SteamTech Holdings Co., Ltd.

ST Nozzle Steam Trap and Zero Steam Leak Unit Product Overview

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INDUSTRIAL DEVELOPMENT ORGANIZATION

SteamTech Holdings Co., Ltd.

J-ESCO

Support Ukraine's reconstruction!
Transfer technology to Ukraine!
Promote technology transfer from Ukraine to the EU!

Steam Tech Holdings has been selected as a contractor for the Green Industrial Recovery Programme for Ukraine promoted by the United Nations Industrial Development Organization (UNIDO).

For more details, please visit the page on the UNIDO website that features information about us.

We are currently operating in Ukraine with the cooperation of various organizations, including the Japanese Ministry of Foreign Affairs, the Ministry of Economy, Trade and Industry, and JETRO.
We are promoting international cooperation to transition to a circular economy, which is characterized by lower environmental impact, environmentally friendly production and products, and superior energy and resource efficiency, by leveraging technologies and expertise suited to sustainability, energy conservation, and carbon dioxide emission reduction.

Uses of Steam

Steam traps are installed in large numbers in equipment that indirectly uses steam as an energy transfer medium and in the lines connected to such equipment.

Power source

- Steam locomotive
- Power plant steam turbines, etc.

Steam turbine

Heat source

Direct

Steaming: Steam oven, sterilization and disinfection applications, vulcanization of rubber products, etc.

Steaming baskets

Indirect

A heating method that uses a heat exchanger. The heat from the steam is transferred to the material to be heated through the walls of the heat exchanger. Therefore, the steam does not come into direct contact with the material to be heated.

Plate-type heat exchanger | Steam-jacketed kettle | Finned tube

Uses of Steam

Steam is used as a medium for energy transfer.
Steam has the following characteristics.

- **Adjusting the pressure allows for physically accurate temperature control.**
- **It helps avoid fire hazards associated with electricity and gas.**
- **While electricity imposes significant losses in transferring energy through a process involving fuel, power generation, transmission, and heating, steam allows for efficient energy utilization in equipment by transferring energy from the fuel directly into steam.**
- **While direct use of gas makes it difficult to control and maintain uniform temperatures, indirect use via steam makes temperature control easier.**

Consequently, steam is widely used in medium- and large-scale plants that require stable temperatures up to about 500°C.

Chemistry

- Petrochemical: Thermal cracking and distillation processes.
- Pharmaceuticals: Drying and heat treatment.
- Petroleum products: Component separation in distillation columns.
- Coal products: Gasification process.

Food

- Food manufacturing: Sterilization and heat treatment.
- Beverage manufacturing: Sterilization and heat treatment.
- Feed manufacturing: Drying and heat treatment.
- Fermented foods: High-pressure short-time steam cooking and expansion processing.

Plastics and Rubber

- Plastic manufacturing: Mold cooling.
- Rubber and tire manufacturing: Heating and molding processes.

Pulp and Paper

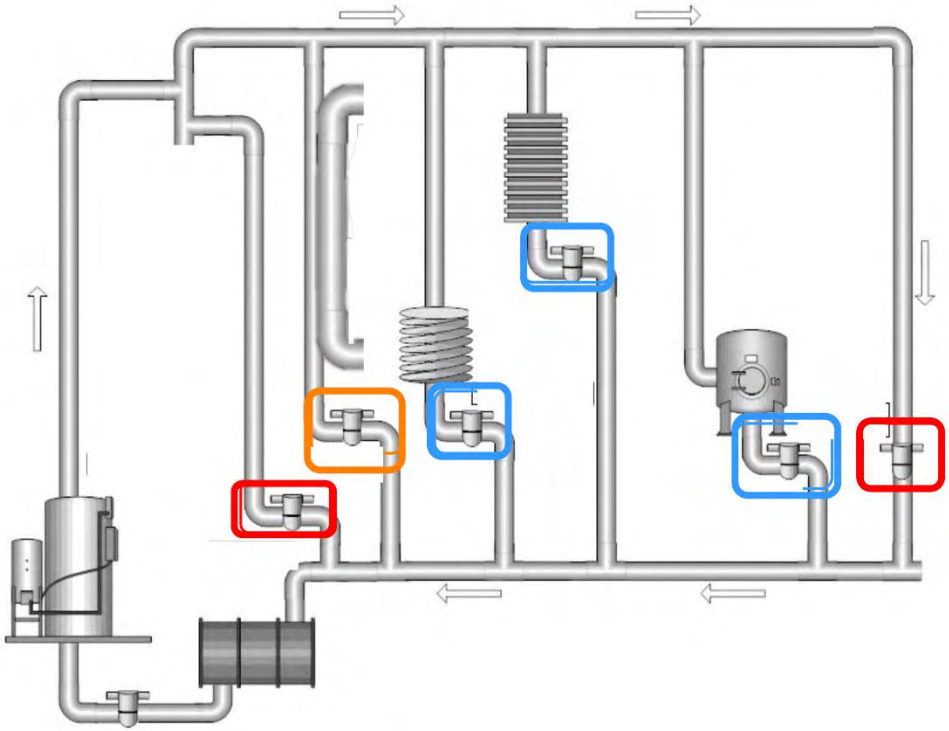
- Pulp production: Drying and heating wood.
- Paper manufacturing: Drying and forming processes.
- Paper converting: Forming and folding processes.

Textile

- Textile manufacturing: Dyeing and finishing.
- Dyeing process: Dyeing and drying processes.

Steam Traps

Steam generated by the boiler is cooled within the piping or used to provide heat for the process and then condensed into water.
A steam trap is a device used to discharge the appropriate amount of condensate to prevent it from accumulating.



