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.

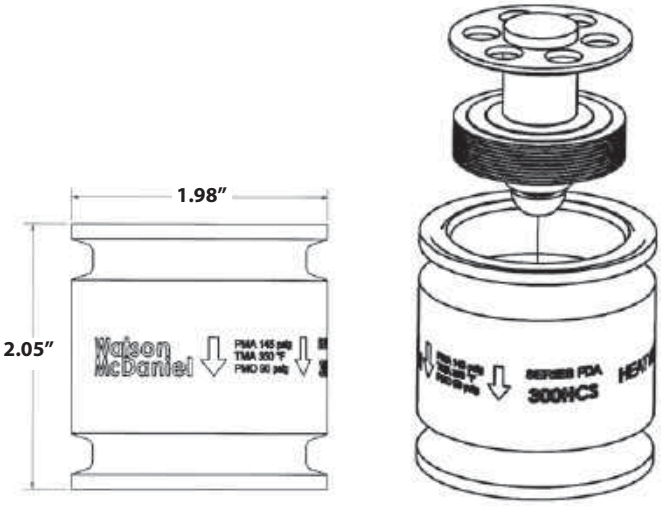
Clean Steam Thermostatic Steam Trap (Repairable)

High-Capacity Sanitary

FDA300

Thermostatic Clean Steam

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.

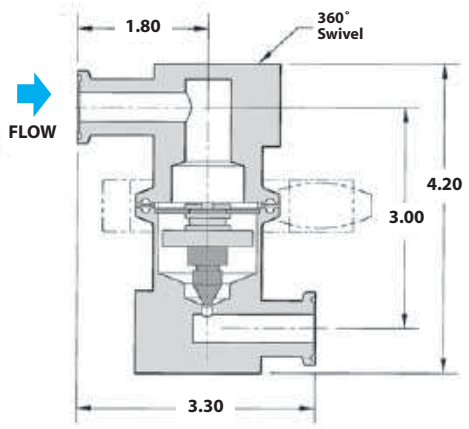
Clean Steam Thermostatic Steam Trap

(Repairable)

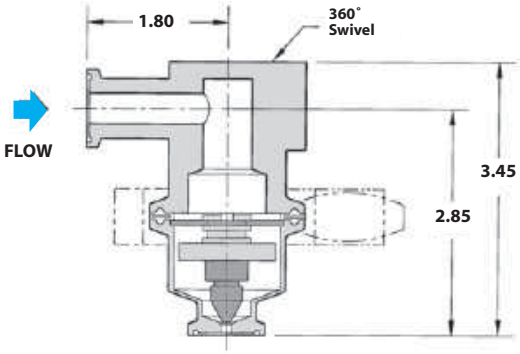
FDA400 Series **Connections: 1/2" & 3/4"**

Units: inches

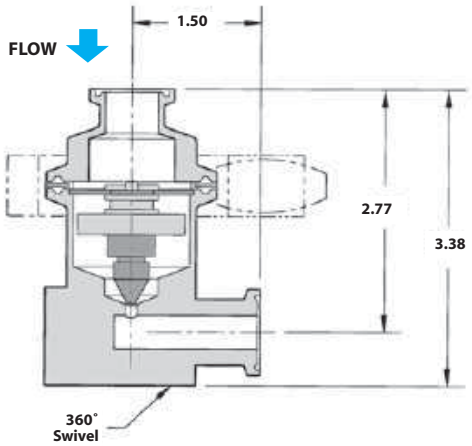
FDA401 9/64" Orifice (0.141) **Inlet: 90° Angle**
FDA411 5/16" Orifice (0.312) **Outlet: 90° Angle**



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

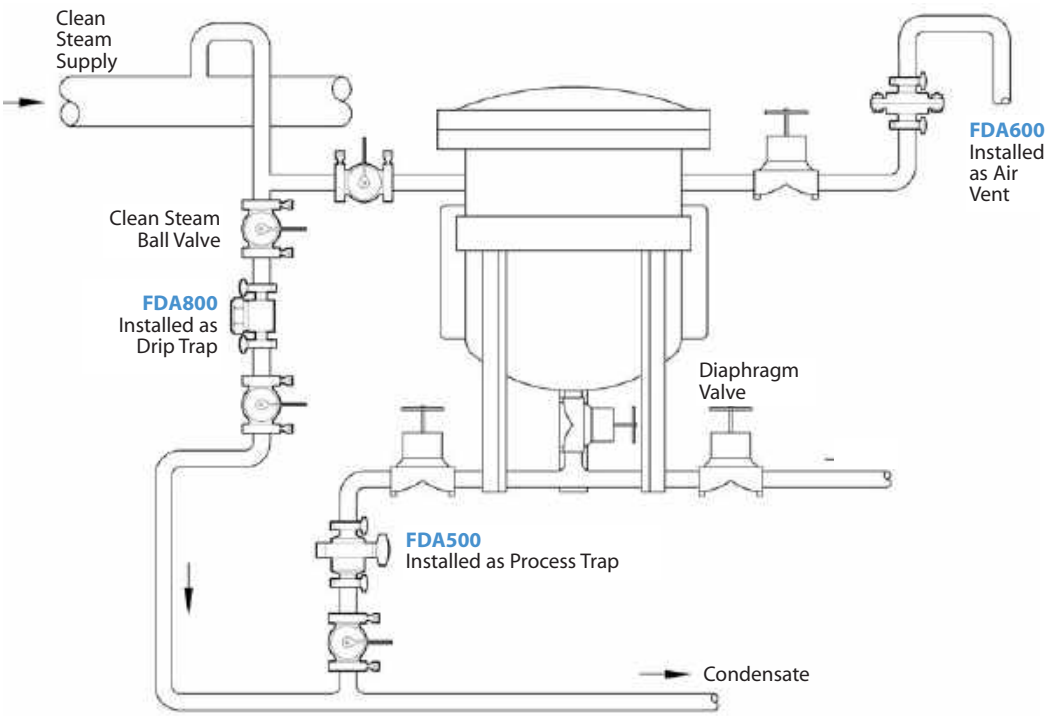
CAPACITIES – *Condensate (lbs/hr)*

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)

