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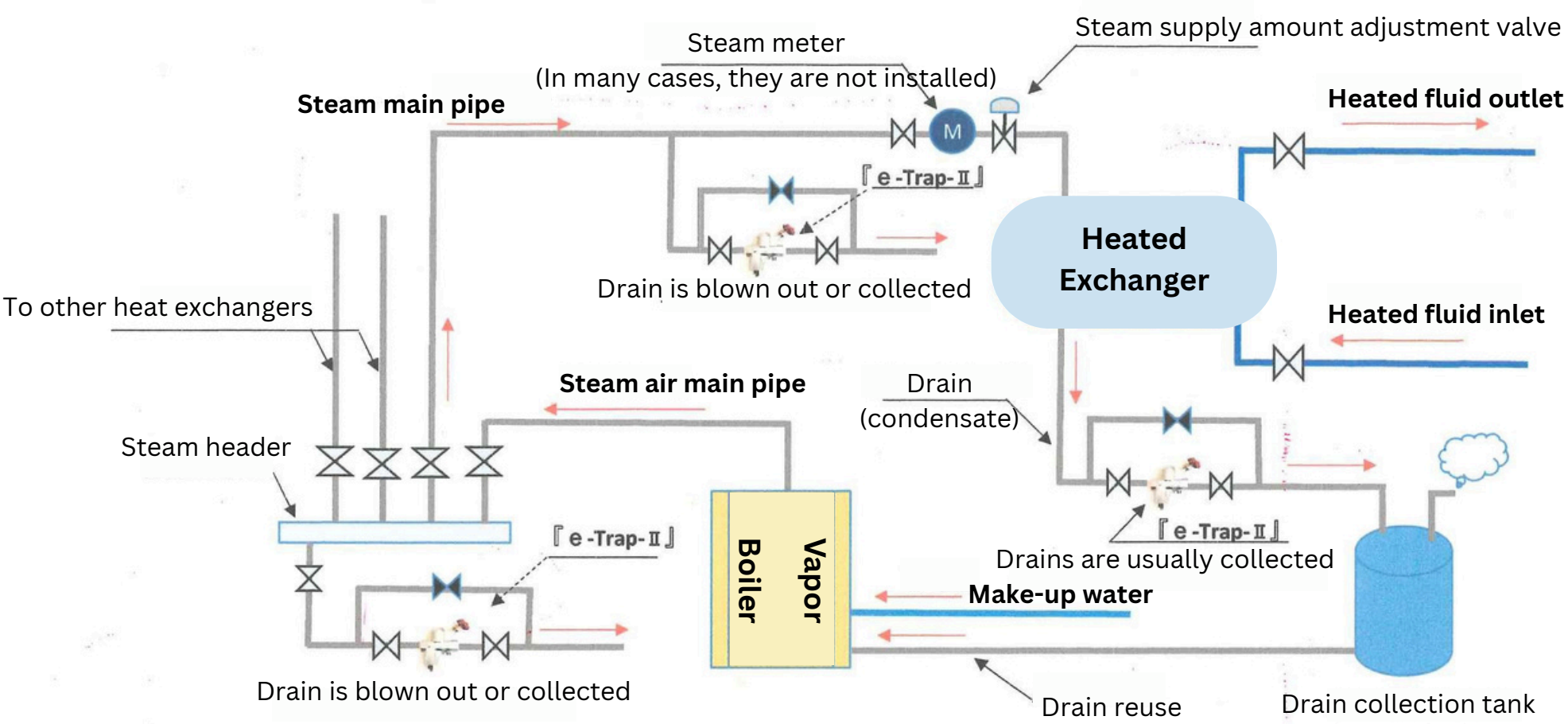
Proposal for reducing steam loss and CO2 emissions

With flow rate adjustment function Nozzle steam trap patent『e-Trap』®

Image of steam equipment and drain recovery and reuse system



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What is a steam trap?

Steam is used in heat exchangers and dryers in factories and facilities, and when the heat energy (latent heat) of the steam is taken away by the other object (heat exchange), the steam instantly changes phase and turns into drain (condensed water). The drain that is created after completing the task of heat exchange must be promptly discharged from the system. This drain discharge device is called a steam trap.

There's a big problem lurking

□There are surprisingly many factories that continue to operate without noticing that their steam traps are malfunctioning.

