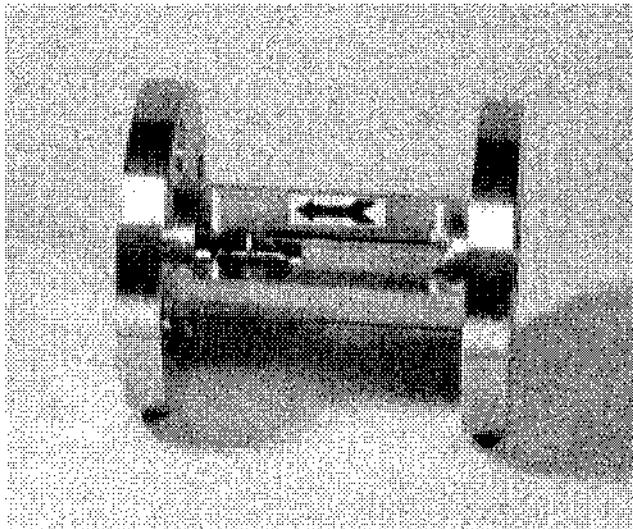


# STEAM



## The steam trap that goes beyond the steam trap!!!

Steam Z is a condensate discharge system developed with a completely new approach. Equipped with only an open orifice, it is free from mechanical failures and troublesome maintenance works, which cannot be avoided with conventional steam traps. By offering better heat transfer, it contributes not only to energy saving but also to the improvement of productivity.




Suitable for pressure higher than 2.5MPa.G  
(25kg/cm<sup>2</sup>)



Suitable for middle to low pressure of less than  
1.6MPa.G (16kg/cm<sup>2</sup>.G)

Steam Z has been adopted in various industries, such as steel, chemical, pulp, textile and food processing. It offers huge advantages especially for applications with steam pressure of more than 3MPa.G, differential pressure of less than 0.1MPa.and condensate flow rates of more than 5 ton/h.

Manufactured by  Engineering CO., LTD

# **1. What is Steam Z?**

Steam Z is a steam trap developed with a completely new approach, based upon the characteristics of an orifice.

An orifice, an open circular hole, has such characteristics that when steam (vapor phase) and condensate (liquid phase) flow mixed together through it, the steam flow rate is much lower than the condensate flow rate. With the application of these characteristics, Steam Z is designed in a very simple and compact structure without any moving parts. As it does not have any moving parts, Steam Z does not suffer from mechanical failures, which are typical of conventional steam traps. With an orifice of the appropriate size, selected on the basis of the maximum condensate flow rate of a steam system or of steam pipes, Steam Z works without steam leakage, even when the condensate flow rate fluctuates.

## **Advantages:**

The advantages of Steam Z are as follows.

- 1) As it has no moving parts and evacuates condensate continuously with a permanently open orifice, Steam Z has a semi-permanent life time, free from mechanical trouble.
- 2) Steam Z maintains its initial performance with very little maintenance work.
- 3) As it has little steam leakage and does not suffer from blow-through breakdowns, Steam Z saves energy. The reduction of fuel and CO<sub>2</sub> generation contributes to the prevention of the global warming.
- 4) There are no restrictions for the mounting position except for the condensate flow direction. Steam Z can be installed vertically, horizontally or in an inclined position. It can be installed even upwards.
- 5) With its small dimensions and light weight, Steam Z can be installed very easily with the minimum of labor and tools, which contributes to cost saving.
- 6) As Steam Z evacuates condensate continuously, it improves the heat transfer and the productivity. It keeps the system free from water hammers.
- 7) As Steam Z has a straight passageway of condensate, there is no trouble due to air or steam accumulation.
- 8) Steam Z responds quickly to load variations, allowing a precise temperature control.
- 9) Steam Z can be used for applications with big quantities of condensate, very high steam pressure or very low differential pressure, for which conventional steam trap cannot be used.

For example;

- (1) 10MPa (100kg/cm<sup>2</sup>) or higher inlet pressure with 1 ton/h or more of condensate
- (2) 80 ton/h or more of condensate
- (3) 0.002MPa (0.02kg/cm<sup>2</sup>) or smaller differential pressure

There are no limits for (1) and (2).