- **Steam distribution piping: Ensures a stable supply of high-quality steam to equipment**
- **Steam-powered equipment: Maximizes productivity, enables quick startup, and prevents quality inconsistencies**
- **Trace line: Maintains the fluid inside the product piping at a constant temperature**

Required Features

- **Discharge condensate.**
- **Minimize steam leakage as much as possible.**

It is generally estimated that energy losses of 10% to 30% or more occur between the steam transport and the secondary side of the process equipment.

Types of Steam Traps

1. Intermittent-discharge (mechanical) steam traps

Bucket steam traps

Disc steam traps

Bimetallic steam traps

Free float steam traps
*A system that partially incorporates elements from a continuous steam trap

(1) Raw steam escapes when the valve operates.
→ Caused by a time lag when the valve closes, a high safety factor, etc.
(2) Age-related deterioration, loss of performance, and malfunctions due to mechanical wear and tear.
→ Caused by wear on the valve and seal components, mechanical malfunctions, etc.
(3) Shock and vibration occur when discharging accumulated condensate.
→ This can cause problems not only with the trap itself but also with the piping system.
(4) Consumable.
→ After about 2 to 4 years, it loses its initial performance, and steam leak becomes excessive.

2. Continuous-discharge steam traps

Orifice steam traps

ST nozzle steam traps

Disc steam traps

Free float steam traps

Bellows steam traps

Bucket steam traps

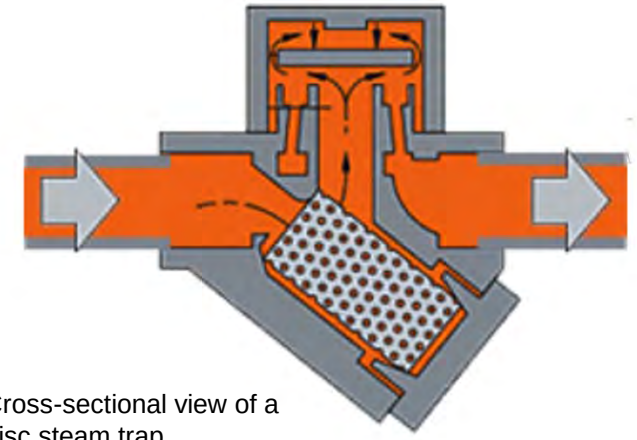
Nozzle steam traps

Orifice steam traps

Advantages and Disadvantages of Mechanical Steam Traps

Advantages

A mechanical steam trap can accommodate changes in condensate volume and pressure as long as they remain within its set range.



Cross-sectional view of a disc steam trap

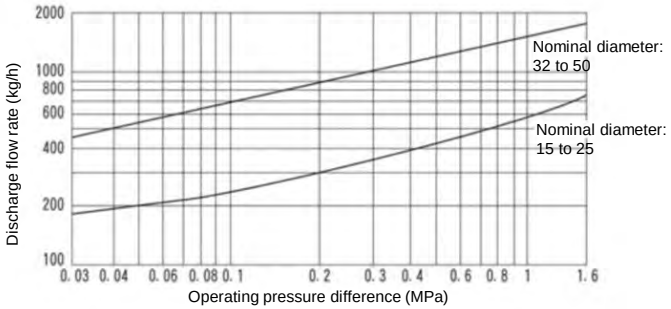
Problems

Steam leakage is unavoidable due to the structural design

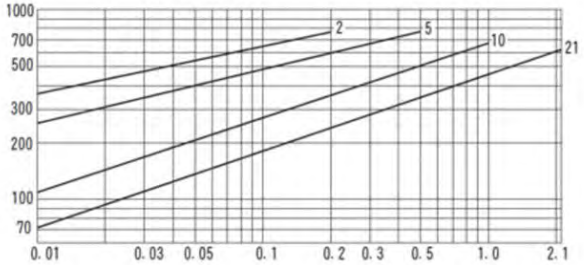
To prevent steam hammers caused by pressure fluctuations associated with the opening and closing of the trap, it is necessary to discharge condensate completely, and this inevitably results in steam leakage.

Lubrication aids (such as grease and bearings) cannot be used even in operations that would normally require them because the condensate detection mechanism and the valve structure are located close together, creating a high-temperature, high-pressure environment.
Although clearances are provided instead, the service life is short and steam leaks occur due to age-related deterioration.

Steam leaks can occur also due to lodged or accumulated debris.
In addition, steam leaks often occur because the discharge flow rate is too high for the device to keep up.



Disc steam trap discharge capacity chart



Free float steam trap discharge capacity chart

Misconceptions About Mechanical Steam Traps

Risks associated with mechanical steam traps

Common perception

Compared to continuous-discharge steam traps, mechanical steam traps simply produce more steam leakage when a problem occurs; there is no risk of clogging causing the process to shut down.

Statistically speaking, that is true, but it is not always the case.

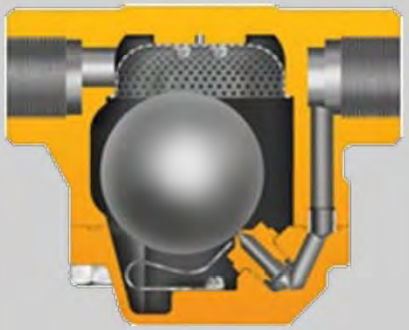
There are two types of malfunctions: steam leakage and clogging.

Problems with free float steam traps

Common perception

Free float steam traps combine the advantages of both mechanical and continuous-discharge steam traps, and do not have the problems mentioned above.

