TAKE CONTROL

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SAMYANG
SYSTEM GROUP

SAMYANG Valve | SAMYANG-Arca | SEM System | Eco-enerdigm

SAMYANG VALVE CO., LTD.

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VOL. 11

SAMYANG VALVE PRODUCT CATALOG

VOL. 11

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SAMYANG VALVE
PRODUCT CATALOG

SAMYANG VALVE CO., LTD.

SAMYANG VALVE
Rich Valve Experience

VOL.
11

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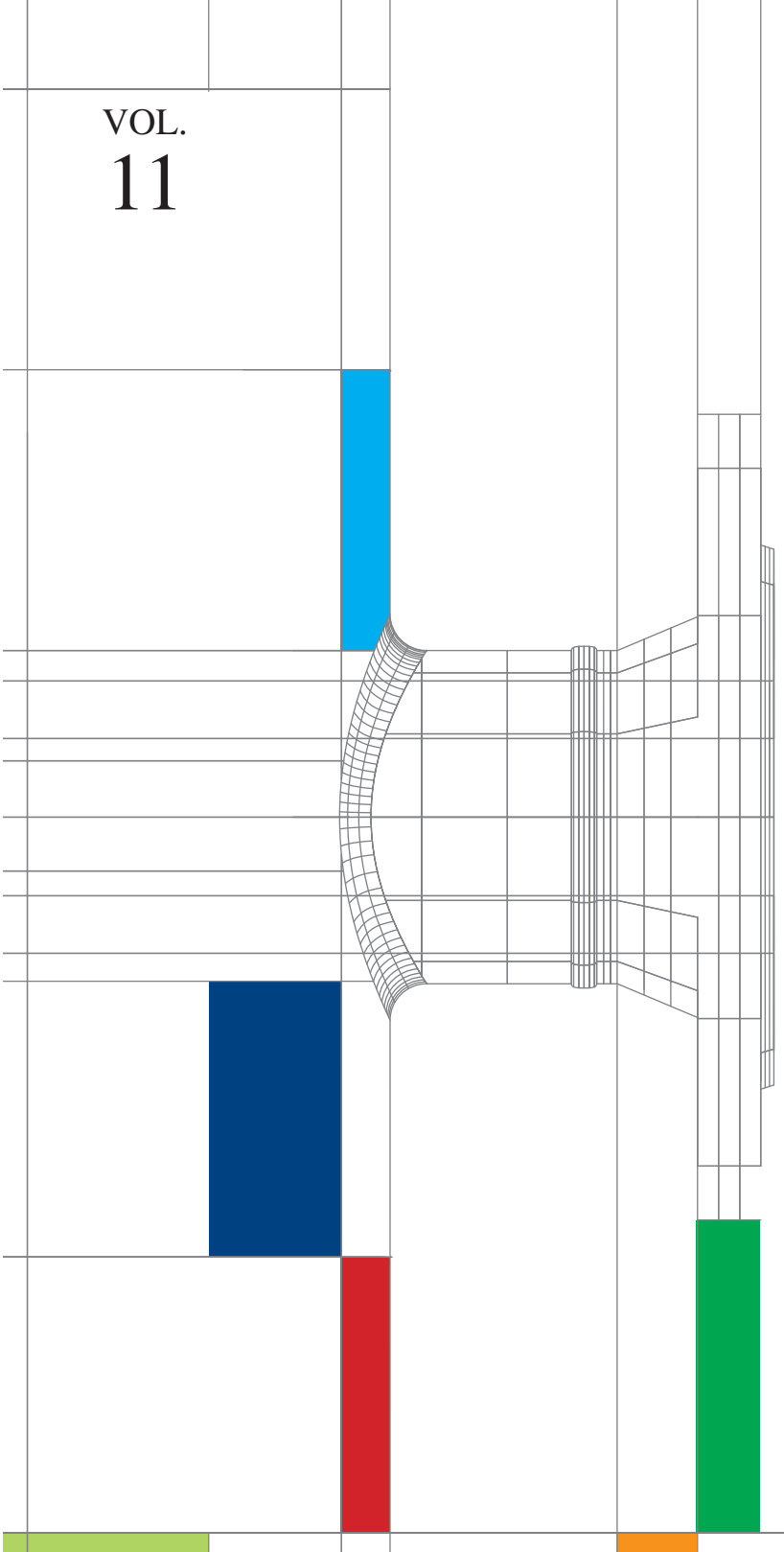
SAMYANG VALVE
PRODUCT CATALOG



SAMYANG VALVE
Rich Valve Experience

Since 1960

"Remaining faithful to the tradition of
system engineering and valve making,
we, SAMYANG SYSTEM GROUP invites you
to share our 50 years of expertise and experience."

SAMYANG
SYSTEM GROUP

ENVIRONMENT · ENERGY · DESIGN

As a company at the vanguard of green technology, which leads the environment, design, and energy, Samyang System Group actively conducts research and offers clean environment-friendly energy, environment-friendly design, and environment-friendly technology, giving new hope to mankind and nature.