## **Disadvantages;**

The disadvantages of Steam Z are as follows.

- 1) For the design of Steam Z, it is necessary to have more accurate data than for the conventional steam traps. It is required to have at least the maximum condensate flow rate and the differential pressure between the inlet and the outlet.
- 2) As Steam Z evacuates condensate directly into the piping, there is a risk of erosion, especially with big quantities of condensate. In order to reduce this risk, it is recommended to have a straight line ten times the piping diameter at the exit of Steam Z. If such is impossible, it is recommended to use a stainless steel pipe up to the first elbow. However, as the mounting position of Steam Z is free, it is often not difficult to have a straight line of the necessary length.

## **2. Condensate evacuation through Steam Z**

Steam has more difficulties to flow through an orifice than condensate. The design of Steam Z is based on such characteristics of an orifice.

The theoretical amount of fluid flowing through an orifice depends on such factors as the kind of fluid, the diameter of the orifice and the differential pressure between the inlet and the outlet of the orifice. This amount can usually be calculated by a well-known formula.

For example, when 100% (pure) condensate flows through a 5mm diameter orifice with a differential pressure of 0.1MPa (1 kg/cm<sup>2</sup>), the theoretical flow rate is 590kg/h. On the other hand, when the fluid consists of 100% steam, the theoretical flow rate of steam is only 22kg/h. This means that the flow rate of steam is only 3.7% of that of condensate.

When the 50%/50% mixture of condensate and steam flows through this same orifice under the same conditions, the condensate flow rate is 295kg/h and the steam flow rate is only 1kg/h or less. So, under these conditions, the steam leakage is much smaller than that of a conventional steam trap, even maintained correctly.

When condensate and steam flow together, the steam flow rate is limited because of the following reasons.

- 1) The steam flows more than 30 times faster than condensate. Therefore, the friction between the steam and condensate produces waves, like the sea produces waves under a strong wind, and these waves seal the orifice. When these waves subside and do not occupy completely the orifice, they let go steam through the orifice. In this way, slow moving condensate blocks high speed flowing steam from passing through the orifice.

The relation between the condensate flow rate and the steam flow rate depends on condensate loads, pressure conditions, orifice types and diameters. We have developed multi-stage types, multi-orifice types (Lotus Z) to ensure excellent performances especially in terms of energy saving. We have continuously improved the orifice design on the basis of field experience, so we are convinced that Steam Z will provide you with the utmost satisfaction under various operating conditions compared with the conventional steam traps.

## **3. Different Types (and Models) of Steam Z**

Different types (and models) of Steam Z are available to cope with various operating conditions.

# Steam Z: Models of Standard Type

These models are designed with screw connections. They are suitable for applications with operating pressure of less than 1.0MPa.G. There are 30 models available in nominal diameters of 1/2", 3/4" and 1" with different condensate evacuation capacities. For condensate evacuation capacities, please refer to Page 4 and 5.

Models with 1/2" screw connections (Z-1 to Z-13)

As they are equipped with a relatively small orifice, to avoid clogging, these models are supplied as a set with a special Y-strainer and a special ball valve. The ball valve can be used to eliminate condensate from the system to prevent freezing under a cold climate or to clean the strainer.

Connections: 1/2" screw connections

Maximum operating pressure: 1.6MPa.G (16kg/cm<sup>3</sup>.G)