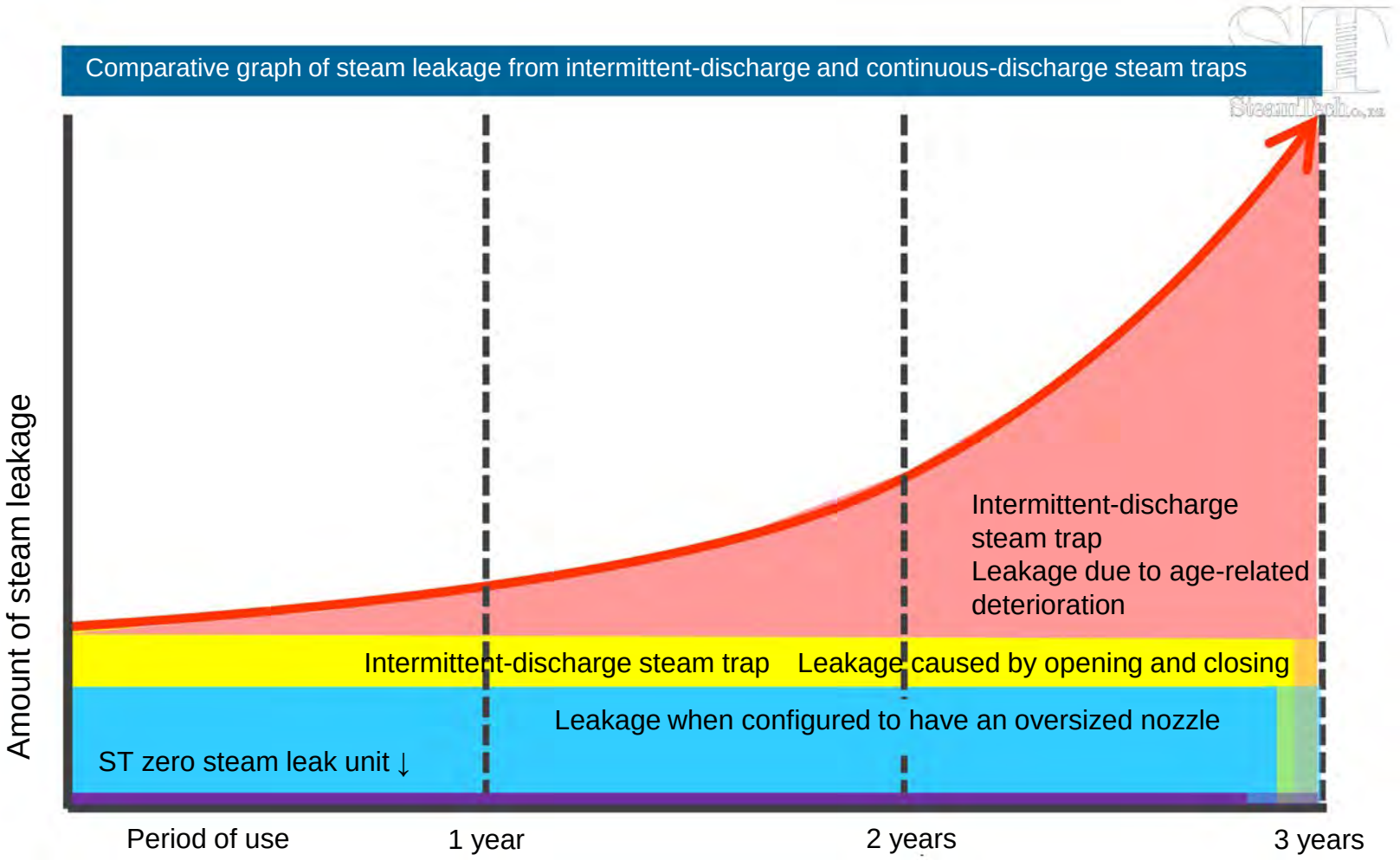
While free float steam traps have relatively few steam leaks, they also inherit the problems of both types and do not help in resolving these problems at all.



The float can also malfunction.

Steam Leakage by Type

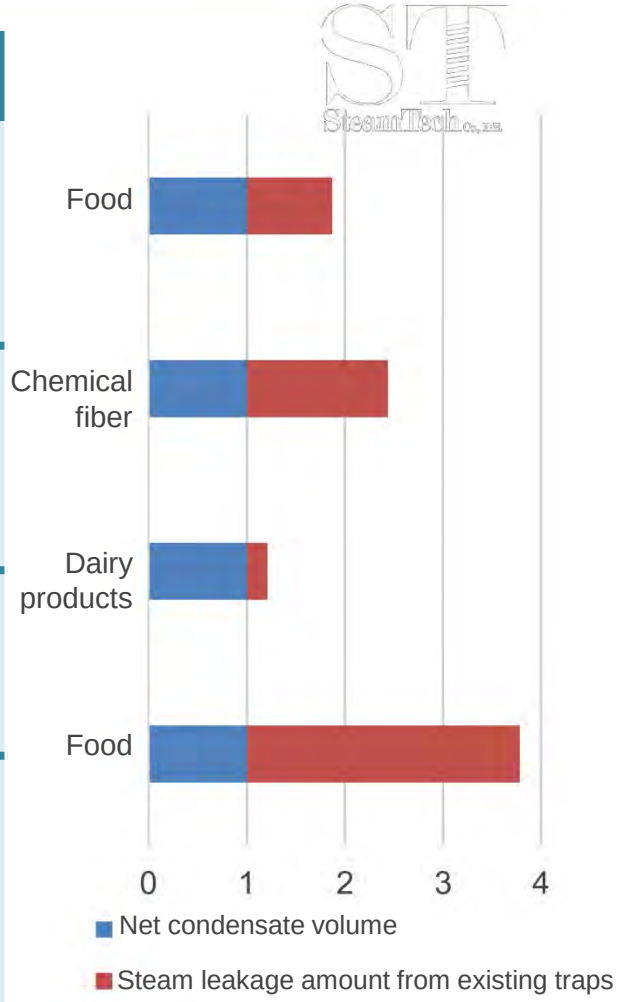
Compared to intermittent-discharge steam traps, significant reductions are possible, as shown in the graph. The reduction rate varies depending on the maintenance status of existing traps and how long they have been in place.