SAMYANG
SYSTEM GROUP

- SAMYANG Valve
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Environmentally Friendly, SAMYANG SYSTEM GROUP,

SAMYANG SYSTEM GROUP stands by the side of sustainability and environment-friendliness. It offers environmentally friendly energy saving products to help you make greener life style choices. It dreams of making today a better one and a bright future.

Contents

SAMYANG SYSTEM GROUP

Headquarter in Bucheon, Korea

Message from the CEO

We love to share our experience to make your life better

SAMYANG SYSTEM GROUP, as a leading company in the filed of valve manufacturing and system engineering, is providing its 50 years experience to make a comfortable and clean living environment with the world's top technology.

Since the establishment in 1960, SAMYANG SYSTEM GROUP has put continuous efforts to make the highest quality automatic valve products for the efficient energy management within the construction and industrial equipment filed, and by that way, thanks to its sustained technical investment, SAMYANG established its valve production plant in 1971. In this regard, SAMYANG has been recognized as a company enabling the domestic planning and manufacturing for the valves, which depended only on import, and awarded President's Awards for Enterprise several times for rendering great services to the development of the nation's economy. The President's Award for Enterprise is the highest honorary award that the Korean Government can grant.

Through accumulated technologies with continuous Research & Development and experiences, SAMYANG SYSTEM GROUP has been keeping the firm superiority in the field of domestic and overseas construction development and industrial plants, and has been recognized by the customers with the top-quality products and the highest services.

For the 21st century, SAMYANG SYSTEM GROUP is born again as a company considering environment and energy to provide the optimum indoor living environment where engineering and environment are harmonized. SAMYANG has researched hand-in-hand with the worldly-renown corporations and universities and produced new generation indoor environmental products to make the environment healthier and cleaner and increase energy efficiency : Hot Water Distributor, Internet-based Home Automation System, Ventilating, Humidification and Radiant Cooling/Heating System.

Thanks to its technical expertise, research re-investment and highly creditable products and after-sales service, SAMYANG has always raised its reputation and will go on being raised by providing the high-quality indoor environmental control system embedded with high technology.

Yang, Chang Duck
CEO

History Highlights

1960 ~ 1990

1960

- Samyang Water Work Company established (Sillim-dong, Jung-gu, Seoul)

1971

- Renamed to Samyang Comprehensive Valve Co., Ltd. with the establishment of the current plant that has a floor space of approximately 826 m^2 on a site spanning approximately 14,770 m^2

1972

- Plant registered (Gyeonggi No. 3-58-24)
- Plant expanded (by approximately 866 m^2)
- Type approved for safety valve (Industrial Advancement Administration No. 1-2002-99)

1975

- Various valve test facilities completely equipped
- Appreciation letter from Minister of Commerce, Industry and Energy received after exhibition of products at a machinery exhibition held by Export Promotion Corporation

1978

- State-of-the-art precision processing machinery introduced from Gragiono of Italy (ARD loan)

1981

- Technology Research Institute of Samyang Comprehensive Valve established
- Chosen as a pilot factory technology-leading company by Industrial Advancement Administration of Ministry of Commerce, Industry and Energy
- Plant No. 4 built

1982

- KS mark received from Korea Industrial Standard
- Approval for manufacturing of firefighting equipment and fixtures received (Gyeonggi Province No. 3-27)
- Approval for manufacturing of high pressure gas equipment received (Gyeonggi Province No. 82-55-24)
- Minister of Commerce, Industry and Energy Award received at Nationwide Plant Saemaeul Quality Control Contest
- Trade business registered (Gyeonggi Province)
- High pressure boiler for testing installed for the first time in Korea (50 kgf/cm^2; 2.6 tons)

1983

- Approval received for types of pressure inspection device and running water inspection device for firefighting equipment (No. 83-4-1014)
- Approval received to deliver expansion joint product to Far Eastern U.S. Construction Committee

1989

- SAMYANG-ARCA Co., Ltd. established based on joint investment with ARCA REGLER GMBH of Germany

1994

- Chosen as power generation facility manufacturer by KEPCO (Safety and relief valves)

1997

- Presidential Corporate Award received

1998

- ISO-9001 certification acquired (BVQ)

2000 ~ 2010

2000

- Fourth Industrial Safety Machinery Exhibition
- Encouragement Award received (Korea Occupational Safety & Health Agency)
- KS mark received from Korea Industrial Standard (KS B 2373, 2374)

2002

- Outstanding quality certificate (EM mark) acquired
- Pressure reducing valve for steam (YPR-100) and diaphragm-type automatic flow control valve (YFC-2N) developed
- Chosen as localized high pressure safety valve developer by Ministry of Commerce, Industry and Energy
- Products exhibited at HVAC, a leading international exhibition on heating, ventilation, air-conditioning, refrigeration, air filtration and purification (Singapore)
- Products exhibited at AHR Expo (Atlanta, U.S.)