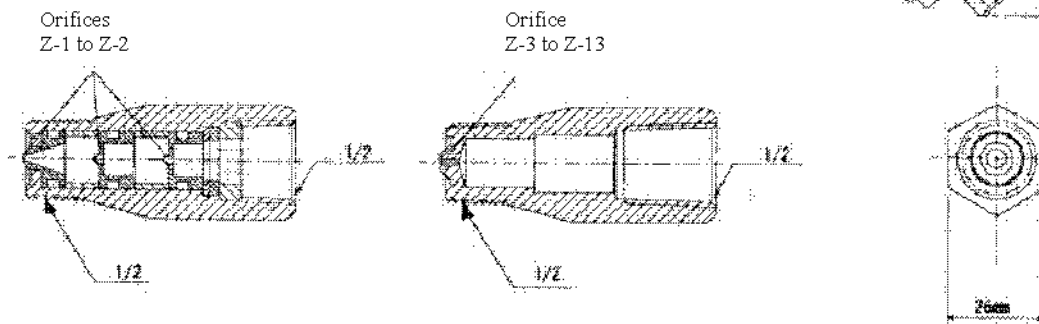
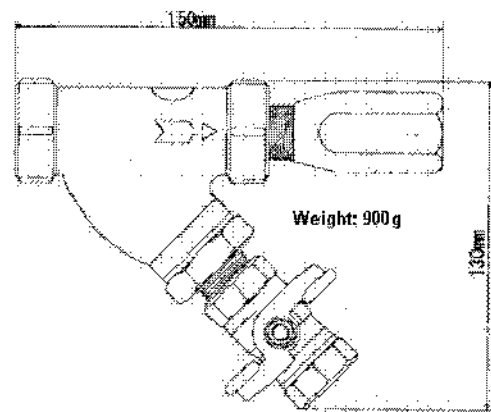
Maximum operating temperature: 220°C

Body material: SUS303

Internal material: SUS304

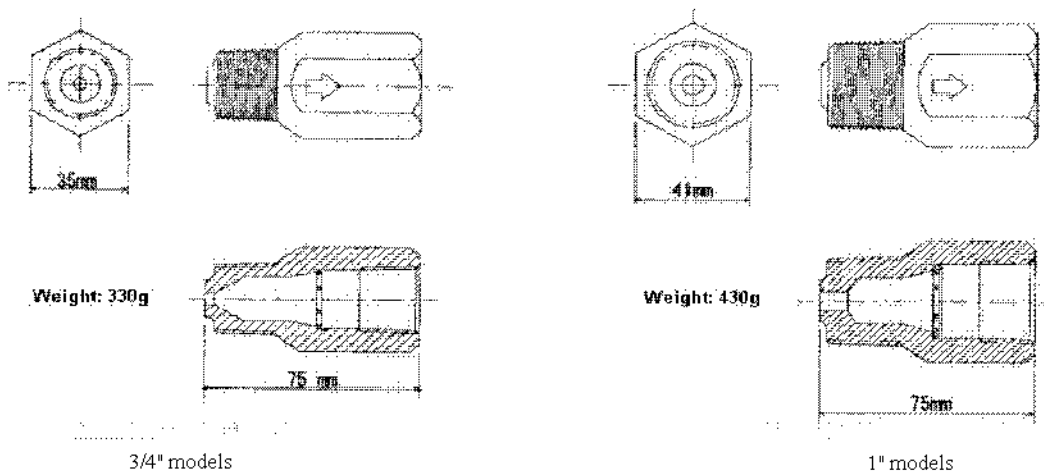
Y-strainer material: FC200 (stainless as option)

Ball valve material: C3771BE (stainless as option)



Models with 3/4" screw connections (Z-2A to Z-0H)

As they are equipped with a relatively big orifice, these models are supplied without a strainer or a ball valve. (We can supply strainers and ball valves as options.)

