{Water Flow Rate} \text{ (GPM) x } \textbf{500} \text{ x } \textbf{Temp Rise } (^{\circ}F)$$

$$= 60 \times 500 \times [140^{\circ} - 45^{\circ}F]$$

$$= \textbf{2,850,000} \text{ Btu/hr}$$

How much Steam Flow is required?

$$Q_s \text{ (steam)} = \frac{E}{LH} \quad \text{(For 50 psi steam, the LH is 912 Btu/lb)}$$

$$= \frac{2{,}850{,}000 \text{ Btu/hr}}{912 \text{ Btu/lb}}$$

$$= \textbf{3,125} \text{ lbs/hr}$$

$$E = U \times A \times \Delta T$$

Fundamental formula for heat transfer and the basic formula for HX sizing

The formula shows that the heat transfer rate (**E**) between the hot steam and cold water is directly proportional to the Surface contact area (**A**) inside the HX and the difference in temperature between the steam and water (ΔT). The more surface area (larger HX) the more heat will get transferred or the hotter the steam temperature (higher pressure) the more heat will get transferred.

E = **Heat Transfer Rate** in Btu/hr of the energy in the steam to the water. The flow of steam (Q_s) required in lbs/hr is determined by dividing **E** by the Latent Heat of Steam (LH) in Btu/lb.

U = is referred to as the **Overall Heat Transfer Coefficient**. This depends on the HX type and the materials involved. Typical **U** values are 120 for Stainless Steel and 200 for Copper. We will use 120 for Stainless Steel HX.

A = The internal **Surface Area** (size) of the HX in Sq. Ft. The size of a HX is determined by the surface contact area between the Steam and Water.

ΔT = **Average Temperature Difference** between Steam & Water. Since the water temperature changes as it flows thru the HX, we need to use the average temperature difference between the steam temperature and the water temperature. See formula below:

Average Temperature Difference

$$\Delta T = \frac{(T_s - T_i) + (T_s - T_o)}{2}$$

$$= \frac{(298 - 45) + (298 - 140)}{2}$$

$$\Delta T = \textbf{205˚F} = \text{Avg Temp. Difference}$$

Heat Exchanger Size

$$E = U \times A \times \Delta T$$

Above formula is rearranged to solve for **A**:

$$A = \frac{E}{U \times \Delta T}$$

$$= \frac{2{,}850{,}000}{120 \times 205}$$

$$A = \textbf{116} \text{ (sq ft.)}$$

The actual size of a Heat Exchanger depends on many factors; however, based on the criteria given, **116** sq. ft of surface area is required to heat 60 GPM of water from 45˚F to 140˚F, based on a steam pressure of 50 PSIG.

Stall Condition:
When the steam pressure in the HX is equal to the back pressure of **15 PSIG**, the condensate will no longer drain out of the HX. The Pump-Trap will now need to operate in Pump Mode to remove the condensate from the HX. We need to calculate how much condensate will be produced when there is **15 PSIG** in the HX.

$$\Delta T = \frac{(T_s - T_i) + (T_s - T_o)}{2}$$

[From the steam table, 15 PSIG steam has a temp of 250°F]

$$= \frac{(250 - 45) + (250 - 140)}{2}$$

ΔT = 157.5° F = Avg Temp. Difference

To find out how much energy will be transferred to the water, we use the **ΔT** calculated above in our heat transfer equation.

E = U x A x ΔT
= 120 x 116 x 157.5
= **2,192,400** Btu/hr

To determine how much steam is required to heat the water, we use the following formula. (LH = Latent Heat.)

$$Q_s \text{ lbs/hr} = \frac{E}{LH} = \frac{2{,}192{,}400}{946}$$

(For 15 psig steam, the LH is 946 Btu/lb)

Steam Flow = **2,318** lbs/hr

When the HX stalls, we will be using 2,318 lbs/hr of steam and will need to pump 2,318 lbs/hr of condensate. The pump-trap must be sized to handle this condensate load since it is the maximum load under stall conditions (see table below).

Table based on a HX size of 116 ft² and back pressure of 15 PSIG

The following table summarizes the above results and shows how the steam flow, pressure, temperature and latent heat vary as a function of the water flow rate. It can be seen that the system is operating in **Trap Mode** between water flow rates of 60 to ~46 GPM, and in **Pump Mode** between ~46 to 20 GPM (based on 15 PSIG back pressure). Also, at flow rates below 35 GPM, the steam pressure inside the HX is below atmospheric pressure (0 PSIG).

Flow Rate Water (GPM)	Steam Usage (lbs/hr)	Steam Pressure in HX (PSIG)	Steam Temp in HX (°F)	Latent Heat of Steam (Btu/lb)	Condensate Generated (lbs/hr)	Trap Differential Pressure (PSI)	System Condition	
60	**3,125**	**50**	**298**	**912**	**3,125**	**35**		**(Maximum Heat Load)**
57.0	2,943	40	287	920	2,943	25	**Trap Mode**	
53.2	2,720	30	274	929	2,720	15		
48.8	2,466	20	259	940	2,466	5		
46.2	**2,318**	**15**	**250**	**946**	**2,318**	**0**	**(Stall Point)**	**Steam Pressure = Back Pressure**
42.9	2,140	10	239	953	2,140	---	**Pump Mode**	
35.0	1,715	0	212	970	1,715	---		
29.2	1,409	-5	192	983	1,409	---	(Vacuum)	
20	**948**	**-10**	**161**	**1,002**	**948**	---		**(Minimum Heat Load)**