2003

- SEM System Co., LTD. established
- Products exhibited at AHR Expo (Chicago, U.S.)
- Outstanding quality certificate (EM mark) acquired (minute heating flow control system : SEM Station)
- Products exhibited at Cooling/Heating Exhibition in Shanghai, China
- U.S. patent acquired for constant flow valve (YFC-2N)

2005

- Products exhibited at AHR Expo (Anaheim, U.S.)
- BEST INC. is established as a Joint ventur with seoul national university
- Engineering Testing Laboratory, Seoul National University Institution of Engineering established.

2006

- Heating temperature control system for each room developed
- Q mark acquired

2007

- Turbine bypass valve delivered by SAMYANG-ARCA to Hwaseong Combined Heat & Power Plant
- Radiant Cooling/Heating Simulation Exhibition Hall built
- High-efficiency energy equipment certificate acquired (automatic temperature controller for heating)

2009

- Established a Joint Venture with RDZ of Italy
- Developed active auto flow regulating system (SEM II Smart System)

2010

- Samyang System Group 50th anniversary
- Acquired NET(New Exellent Technology) certification (SEM II Smart System)

Prizes & Certifications

SAMYANG VALVE

Rich Valve Experience

#48-14 Samjeong-dong, Ojeong-gu, Bucheon-si,
Gyeonggi-do, 421-808, Korea
Tel : 82-32-678-3121~3 / **Fax :** 82-32-681-1117

SAMYANG VALVE

Since its founding in 1960, Samyang Valve Co., Ltd. has been producing automatic valves for fluid control to ensure efficient energy management in the construction and industrial facility fields. The company is recognized for its high-quality products by many customers at home and abroad.

Samyang Valve has fully established itself as a leader in the domestic valve industry, thanks to continuous efforts made to enhance customer satisfaction based on research and development of products that meet the specific needs of customers; and to manufacture products that are appropriate for conditions on the field where construction and industrial facilities are used.

Based on advanced technology and extensive experience, Samyang Valve will continue to manufacture high-quality, high-performance products. The company will take a step further by offering more value to customers with a customer-oriented mindset.

- Pressure Reducing Valve
- Constant Flow Temperature Control Valve
- Primary Pressure Control Valve
- Safety Valve
- Steam Trap
- Control Valve for District Cooling and Heating
- Level Control Valve
- Bellows Type Expansion Pipe Joint
- Flexible Tube
- Water Separator
- Control Check Valve
- Strainer
- Hammerless Check Valve
- Suction Diffuser
- Air Vent Valve
- Ball, Slip, Multi Joint

SAMYANG-ARCA

Most Advanced Valve Technology

#48-11 Samjeong-dong, Ojeong-gu, Bucheon-si,
Gyeonggi-do, 421-808, Korea
Tel : 82-32-678-6390~1 / **Fax :** 82-32-678-3124

Samyang-Arca Co., Ltd. was established in 1987 through a technology alliance and a joint investment with Germany' ARCA-Regler GmbH, a professional control valve company with a tradition of 100 years. Since then, for more than 20 years Samyang-Arca has been manufacturing control valves, which are essential for key industries of a nation, and supplying them in Korea and abroad. Samyang-Arca has been manufacturing and supplying control valves such as valves used in an extremely low temperature of -190 ANSI 4500# class high pressure and / or high temperature regulating valves, and turbine bypass valves that function even at 1,000 MW-level power plants. Samyang-Arca' control valves work at a wide array of plants in Korea and abroad, including thermal power plants, nuclear power plants, desalination plants, heat recovery steam generators (HRSG), combined heat and power plants, petrochemical plants, as well as iron and steel manufacturing plants. Samyang-Arca always makes efforts to satisfy customer needs and seeks to offer highly reliable products to meet customer expectations.

Brewing and shipbuilding industry

The SAMYANG-ARCA control valves for sour gas and solids-containing media feature little pressure loss and can be effectively applied in low temperatures, just like the high-capacity microflow valve and butterfly valve.

SAMYANG-ARCA has been developing valves for impact and vibration prevention that can also be used in the shipbuilding industry.

The company' s "bio-valve" series satisfy the sanitation regulations in the food and drink manufacturing industry. The series can be applied in various areas, ranging from food and drink manufacturing to bottle factories, thanks to its outstanding performance in terms of functions as well as installation.

Petrochemicals industry

Energy use is being brought down through accurate selection of standard sizes that are needed for different processes, such as those for paper, textile, sugar, rubber, and plastic.

Metal and steel industry

The company' s products can be installed in various ways, based on their measurement range and unique strengths that allow them to meet specific requirements in the metal and steel industry concerning high pressure and high temperature.