Actual Measurements of Steam Leakage from Intermittent-Discharge Steam Traps

Steam leakage occurs even when the device is new, and the amount increases over time

Installation plant	Installation location	**Leakage rate**
Major food processing plant	Batch process Disc steam traps (2 months after installation)	**87%**
Major chemical fiber plant	Steam headers Bucket steam traps (1 year after installation)	**144%**
Major dairy processing plant	Air supply lines Disc steam traps (New)	**21%**
Major food manufacturer	Steam headers Thermostatic steam traps (2 years after installation)	**278%**



Advantages and Disadvantages of Orifice Steam Traps

Advantages

No steam leaks caused by reasons similar to those of intermittent-discharge steam traps.
(e.g., leakage due to the opening and closing of the valve, age-related deterioration, and lodged debris)

Problems

Cannot accommodate changes in condensate volume and pressure

Possibility of clogging due to debris, leading to condensate accumulation in the air supply line and a process shutdown.

Holes are gradually enlarged by flash steam and corrosion over time, leading to an increase in discharge volume.

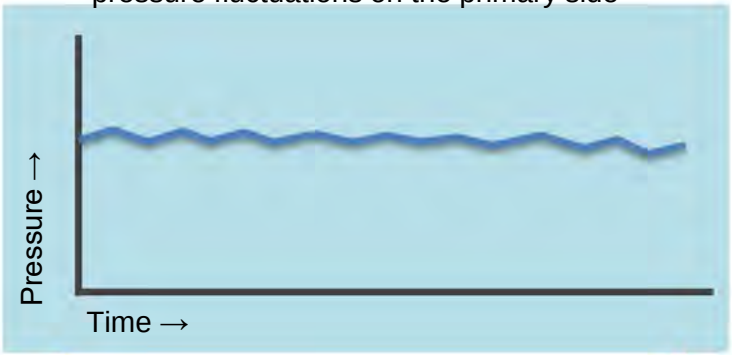
The difficulty of replacing the orifice and lack of fine adjustment of orifice size lead to steam leakage.

The design does not take advantage of the characteristics of continuous-discharge steam traps.

With continuous-discharge steam traps, there are no pressure fluctuations on the primary side, so steam hammers caused by such fluctuations do not occur. Therefore, the ideal approach is to allow a certain amount of condensate to accumulate just before steam traps so that only the condensate is efficiently discharged.

However, competitors' orifice steam traps are often configured in a manner similar to intermittent-discharge steam traps to prevent condensate from accumulating on the primary side, thus resulting in steam loss. Conversely, if orifice steam traps are configured to accumulate condensate on the primary side, they will severely deteriorate over time. (When water turns into steam, its volume expands and its flow velocity increases significantly)

Continuous-discharge steam traps have less pressure fluctuations on the primary side

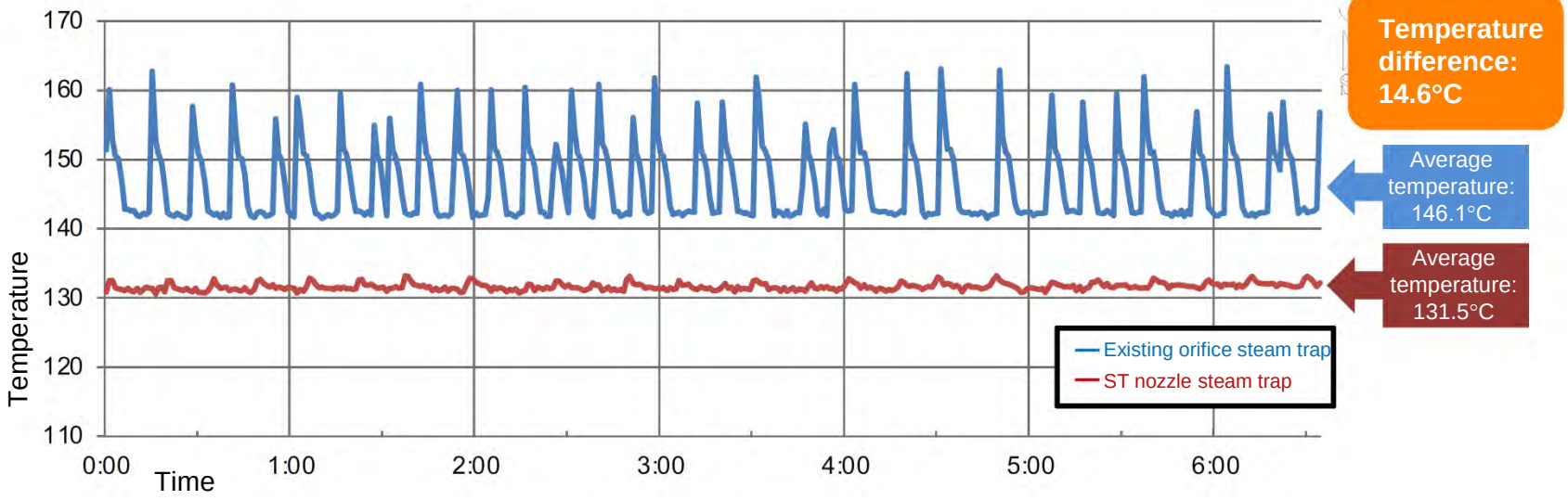


Requires usage that takes advantage of the characteristics of continuous-discharge steam traps

Steam Leakage from Continuous-Discharge Steam Traps

Continuous-discharge steam traps with incorrectly selected orifice sizes cause significant steam leaks.
The graph below compares an orifice steam trap used by a customer with a properly adjusted ST nozzle steam trap. Although the measurements were taken under the same conditions, the ST nozzle steam trap exhibited less variation in temperature and a lower average temperature.

Temperature trends on the primary side of the trap



Measurement of leakage amount from an orifice steam trap

Installation plant	Installation location	**Leakage rate**
Major paper mill	Steam supply pipe Orifice steam trap (New)	**73%**

(This result is attributable to the difficulty of adjusting the orifice trap valves.
In addition, the existing trap was clogged and was replaced with a new one.)