However, they do not realize how much steam loss there is. Steam loss = fuel consumption loss = large CO2 emissions

▶When should you notice a steam trap malfunction?
(Proof that steam loss was overlooked)

①**Heat Exchanger**.....Decreased thermal efficiency (temperature no longer increases)
②**Dryer**.....Drying time is longer
③**Steam air pipe**.....Severe steam leakage

- Faults that are difficult to notice are cases where the drainage of steam traps installed in steam air pipes and steam headers is not properly discharged.

Steam trap recognition

The majority of adoption cases to date have been movable (mechanical)

▶ The cheaper the better	In the long run, the losses are great
▶ If it breaks, just replace it	Replacement work can be dangerous wasted work time
▶ Treatment as consumables	Increased waste (waste of resources)

I don't really care about the amount of steam loss or not.

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What is a movable steam trap?

Representative types of movable steam traps

▶Float and bucket type

The float or bucket moves up and down depending on the amount of drain that accumulates or decreases, opening and closing the valve.

▶Disc type

The valve opens and closes by utilizing the difference in flow rate between steam and drain.

▶Bimetal type

The valve opens and closes by causing a temperature sensor to expand or contract depending on the temperature difference between the steam and the drain.

Movable types are prone to steam loss

≪Reason≫

▶Steam leakage occurs when the valve is opened or closed.

▶ Since this involves the accumulation of condensate, the steam present there turns into condensate.

*The **steam loss** referred to here is the *sum of the amount of steam leakage and the amount of coexisting steam* that is converted into drain due to the loss of latent heat to the retained drain.

Movable type is prone to breakage

≪Reason≫

Frequent opening/closing operations

- **If it breaks, it will disrupt operations.**
- **Replacement work may be dangerous** (high pressure, high temperature)

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By simply switching to the e-Trap-II , steam loss can be significantly reduced.

≪Reason≫

1.It can be adjusted to match the actual drain flow rate, *minimizing steam leakage*.

- Select the appropriate nozzle according to the amount of drain.
- Fine adjustments can be made by operating the external flow rate adjustment handle.

  (No dangerous work)

2.Continuous drainage

- *Since drain is not stored*, the drainage of *coexisting steam can be minimized*.

『e-Trap- II 』 is hard to break

≪Reason≫ *no moving parts*・・・・・

① Less replacement work required, making it safe and secure.

② Fewer breakdowns and stable operation.

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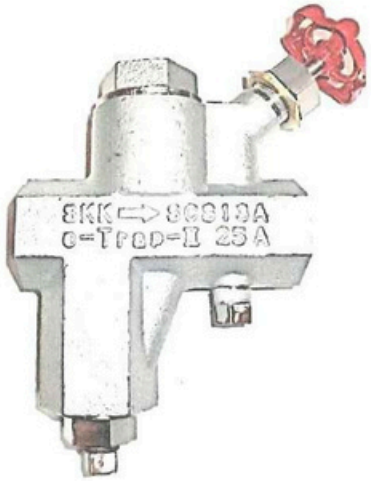
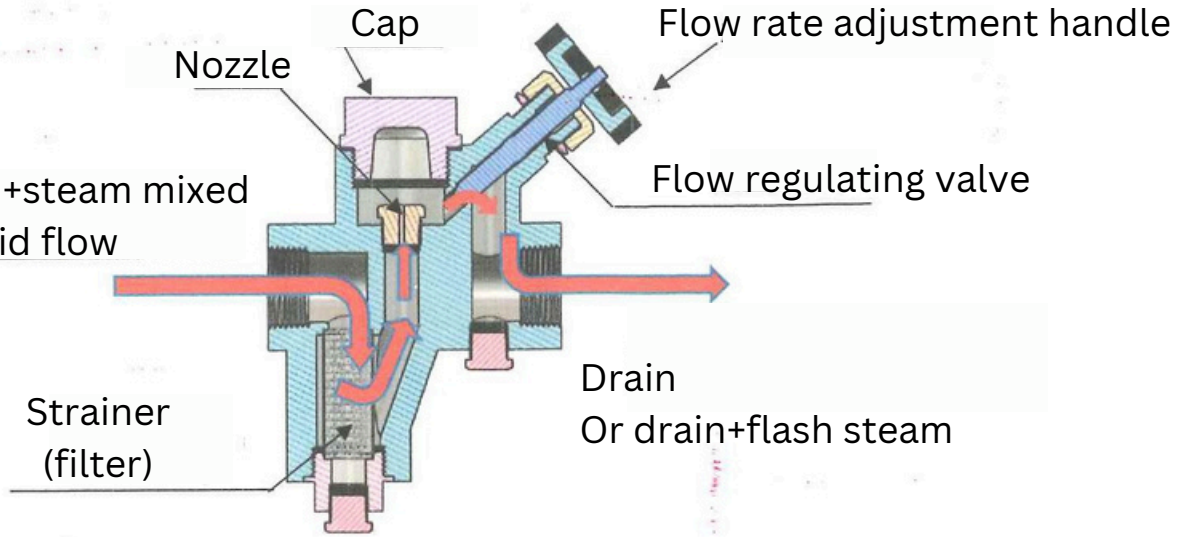
『e-Trap-Ⅱ』Photograph