SEM SYSTEM

Smart Heating

#48-115 Samjeong-dong, Ojeong-gu, Bucheon-si,
Gyeonggi-do, 421-808, Korea
Tel : 82-32-710-8230~3 / **Fax :** 82-32-673-6560

Sem System Co., Ltd. was established in 2003 through a technology alliance with Italy's Caleffi, a worldwide manufacturer of hydronic solutions including pressure reducing valves, tempering valve, RPZ, double check valves, and other products for heating and HVAC applications. with a tradition of 40 years. Since then, Sem System has been manufacturing and supplying the European-style distribution system for heating. It was the first European-style distribution system of an underfloor heating system introduced in Korea, thereby saving energy and further upgrading the home floor heating culture. Beyond the simple hot water distribution function of existing distribution systems, the Sem System's distribution system is a modular system that is designed to save energy through flow control by room and to maintain a pleasant indoor temperature. Moreover, its slim and compact structure ensures easy installation and maintenance, Therefore, the Sem System's distribution system is an effective product that improvs work efficiency and allows convenient use of residents. Through continuous adoption of globally advanced heating technology and R &D, Sem System keeps developing and offering new products that effectively cut down energy use.




- DISCAL, a water separator
- Pressure reducing valve by household
- Adjustable automatic supply equipment
- Adjustable pressure reducing valve
- Temperature regulating equipment
- Pressure reducing valve by household
- Temperature-adjustable mixing valve

SEM Total Solution System

ECO·ENERDIGM

RDZ INVISIBLE Heating & Cooling

#48-117 Samjeong-dong, Ojeong-gu, Bucheon-si,
Gyeonggi-do, 421-808, Korea
Tel : 82-32-672-0874 / **Fax :** 82-32-672-0876

Eco · enerdigm

Eco-enerdigm was built on the technology of Samyang System Group that was founded in 1960. Since 2003, Eco-enerdigm has been testing and researching radiant cooling and heating system and has adopted the European radiant cooling system that is eco-friendly. In year 2007, an Italian company, RDZ (the specialty company of radiant system), has offered their 40 years of knowledge and experience in radiant cooling system. Now Eco-enerdigm can offer both the best technology and local knowledge from the two companies above and provide every need from system designs, installations to after services.




Total Solution System

SAMYANG VALVE
Developing Energy Saving Products and Solutions

Since 1960, SAMYANG VALVE is a leader in the valve industry and marked an impressive record of firsts. It has been developing innovative energy saving systems, and enhances every product with the vision of the best company offering innovative energy saving solutions. SAMYANG VALVE offers the most appropriate energy-saving systems for your energy efficient home and building projects.

SAMYANG VALVE

SINCE 1960

RICH VALVE EXPERIENCE

FACTORIES

- Industrial machinery • Automobiles • Food
- Shipbuilding • Smiconductors • Pharmaceuticals
- Textile • Animal feed

ENVIRONMENT

- Water and wastewater treatment facilities
- Waste disposal sites • Golf courses
- Sprinkling water at parks • Agricultural water

PLANTS

- Power plants • Nuclear energy
- Space power generation • Pharmaceuticals
- General chemistry • Petrochemistry
- Oil economy • Paper manufacturing

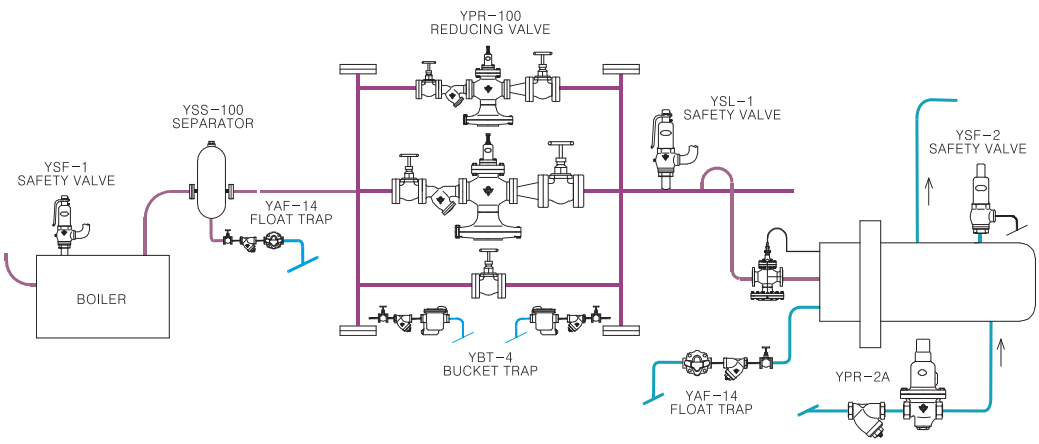
GENERAL

- Air-conditioning equipment • Sanitation facility
- Cooling/heating • Steam/hot water/cold water lines
- Fire-fighting equipment • Water supplying/heating