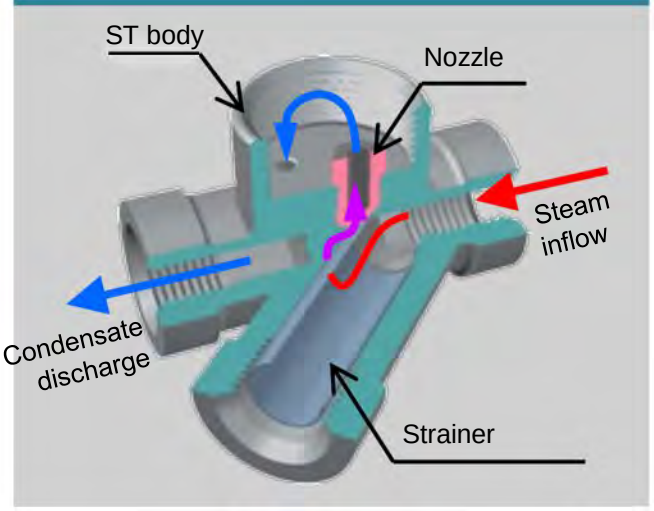
A significant amount of steam leaks even from continuous-discharge steam traps

Advantages of ST Nozzle Steam Traps

Advantages
Easy to adjust by replacing the nozzle
A built-in strainer prevents debris from getting caught
The tunnel-structured nozzle is less susceptible to wear
A wide variety of nozzle types accommodates a wide range of flow rates
Featuring an operating logic that minimizes steam loss
No pressure fluctuations associated with the opening and closing of the valve
Excellent durability
Easy to maintain

ST nozzle steam trap external view

Structure of ST nozzle steam trap



Advantages of ST Nozzle Steam Traps

Features		Factors contributing to features
1	High durability	・Made entirely of stainless steel ・No moving parts
2	High energy-saving performance	・Continuous condensate discharge depending on the nozzle selected ・Reduction of fuel costs
3	Excellent maintainability	・The strainer is cleaned by flushing as needed ・Reduction of administrative workload
4	Reduces indirect costs	・Reduction of boiler feedwater and water softening costs
5	Overall environmental performance	・Significant energy savings ・Significant CO_2 emissions reduction ・Accommodates noise reduction measures

Concerns Regarding ST Nozzle Steam Traps and Their Solutions

Problems

Cannot accommodate changes in condensate volume and pressure

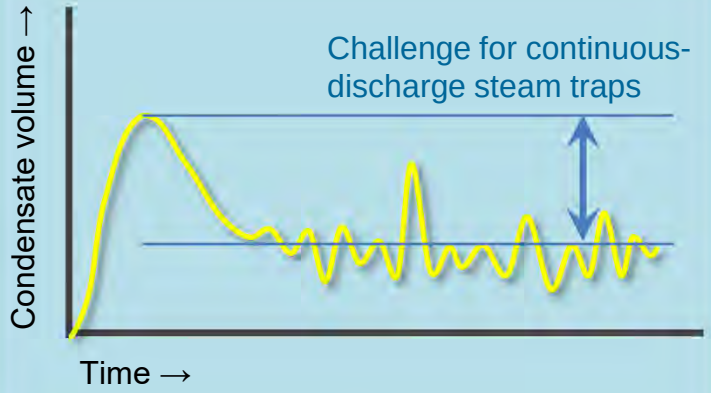
Solutions

(1) If the volume inside the piping from the process to the steam trap is sufficient to accommodate fluctuations in condensate volume, it is possible to maintain a constant discharge relative to the average volume.

(2) Select a nozzle that is two to three sizes larger, as configurations with an oversized nozzle will not result in significant leakage compared to intermittent-discharge steam traps. (See next page)

(3) Implement a system to bypass the steam valve and force condensate to discharge when condensate volume increases. (See the “Zero Steam Leak Unit” sheet)

How to adapt to fluctuating condensate volumes



Use an oversized nozzle Use a zero steam leak unit

Principle of ST Nozzle Steam Traps

Condensate that continues to form inside the pipes has the following properties:

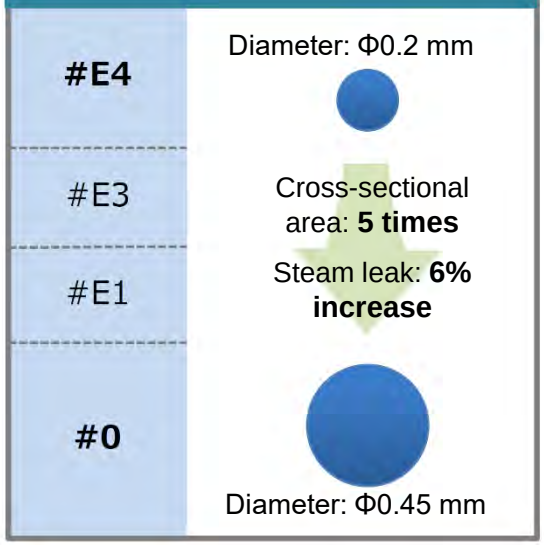
(1) It passes continuously through the nozzle holes and continues to be discharged properly.

(2) Even when its volume is small, it is decompressed to flash into flash steam while passing through the narrow nozzle holes, and its volume hinders the passage of the steam.

(3) Even if it is scarce, the mass that can pass through is negligible because the nozzle holes are small, and the density and kinematic viscosity of steam are extremely small—approximately 1/1700* and 1/70*, respectively, of those of water.