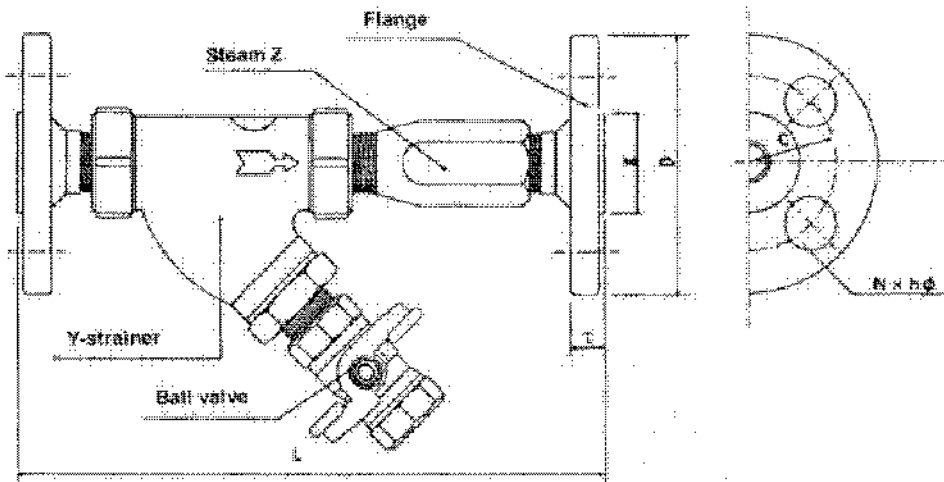


**Table of condensate evacuation capacities of different models of Steam Z**

$\Delta P$ MPa	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Z-1	7.6	10.7	13.1	15.1	16.9	18.5	20.0	21.3	22.7	23.9
Z-2	8.7	12.3	15.0	17.4	19.4	21.2	23.0	24.6	26.1	27.4
Z-3	11.7	16.6	20.3	23.4	26.2	28.7	31.0	33.1	35.1	37.0
Z-4	13.4	19.0	23.3	26.9	30.1	33.0	35.6	38.1	40.3	42.6
Z-5	15.1	21.4	26.2	30.2	33.8	37.0	40.0	42.8	45.4	47.4
Z-6	22.9	32.4	39.7	45.9	51.2	56.2	60.6	64.9	68.8	72.5
Z-7	29.3	41.4	50.7	58.6	65.5	71.7	77.4	82.8	87.8	92.6
Z-8	40.0	56.6	69.3	80.0	89.5	98.0	105.8	113.1	120.0	126.5
Z-9	55.2	78.0	95.5	110.2	123.3	135.0	145.6	155.9	165.3	174.3
Z-10	77.0	109.0	133.5	154.1	172.4	188.8	203.9	218.0	231.0	243.7
Z-11	104.8	148.3	181.6	210.0	234.5	256.8	277.4	296.6	314.6	331.6
Z-12	148.3	210.0	256.8	296.6	331.5	363.1	392.2	419.3	444.8	468.8
Z-13	213.6	302.1	369.9	427.2	477.6	523.3	565.1	604.2	640.8	675.5

$\Delta P$ MPa	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Z-2A	243	344	421	487	544	596	643	688	729	768
Z-5A	291	412	504	582	651	713	770	823	873	920
Z-8A	343	485	594	686	767	840	908	970	1029	1085
Z-0B	380	538	659	760	850	931	1006	1075	1140	1202
Z-5B	481	680	833	962	1076	1178	1273	1360	1443	1521
Z-7B	524	742	906	1048	1171	1284	1386	1482	1572	1657
Z-0C	594	840	1029	1188	1328	1455	1571	1680	1782	1878
Z-5C	718	1015	1244	1436	1605	1759	1900	2031	2154	2271
Z-0D	855	1209	1481	1710	1912	2094	2262	2418	2565	2704
Z-5D	1004	1420	1738	2008	2245	2459	2656	2840	3012	3175

$\Delta P$ MPa	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Z-0E	1164	1646	2016	2328	2603	2851	3080	3292	3492	3681
Z-5E	1336	1889	2314	2672	2978	3273	3535	3779	4008	4224
Z-0F	1520	2150	2633	3040	3399	3723	4022	4299	4560	4807
Z-5F	1716	2427	2972	3432	3837	4203	4540	4854	5148	5426
Z-0G	1924	2715	3326	3840	4293	4703	5080	5431	5760	6072
Z-5G	2144	3032	3714	4288	4794	5252	5672	6064	6432	6780
Z-0H	2375	3359	4114	4750	5311	5818	6284	6718	7125	7510



**Table of condensate evacuation capacities of different models of Steam Z**  
(For pressure of less than 1 kg/cm<sup>2</sup>)