CONTENTS

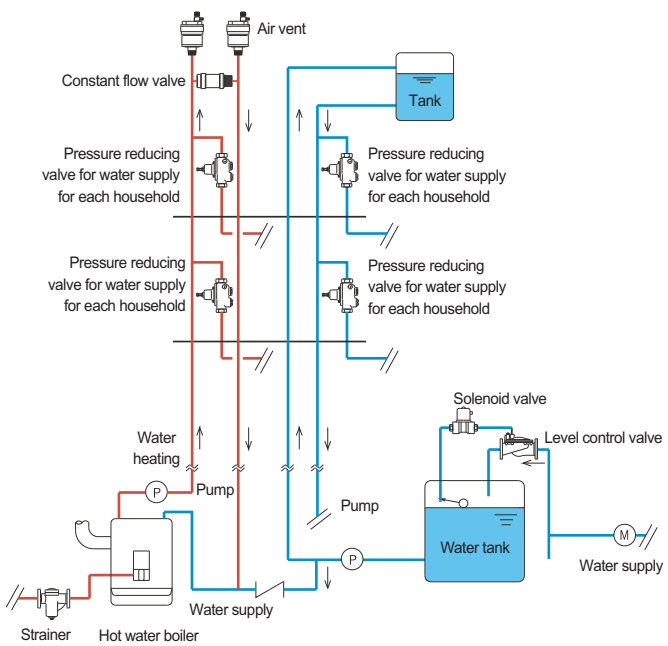
Application Diagrams

Boiler/heat exchanger facility

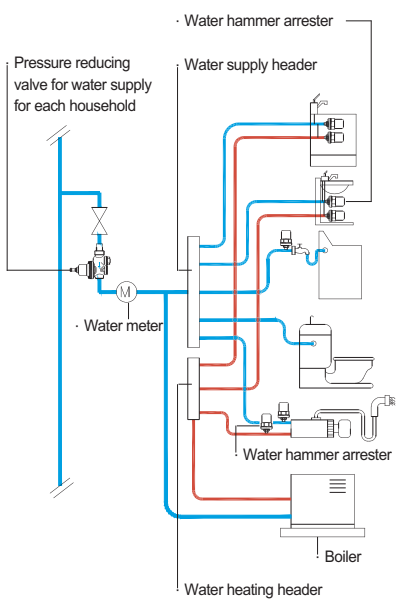


Water supplying/heating facility

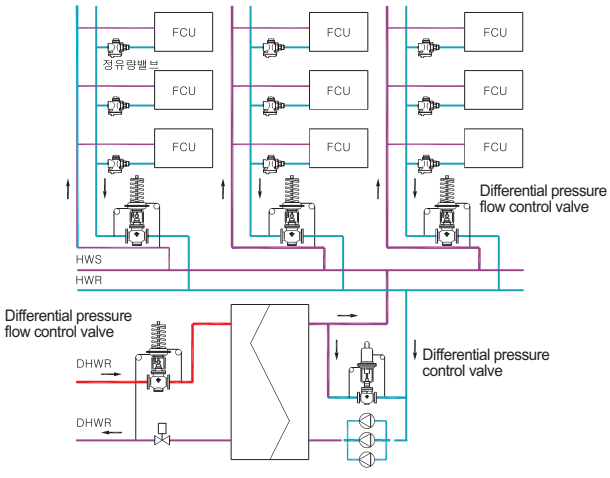
Apartment Building



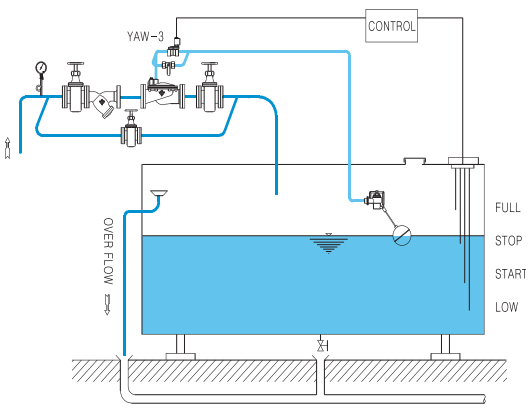
Each Household



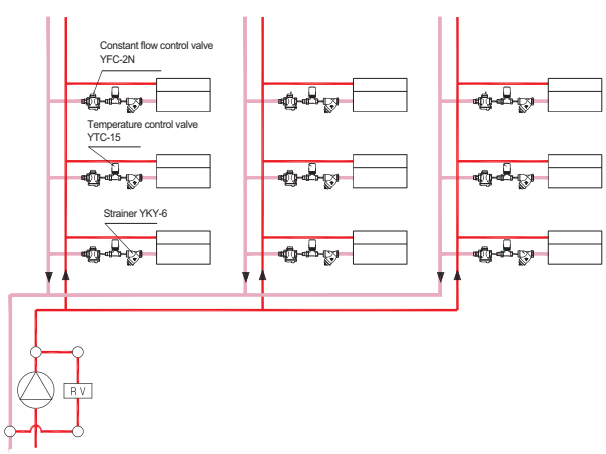
District cooling/heating facility



Level control valve facility



Constant flow temperature control facility



PRODUCTS INDEX

Samyang manufactures all types of valves needed for the flow of fluid.

This comprehensive catalogue classifies the standard products of Samyang Valve into 11 product types. Products that are currently being developed have not been included in this catalogue. Please consult with Samyang Valve's sales representatives for inquiries on technologies or specifications not included in this catalogue.