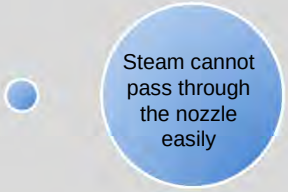
*At atmospheric pressure and a saturation temperature of 100°C

Nozzle size and steam leakage amount



Properties of water and steam

Water molecule	Liquid	Gas
Volume	1	1700
Kinematic viscosity	1	70



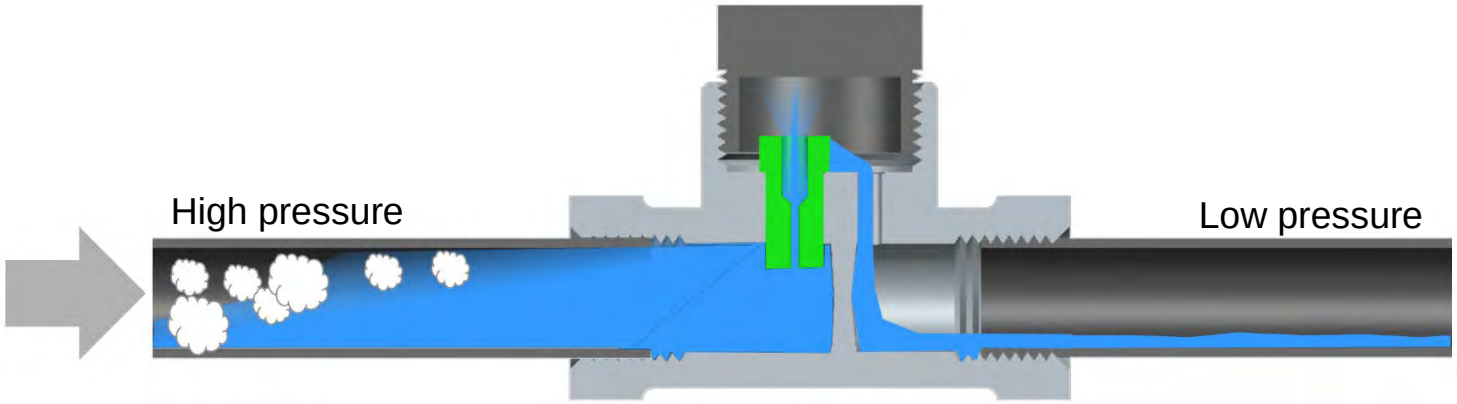
Steam leakage is small even when an oversized nozzle is selected

For example, when the optimal nozzle is Φ0.2 mm, use of the three-size larger #0 nozzle (Φ0.45 mm) results in a cross-sectional area that is 5.06 times larger.
However, the specific gravity of steam is 1/1700 and the kinematic viscosity ratio of steam condensate is approximately 1/70, when viscosity is taken into account, meaning that the mass of the discharged steam at this 4.06 (min) is 1/70 of the original.
Therefore, the calculation 1 + (4.06/70) = 1.06 shows that the steam leakage rate is only 6%.

*The estimates above apply to conditions at atmospheric pressure. The values vary depending on the pressure.

Selection Assumptions and Results

	Mechanical steam traps	ST nozzle steam traps
Selection assumptions	**High safety factor. The higher, the better.**	**Performance should be selected according to the actual condensate volume and load fluctuations.**
Installation considerations	• Condensate must be completely discharged after each operation • The number of operations should be reduced to prevent deterioration • The actual condensate volume is unknown • The bigger serves for the smaller, etc.	• It is acceptable to let condensate accumulate just before the steam trap. • Select it according to the actual condensate volume and load fluctuations • The discharge capacity levels are subdivided
Operations	**We recommend selecting steam traps that are more robust and have a higher discharge capacity. Any steam trap with high discharge performance will do.**	**A wide variety of nozzles are offered to accommodate a wide range of condensate volumes. The nozzle is easy to replace. Performance can be adjusted even after steam trap installation.**
Maintenance	**Steam trap replacement work**	**Valve open/close and nozzle replacement and cleaning**
Results	**The lower the safety factor, the more prone the device is to age-related deterioration. The higher the safety factor, the more severe the steam leaks caused by deterioration will be.**	**Unlike mechanical steam traps, the lack of moving parts allows it to maintain its initial state with minimal steam leakage over the long term.**



Excellent Durability and Ease of Maintenance

Excellent durability

The lack of mechanical moving parts ensures excellent durability.

With few parts, the body is structured very simply.

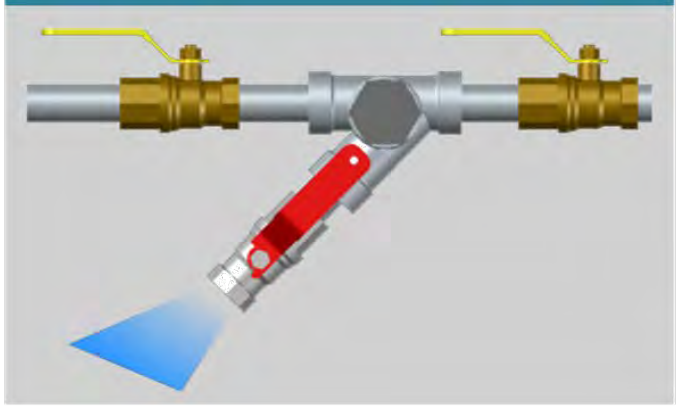
Even if the nozzle were to wear out due to flash steam, the smallest-diameter section is unlikely to be affected because it is located at the end of the tunnel.

Complete parts of an ST nozzle steam trap

Ease of maintenance

A built-in strainer finer than the nozzle diameter prevents clogging.
If scale builds up inside the piping, the strainer can be easily flushed clean.

Illustration of strainer cleaning



A Wide Variety of Nozzle Types and Customization Technologies

Small to extra-large nozzles are available

From 27 types of standard nozzles to custom ultra-fine and extra-large nozzles tailored to specific flow rates, we offer a wide range of customization options.

The body size is designed to accommodate large-diameter pipes (such as 100A). Flange-to-flange dimension, pressure rating, and other specifications can be customized as required.