Model	$\Delta P$ MPa	0.005	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
	(kg/cm <sup>2</sup> )	(0.05)	(0.1)	(0.2)	(0.3)	(0.4)	(0.5)	(0.6)	(0.7)	(0.8)	(0.9)
1/2	Z-1	1.7	2.4	3.4	4.2	4.8	5.4	5.9	6.4	6.8	7.2
	Z-2	1.9	2.8	3.9	4.8	5.5	6.2	6.7	7.3	7.7	8.3
	Z-3	2.6	3.7	5.2	6.4	7.4	8.3	9.1	9.8	10.5	11.1
	Z-4	3.0	4.2	6.0	7.3	8.5	9.5	10.4	11.2	12.0	12.7
	Z-5	3.4	4.8	6.7	8.3	9.6	10.7	11.7	12.6	13.5	14.3
	Z-6	5.1	7.2	10.2	12.5	14.5	16.2	17.7	19.2	20.5	21.7
	Z-7	6.5	9.3	13.1	16.0	18.5	20.7	22.7	24.5	26.2	27.8
	Z-8	8.9	12.6	17.9	21.9	25.3	28.3	31.0	33.5	35.8	37.9
	Z-9	12.3	17.5	24.7	30.1	34.9	39.0	42.8	46.2	49.4	52.4
	Z-10	17.2	24.3	34.4	42.1	48.7	54.4	59.6	64.4	68.9	73.0
	Z-11	23.4	33.1	46.9	57.4	66.3	74.1	81.2	87.7	93.7	99.4
	Z-12	33.2	46.9	66.3	81.2	93.8	105	115	124	133	140
	Z-13	47.8	67.5	95.5	117	135	151	165	179	191	203

Model	$\Delta P$ MPa	0.005	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
	(kg/cm <sup>2</sup> )	(0.05)	(0.1)	(0.2)	(0.3)	(0.4)	(0.5)	(0.6)	(0.7)	(0.8)	(0.9)
3/4	Z-2A	54.3	76.8	109	133	154	172	188	203	217	230
	Z-5A	65.0	92.0	130	159	184	206	225	243	260	276
	Z-8A	76.7	108	153	188	217	243	266	287	307	325
	Z-0B	85.0	120	170	208	240	269	294	318	340	360
	Z-5B	107	152	215	263	304	340	373	402	430	456
	Z-7B	117	166	234	287	331	370	406	438	469	497
	Z-0C	132	188	266	326	376	420	460	497	531	564
	Z-5C	160	227	321	393	454	508	556	601	642	681
	Z-0D	191	270	382	468	541	605	662	715	765	811
	Z-5D	224	317	449	550	635	710	778	840	898	952

Model	$\Delta P$ MPa	0.005	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
	(kg/cm <sup>2</sup> )	(0.05)	(0.1)	(0.2)	(0.3)	(0.4)	(0.5)	(0.6)	(0.7)	(0.8)	(0.9)
1	Z-0E	260	368	520	638	736	823	902	974	1041	1104
	Z-5E	299	422	597	732	845	945	1035	1118	1195	1267
	Z-0F	340	481	680	833	961	1075	1177	1272	1360	1442
	Z-5F	384	543	767	940	1085	1213	1329	1435	1535	1628
	Z-0G	430	608	860	1054	1217	1360	1490	1610	1721	1825
	Z-5G	479	678	959	1174	1356	1516	1660	1794	1918	2034
	Z-0H	531	751	1062	1300	1502	1679	1840	1987	2124	2253

## Steam Z: Models of P Type

Equipped with screw connections, these models are suitable for applications with operating pressure of 1.5 to 2.5MPa.G (15 to 25kg/cm<sup>2</sup>.G) and with a condensate flow rate of 10 to 300kg/h. These models are ideal for condensate elimination from steam pipes.

The body is machined from a hexagonal stainless steel bar. It can integrate 4 orifices and a built-in strainer in its structure. Depending upon the operating conditions, the condensate evacuation capacity is adjusted by the diameter and number of orifices. All the components are in stainless steel. As with the standard type, flange connections can be supplied as options.