『e-Trap-Ⅱ』Cross-section



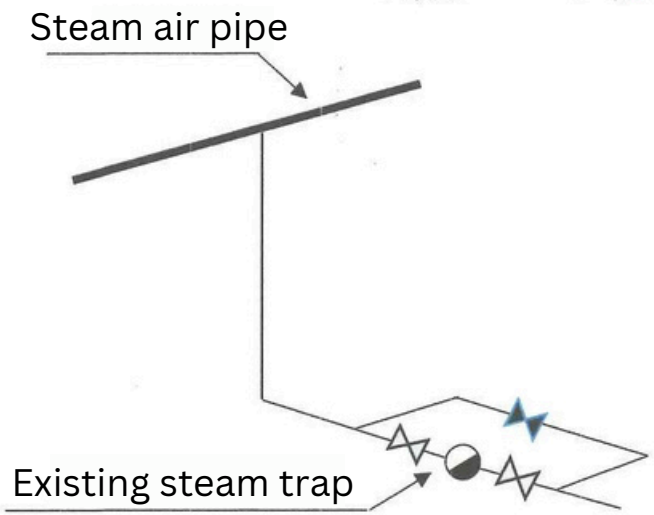
Specification

- **Diameter** : 15A 20A 25A
- **Connection method**: Screw-in
- **Main body material**: SCS13A (SUS304 casting)
- **Face to face**: 121mm (common for 15A, 20A, and 25A)
- **Maximum operating pressure**: 2MPa
- **Nozzle**: Common to all diameters (18 types from No. 1 to 18)
- **Strainer (filter)**: Standard 60 mesh
  : (Nozzles No. 1 to 3 use 80 mesh)

The **nozzle has holes**, and the hole diameter is larger when the drain (steam usage) flow rate is high, and smaller when the flow rate is low. There are **18 types of nozzles with different hole diameters**. The nozzle number can be determined using the nozzle selection table once the operating pressure (differential pressure before and after the trap) and the drain discharge rate (Kg/h) are known. In addition, fine adjustment of the flow rate using a **flow control valve is used when there is a large amount of drain discharge**, such as from a heat exchanger. (As a guideline, use nozzle No. 10 or higher.)