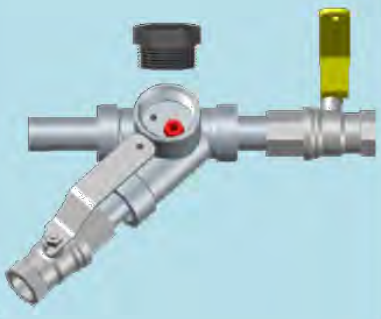
Easy to Adjust by Replacing the Nozzle

Replacement procedure

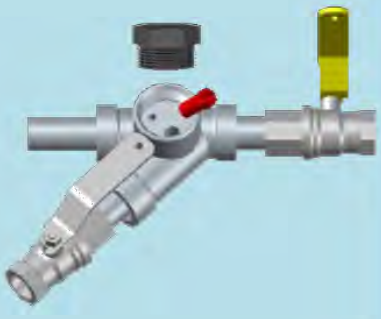
Open the nozzle cap and replace the nozzle. Even while the system is running, adjustments can be made quickly and easily.

Close the valves on the primary and secondary sides

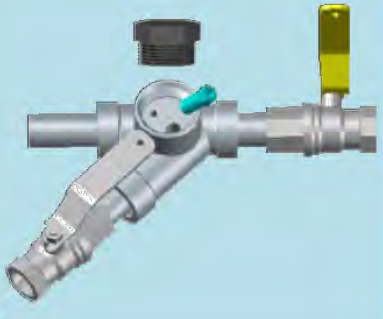
Open the nozzle cap



Remove the nozzle



Install a new nozzle



Close the nozzle cap

Open the valves on the primary and secondary sides

Zero Steam Leak Unit

Patent No. 5745149

In areas where condensate volume fluctuates significantly, install the zero steam leak unit to further reduce steam leaks.

When the condensate volume increases and reaches the upper limit of the float switch in the drain receiver, the solenoid valve at the tip of the strainer opens, allowing a large volume of condensate to be discharged. From this state, when the condensate volume decreases and reaches the lower limit of the float switch, the solenoid valve closes.

In this process, as the water level rises and falls within the range of the vertical pipe's condensate receiver, no steam hammer occurs. Furthermore, as the mechanical components of the solenoid valve are designed not to come into contact with condensate, they are subject to very little age-related deterioration.

Patents Related to Steam Tech Products

Japanese patent granted for the nozzle steam trap as a condensate discharge device
Patent No. 5561632

Japanese patent granted for the zero steam leak unit as a condensate discharge device
Patent No. 5745149

Japanese utility model registered for the automatic pressure-regulating steam trap
Registration No. 3195425

Japanese trademark registered for the nozzle shape
Registration No. 5681172 and No. 5681173

ST Nozzle Steam Trap Product Information

Large sizes are made to order

Model	Nominal diameter	Nozzle (Standard)	Discharge capacity (kg/h): ⊿P			Connection	Maximum operating pressure PMO (MPaG)	Maximum operating differential pressure ΔPMX (MPaG)	Maximum operating temperature TMO °C
			0.1 MPa	1.0 Mpa	6.0 MPa				
ST -15AR -20AR -25AR	15 20 25	Minimum type	4	12	27	SW PT NPT Other	6.00 (61.2 kgf/cm²G)	6.00 (61.2 kgf/cm²G)	450°C
		Maximum type	500	1500	3500				

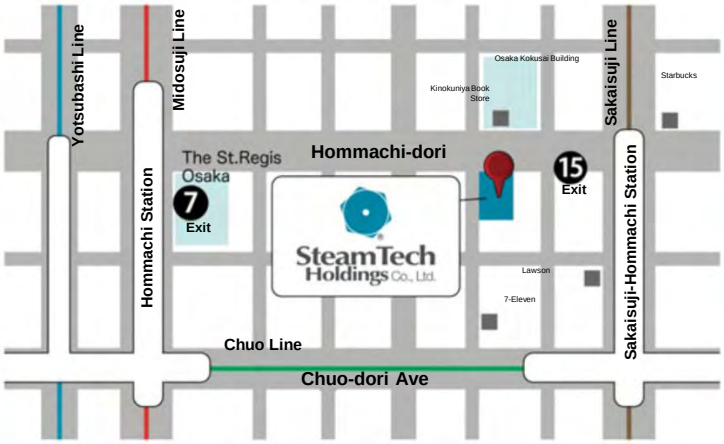
Specifications

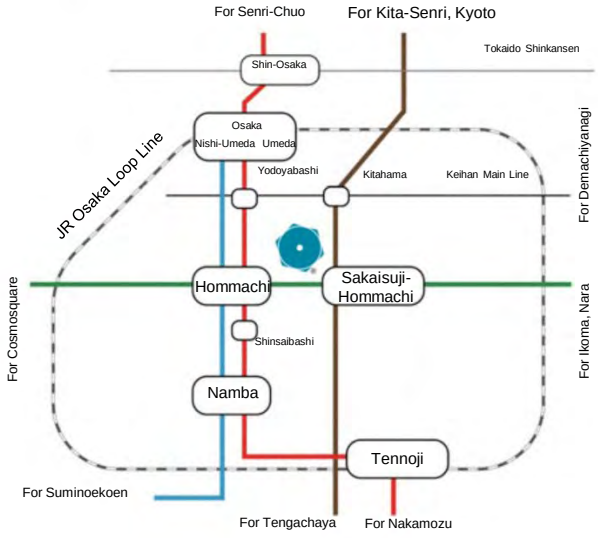
Trap type			
1	Type	Nozzle steam traps	
Connection type			
1	Size	Standard type: Custom type:	15A – 25A 32A –
2	Connection ends	Rc(PT)/NPT Socket weld (SW)/Flange	
Material			
1	Body	JIS SCS13 (Stainless steel casting)	
2	Nozzle cap gasket	PK	PEEK
		MG	JIS SUS304
3	Strainer cap gasket	PK	PEEK
		MG	GRAPHITE
4	Nozzle cap	JIS SUS304	
5	Strainer (Mesh/Spring/End)	JIS SUS304	
6	Strainer cap	JIS SUS304	
7	Steam plug	JIS SUS304	
8	Nozzle tag	JIS SUS304	