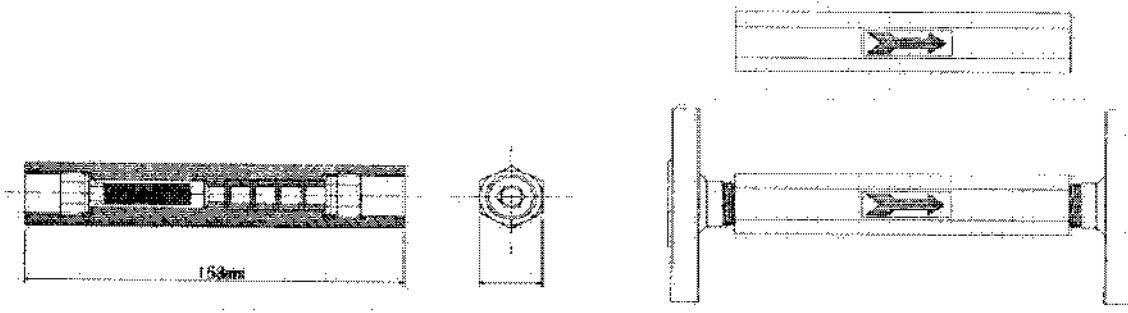
Connections: 1/2" screw connections

Maximum operating pressure: 2.5MPa.G (25kg/cm<sup>2</sup>.G)

Maximum operating temperature: 260°C

Body material: SUS304

Internal material: SUS316



Sectional view of P type

External view of P type

## Steam Z: Models of LP Type

Designed with screw connections, the maximum operating pressure of models of P Type is limited to 2.5MPa.G (25 kg/cm<sup>2</sup>.G). The models of LP Type can be used for a higher pressure range or when it is not acceptable to use a screw connection for primary side (inlet). As the inlet side is directly exposed to high pressure, a lap flange (loose flange) is adopted for the inlet side. RF, RTJ or serration can be selected for flange joint face. The flange diameters of 1/2", 3/3" and 1" are available with a pressure rating from 150 to 2500 LB. (The flanges can also be manufactured under different standards.) As it is exposed only to low pressure, the secondary side (outlet side) is usually connected with a screw connection (1/2"). A flange connection is also available.

The body is machined from a stainless steel bar, and the internal structure is the same as P Type. These models are most suitable for condensate elimination for high pressure steam pipes. They are less costly and more durable than the conventional steam traps, especially in case of pressure higher than 600 LB.

Connection (inlet): 1/2", 3/4" or 1" flange

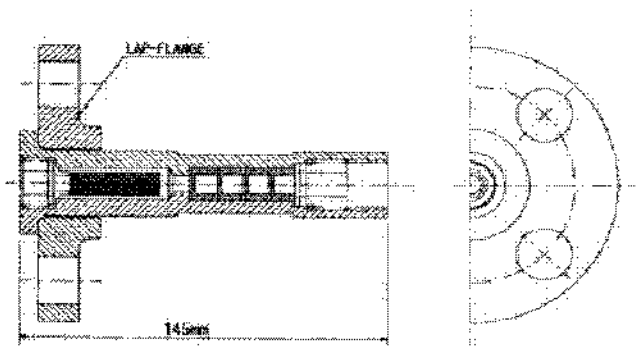
Connections (outlet): 1/2" screw connection

Maximum operating pressure: 20MPa.G (200g/cm<sup>2</sup>.G)