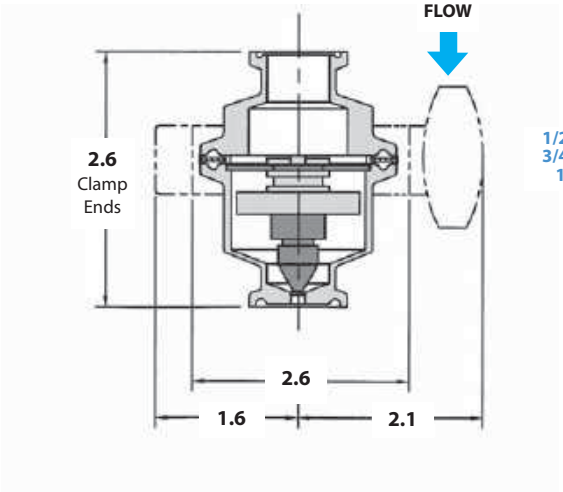
Typical Clean Steam Application



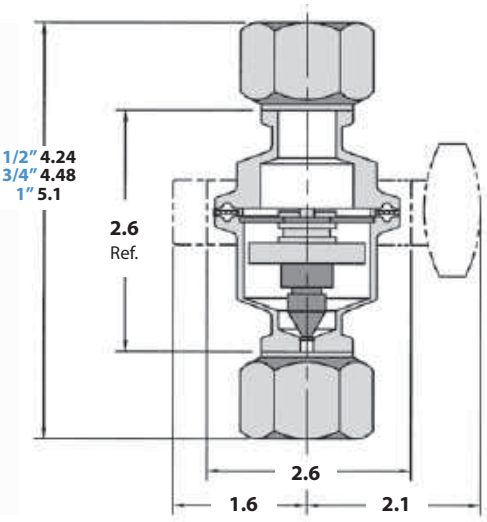
FDA500 Series **Connections: 1/2", 3/4" & 1"**

Units: inches

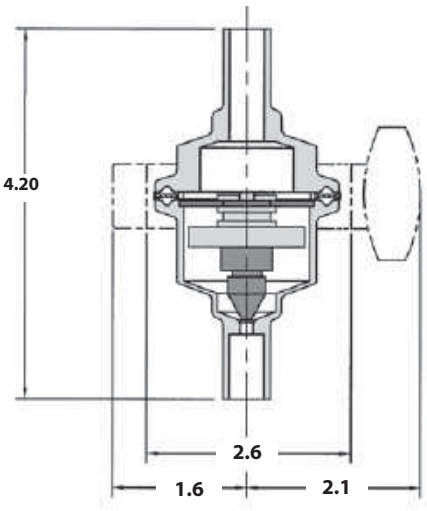
Tri-Clamp Connection: TC x TC



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

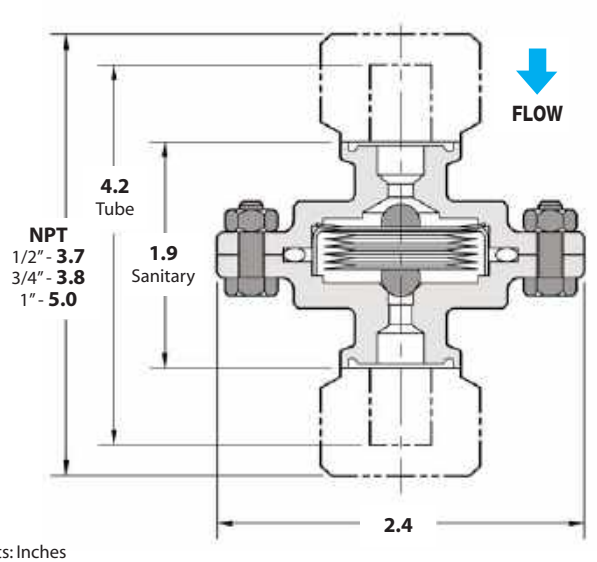
- All wetted parts are 316L stainless steel
- Operates close to saturation curve to minimize condensate back-up
- Completely self-draining in the vertical downward flow orientation

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

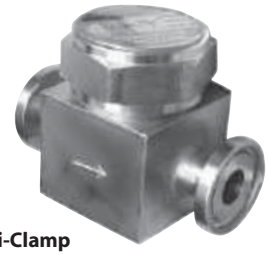
Clean Steam Thermodynamic Steam Trap

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.

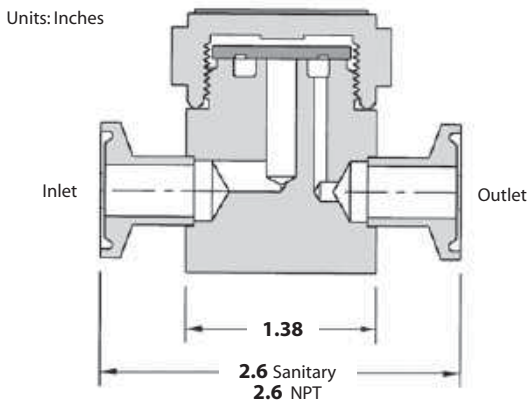
Installation and Maintenance

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.*