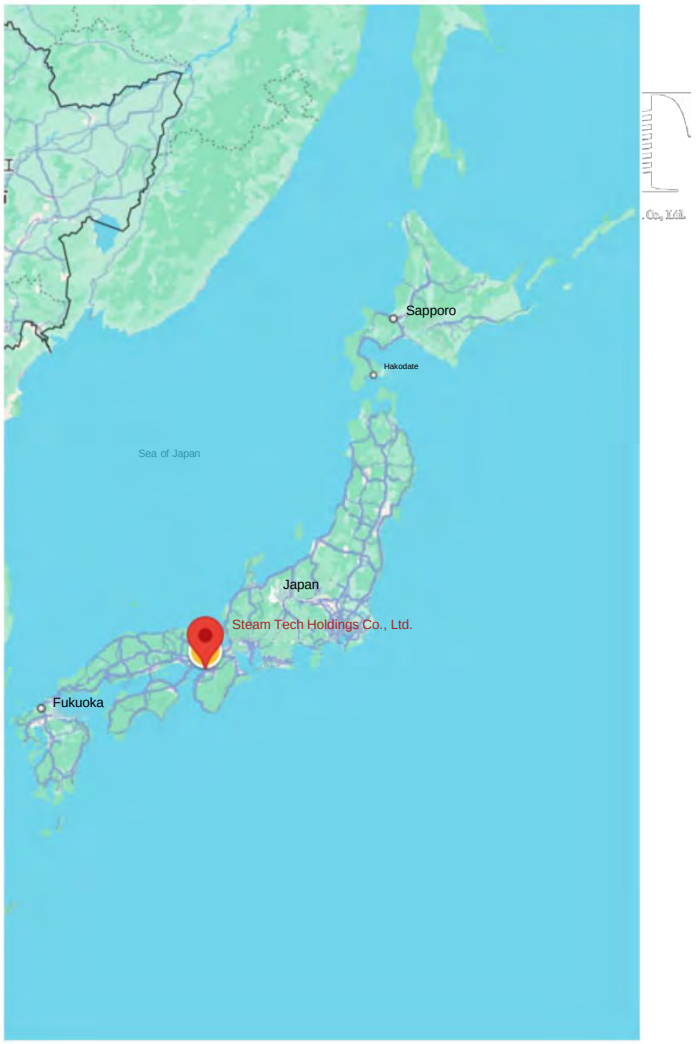
Steam Tech Company Profile

Trade name	Steam Tech Holdings Co., Ltd. Corporate Number: 9120101030371
Headquarters location	2-3-25, Orionocho, Sakai-ku, Sakai, Osaka, 590-0001 Japan
Branch office	ASSORTI HOMMACHI BLDG. 2F UIS, 2-3-4, Hommachi, Chuo-ku, Osaka, 550-0014 Japan
CEO	Akira FUKAI
Established	August 4, 2011
Capital	10,000,000 yen
Business	Manufacture and sale of zero steam leak units and nozzle steam traps
Contact	Tel.: (+81) 06-4708-3844 https://www.steamtech.jp/

Head Office


Yotsubashi Line
Midosuji Line
Sakaisuji Line
Osaka Kokusai Building
Starbucks
Kinokuniya Book Store
The St.Regis Osaka
Hommachi-dori
7 Exit
15 Exit
Hommachi Station
SteamTech Holdings Co., Ltd.
Lawson
7-Eleven
Sakaisuji-Hommachi Station
Chuo Line
Chuo-dori Ave


For Senri-Chuo
For Kita-Senri, Kyoto
Tokaido Shinkansen
Shin-Osaka
Osaka
Nishi-Umeda
Umeda
JR Osaka Loop Line
Yodoyabashi
Kitahama
Keihan Main Line
For Demachiyanagi
Hommachi
Sakaisuji-Hommachi
Shinsaibashi
Namba
Tennoji
For Cosmosquare
For Ikoma, Nara
For Suminoekoen
For Tengachaya
For Nakamozu


Sapporo
Hakodate
Sea of Japan
Japan
Steam Tech Holdings Co., Ltd.
Fukuoka

Company Profile - Our Customers

Asahimatsu Foods Co., Ltd.
Oji Imaging Media Co., Ltd.
Okamoto Industries, Inc.
Kansai Sugar Co., Ltd.
Kibun Foods Inc.
Coca-Cola West Products Co., Ltd.
Konica Minolta, Inc.
Sunstar Inc.
Suntory Products Limited
Sanwa Yushi Co., Ltd.
Resonac Holdings Corporation
Shimaya Co., Ltd.
Sugai Chemical Industry Co., Ltd.
Central Glass Co., Ltd.
Sony Semiconductor Solutions Corporation
Pacific Sugar Mfg. Co., Ltd.
DKS Co. Ltd.
Daido Chemical Co., Ltd.
TableMark Co., Ltd.

TonenGeneral Sekiyu K.K.
Tokyo District Heating Co., Ltd.
Toray Industries, Inc.
Nippon Beet Sugar
Manufacturing Co., Ltd.
Nichiban Co., Ltd.
Nissin York Co., Ltd.
Fuji Oil Co., Ltd.
Fukaki Woollen Textile Co., Ltd.
Hokushin Co., Ltd.
Umios Corporation
Meiji Co., Ltd.
Meiwa Rubber Co., Ltd.
Yutaka Foods Corporation
LG Chem, Ltd.

*And many others