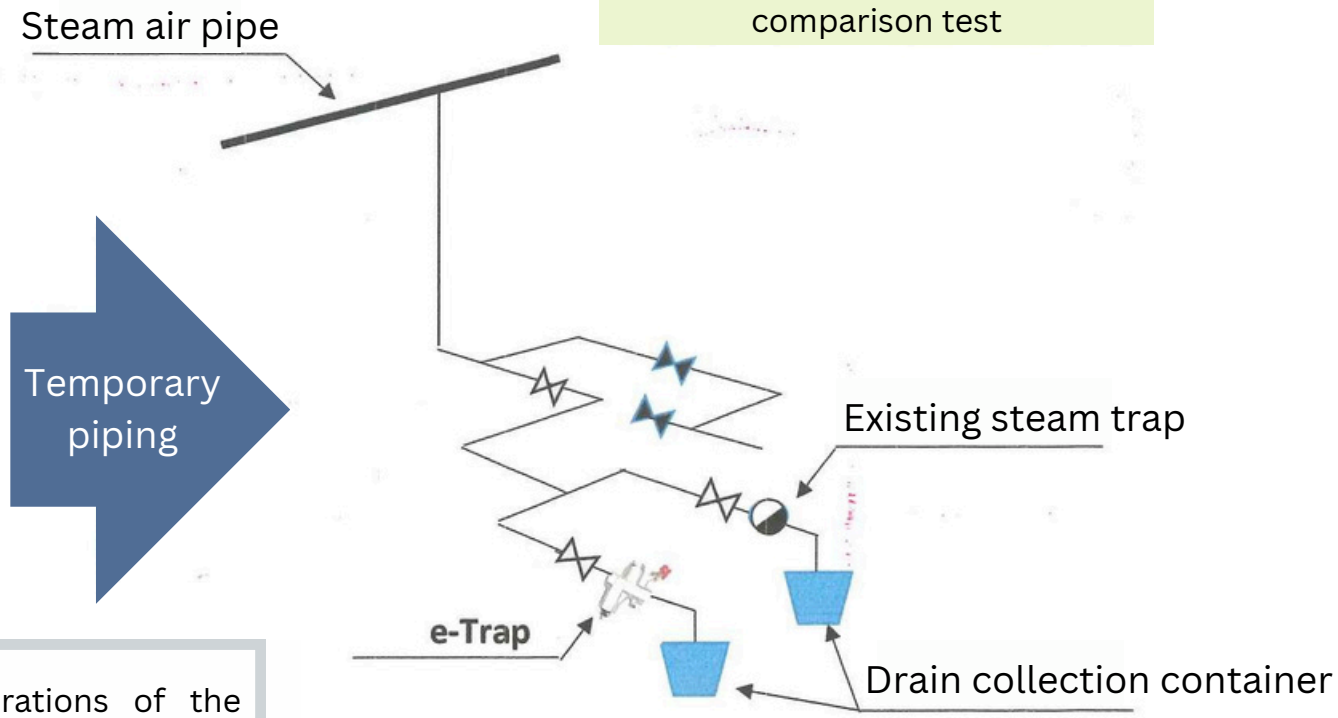
Steam trap performance comparison test procedure (For steam flue pipes)

Condition **before** performance comparison test



Temporary piping

Status **during** performance comparison test



Considering the number of operations of the existing steam trap, both the existing steam trap and the e-Trap measure the amount of condensate discharged in the same period of time. The difference in drain volume is judged as energy saving.

Prior to the comparison test, a small amount of water is placed in the collection vessel so that any steam leaking from the steam trap is dissolved in the water and prevented from escaping.

Steam trap performance comparison test results (steam flue pipe example)

Testing company	D Chemical Factory	
Test target part	Steam air pipe	
Steam pressure/temperature	0.55MPa	162°C
Tester	Rock head	

Operating time	24 hours/day
No.working day	323 days/year
Steam unit price	4.0 yen/kg

Type of fuel	Unit price	
A heavy oil		Yen/KL
City gas		Yen/m2

Test Data			
Measurement items		Existing trap Disc type 15A	e-Trap Nozzle No.1
Trap initial temperature	(°C)	162	162
Measurement time	Point	20	20
Weight before measurement	(Kg)	5.67	7.34
Water temperature before measurement	(°C)	25.70	24.50
Weight after measurement	(Kg)	8.16	8.63
Water temperature after measurement	(°C)	91.80	45.10
Increased drain amount	(Kg)	2.49	1.29

Steam loss reduction rate **48.19%**

(2.49-1.29) /2.49x100＝48.19

Annual savings amount **111,629** yen

(2.49-1.29) x 60/20 x 24 X 323 X 4＝111,629

Annual CO2 reduction amount **3.43 t CO2**/year

①Boiler feed water temperature (recovery drain + make-up water) Saturated water specific enthalpy at 80℃ : 334.9487KJ/Kg

②Specific enthalpy of saturated steam temperature 162℃ : 2759.8254KJ/Kg

③Thermal energy required to create steam ②−①： 2424.8767KJ/Kg

④ Thermal energy reduction: 67.7GJ/year

⑤CO2 reduction: 3.43tCO2/year (＝ (2.49−1.29) x60/20x24x323x2424.8767/1,000,000)

(=67.7GJ/year× 0.0507)

*0.0507 is the CO2 emission coefficient based on calorific value (tCO2/GJ)

Inspection

1. After measuring the water temperature, the temperature of the existing trap was 91.8℃, which was very high. This is thought to be due to a steam leak.
2. Steam loss from a steam trap installed in a steam flue pipe is often thought to be insignificant, but;

① By simply replacing one existing steam trap with an e-Trap, the annual reduction effect is 111,629 yen/year.

② The amount of CO2 reduction is 3.43t CO2/year.