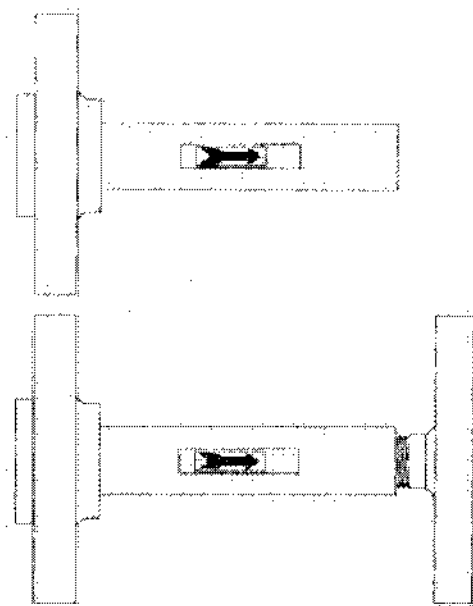
Maximum operating temperature: 500°C

Body material: SUS304

Internal material: SUS316



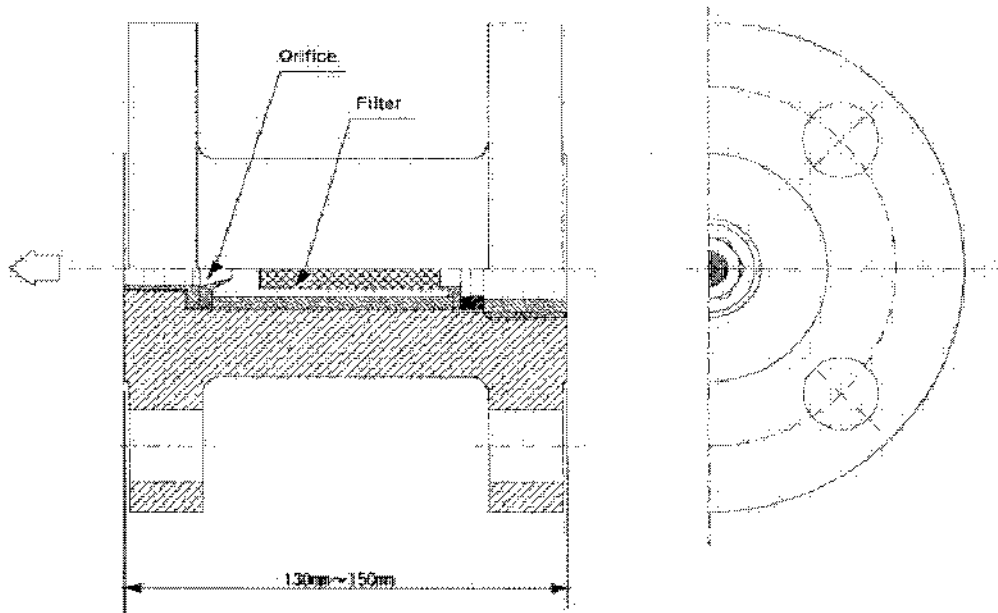
Sectional view of LP type



External view of P type

# Steam Z: F Type

These models are most suitable for high pressure applications with a relatively big condensate flow rate, and where screw connections are not acceptable. Machined from a stainless steel rod or a forged block, they don't have any welded parts. The orifice system has a structure that can integrate a single orifice or multi-stage orifices in a series. Depending upon the operating conditions, the material, the flange standards and the size and orifice system can be selected.