Information in the catalogue, including structures, dimensions, and materials of products, may change without prior notice to meet the latest needs of clients and for product improvements.

Pressure Reducing Valve

1

Pressure Reducing Valve

Effectively used for construction facilities and other industries as a whole, pressure reducing valves stabilize the piping system by reducing high pressure to a set pressure. They are categorized, as per their structure, into pilot, pilot diaphragm, and direct operating types.

Steam pressure reducing valve

Type	Size	Applicable fluid	Applicable pressure (kgf/cm²g)		Structure	Materials		End connection	Page
			Primary	Secondary		Body	Disc, seat		
YPR-100	15(½")~150(6")	Steam	Maximum 17	0.21~2.1	Pilot	GCD450	STS	KS 10 RF FLANGE	24
				1.4~7					
YPR-100A			Maximum 30	5.6~14		SCPH2		KS 20K, 30K RF FLANGE	
YPR-1S	15(½")~200(8")		Maximum 10	0.35~8		GC200	BC6	KS 10 RF FLANGE	26
YPR-50	15(½")~25(1")		Maximum 14	0.2~10	Direct operating		STS	KS PT SCREW	28

Steam pressure reducing valve

Type	Size	Applicable fluid	Applicable pressure (kgf/cm²g)		Structure	Materials		End connection	Page
			Primary	Secondary		Body	Disc, seat		
YPR-8S	15(½")~20(¾")	Cold/hot water	Maximum 10	0.5~1.5	Direct operating	15A:BsC3 20A:BC6	VITON/STS	KS PT SCREW	29
YPR-8U								Inlet : KS PT UNION (8A : KS PT SCREW) Outlet : KS PT SCREW	
YPR-8G	15(½")			1.5~3		BsC3			30
YPR-8A									
YPR-8N				3~5					31
YPR-8H						BsC3 BC6	VITON/PUS		
YPR-8E				1.2~5					32
YPR-2A	15(½")~25(1")			0.5~3.5		GC200	NBR/BC6	KS PT SCREW	33
	32(1½")~150(6")			3~7				KS 10K FF FLANGE	
YAWR-1	200(8")~250(10")			0.5~3.5	Pilot			KS 10K RF FLANGE	35
	300(12")~400(16")			3~7					
YPR-41	15(½")~150(6")	Water, vapor	Maximum 20	0.5~12	Direct operating	SCPH2, STS316	NBR/STS		37

Primary pressure regulating valve

Type	Size	Applicable fluid	Applicable pressure(kgf/cm²g)		Structure	Materials		End connection	Page
			Primary	Secondary		Body	Disc, seat		
YPR-2W	15(½")~25(1")	Water	Maximum 10	0.5~7	Direct operating	GC200	NBR/BC6	KS PT SCREW	38
	32(1¼")~150(6")							KS 10K FF FLANGE	
YAWM-1	200(8")~400(16")				Pilot			KS 10K RF FLANGE	40

Type YPR-100, 100A Pressure Reducing Valve For Steam

This pressure reducing pilot diaphragm valve for steam is a self-operated valve that has a high Cv value, and maintains an outstanding level of controllability in primary pressure changes as well as steam equipments' load fluctuations.

■ Features

- 20:1 Maximum Pressure Turndown Ratio provides one-stage reduction without the customary costly two stage reduction.
- High Cv value and superb flow-controlling capacity allows even products that are one or two size smaller than the usual nominal diameter.
- Low pressure (0.21 kgf/cm²g) management is possible.
- Three different springs are employed based on the secondary pressure regulating range, thereby color-differentiating the pressure range based on the pipeline conditions.
- Simple structure, and major moving parts are made of durable stainless steel : removal of an adapter between the main valve and pilot valve enables easy repair and inspection.

■ Specifications

Type		YPR-100	YPR-100A
Applicable fluid		Steam	
Primary pressure		Maximum 17 kgf/cm²g	Maximum 30 kgf/cm²g
High pressure regulating range		0.21~2.1kgf/cm²g(for low pressure), 1.4~7.0kgf/cm²g(for medium pressure), 5.~14.0kgf/cm²g(for high pressure)	
Maximum pressure reduction ratio		20:1	
Minimum differential pressure in the inlet and outlet side of the valve		0.5kgf/cm²	
Leakage allowance		0.01% less of rated flow	
Fluid temperature		220° C below	250° C below
End connection		KS 10K, 20K kgf/cm²g RF FLANGE	KS 20K, 30K kgf/cm²g RF FLANGE
Material	Body	GCD450	SCPH2
	Disc, seat	STS	
	Diaphragm	Copper	
Hydraulic test pressure		30 kgf/cm²g	45 kgf/cm²g

▶ Strainer (over 80 Mesh) installation is required to ahead inlet when valve installing.
▶ Install a water separator at the inlet of the pressure reducing valve to ensure the removal of condensate.