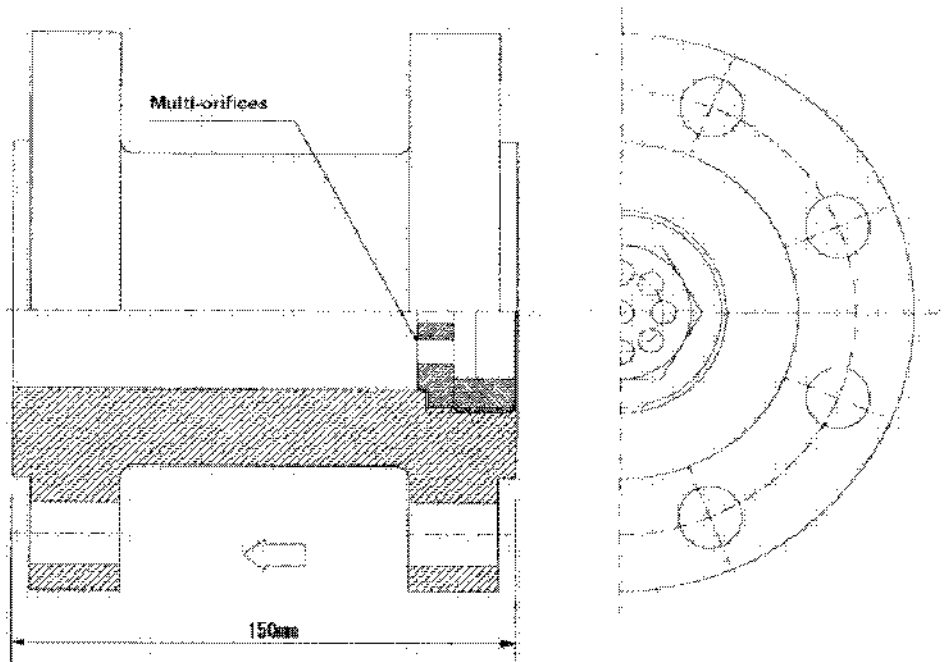


## Examples of typical applications

Operating pressure	Condensate flow rate	Usage
18.3 MPa (183kg/cm <sup>2</sup> )	10 to 30kg/h	Steam pipe in a thermal power station
11.5 MPa (115kg/cm <sup>2</sup> )	15,000kg/h	Ethylene manufacturing process

# Lotus Z (for large capacity applications)

Lotus Z is most suitable for applications with large quantities of condensate or with very small differential pressure, such as big heat exchangers, reboilers, air heaters and evaporators. Machined from a stainless rod or a forged block, Lotus Z does not have any welded parts. The orifice system has a structure integrating several orifice holes bored in a single stainless steel plate. Depending upon the operating conditions, we can design and manufacture a Lotus Z with an optimum number of orifices, orifice diameter and orifice arrangement. As Lotus Z is compact, light and simple in its construction compared with a conventional steam trap, the piping design work can be easier and also the cost for piping and thermal insulation work can be considerably reduced.



### Examples of typical applications

Operating pressure	Condensate flow rate	Flanges	Usage
0.72MPa (7.2kg/cm <sup>2</sup> )	65 ton/h	300LB-5B	Ethylene manufacturing process
0.62MPa (6.2kg/cm <sup>2</sup> )	45 ton/h	150LB-4B	Glycol manufacturing process
0.01MPa (0.1kg/cm <sup>2</sup> )	2 ton/h	150LB-2B	Benzene manufacturing process

# Zetron

Zetron is developed for tracing applications with relatively small quantities of condensate. It has a built-in filter and can be equipped with two to four-stage orifice structure, depending upon the condensate flow rate and operating pressure.

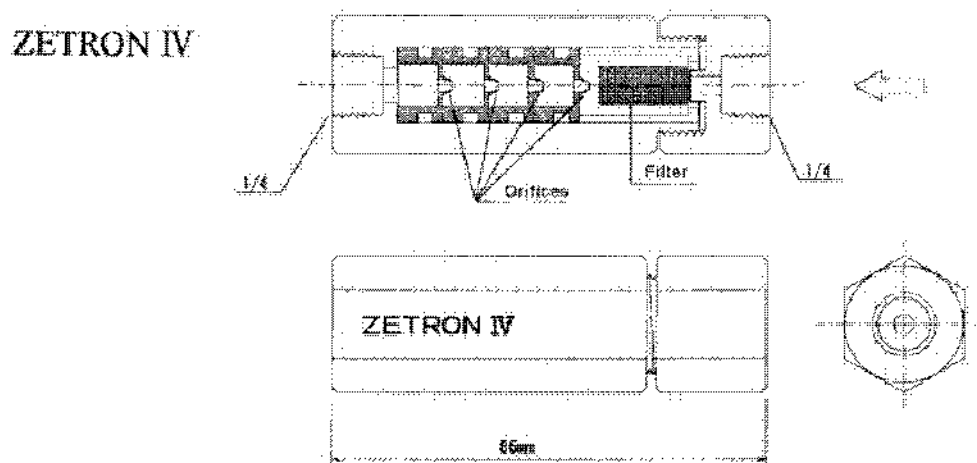
Connections: 1/4" screw connections

Maximum operating pressure: 0.7MPa.G (7kg/cm2.G)

Maximum operating temperature: 180°C

Body material: Nickel plated brass

Internal material: SUS304



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