■ Pressure regulating spring range

Yellow	0.21~2.1kgf/cm²g
Red	1.4~7.0kgf/cm²g
Blue	5.6~14.0kgf/cm²g

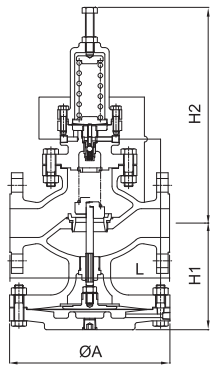
■ Dimensions

(mm)

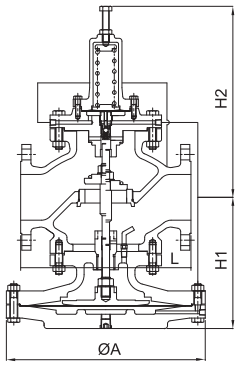
Size	L	øA	H1	H2	Cv	Weight (kg)
15(½")	130(130)	196	140(127)	273(130)	5	17.5
20(¾")	150(150)	196	135(130)	281(130)	7.2	18
25(1")	184(197)	223	150(135)	283(130)	10.9	23.5
32(1¼")	180(180)	223	163(143)	293(130)	14.3	24.5
40(1½")	222(235)	223	173(148)	297(130)	18.8	26
50(2")	254(267)	272	195(194)	292(130)	32	41.5
65(2½")	276(292)	348	255(227)	327(130)	60	69.5
80(3")	298(318)	348	260(230)	332(130)	78	75
100(4")	352(368)	402	285(252)	343(130)	120	97.5
125(5")	400	460	330(368)	415(368)	160	180
150(6")	451(473)	530	384(368)	445(368)	245	230

▶ Dimensions in parenthesis are for YPR-100A.

■ Dimensional drawing

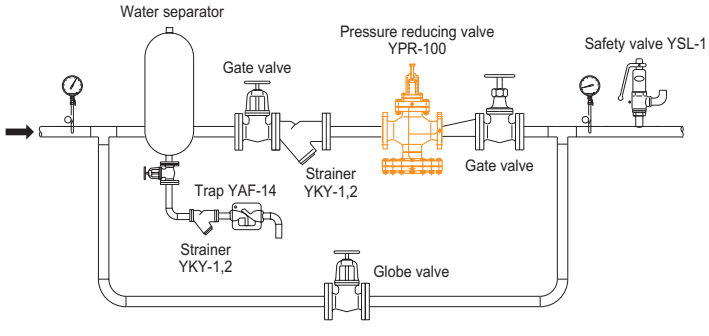


Type 15-40A



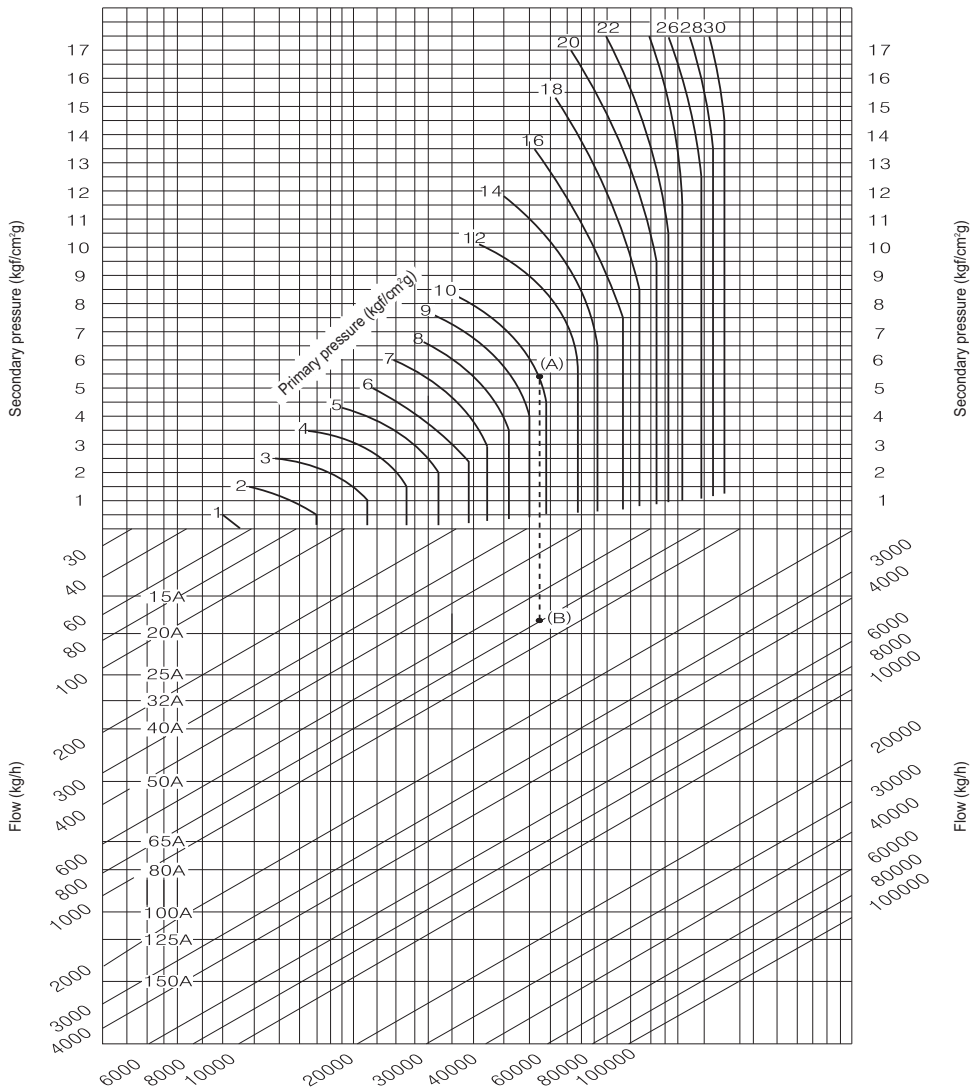
Type 50-150A

■ Application Diagram (Example)



Type YPR-100, 100A Pressure Reducing Valve

■ Chart on selecting a size

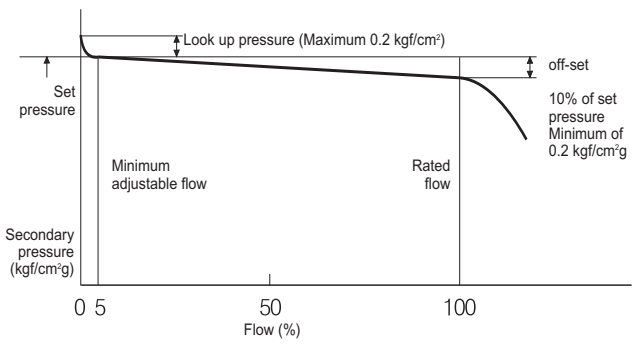


How to select the size of a valve by the chart

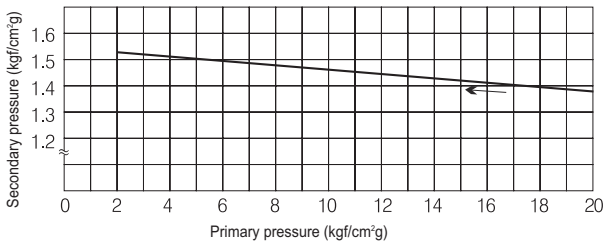
Example) If the primary pressure is 10 kgf/cm²g, secondary pressure is 5.5 kgf/cm²g, and flow is 800 kg/h,

1) Determine “A,” the point of intersection between the primary pressure (10 kgf/cm²g) and secondary pressure (5.5 kgf/cm²g).
2) Go down vertically from “A” to make intersection “B” with the flow (800 kg/h). Now that “B” is in between a size of 15A and 20A, a size of 20A should be selected.

■ Flow characteristics chart



■ Pressure characteristics chart



▶ Assuming that the secondary pressure was set to 1.4 kgf/cm²g, while the primary pressure was 17.5 kgf/cm²g, this chart shows changes in the secondary pressure when the primary pressure is adjusted to between 2 and 14 kgf/cm²g.

Type YPR-1S Pressure Reducing Valve For Steam

This pressure reducing valve, which is used for construction facilities and industrial steam lines, demonstrates stable control and subtle operations. It features an outstanding performance even with severe changes in the steam flow and primary pressure.

■ Features

- Pilot-type pressure reducing valve for steam features a precise adjustment function.
- With only a single adjustment, a constant pressure level is maintained, thereby ensuring safety.
- Convenient piping construction, thanks to its simple structure and solidity.
- Superb performance even in places where primary steam pressure changes are severe.
- Pressure at a constant level, regardless of changes in the secondary flow.

■ Specifications

Applicable fluid		Steam
Primary pressure		Maximum 10 kgf/cm²g
Secondary pressure regulating range		0.35~5 kgf/cm²g (for standard pressure) 4~8 kgf/cm²g (for medium pressure)
Maximum pressure reduction ratio		10:1
Minimum differential pressure in the inlet and outlet side of the valve		0.7kgf/cm²
Leakage allowance		0.05% less of rated flow
Fluid temperature		220° C below
End connection		KS 10K RF FLANGE
Materials	**Body**	GC200
	Disc, seat	BC6
Hydraulic test pressure		15 kgf/cm²g

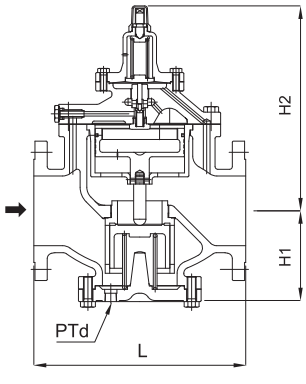
▶ Strainer (over 80 Mesh) installation is required to ahead inlet when valve installing.
▶ Install a water separator at the inlet of the pressure reducing valve to ensure the removal of condensate.

■ Dimensions

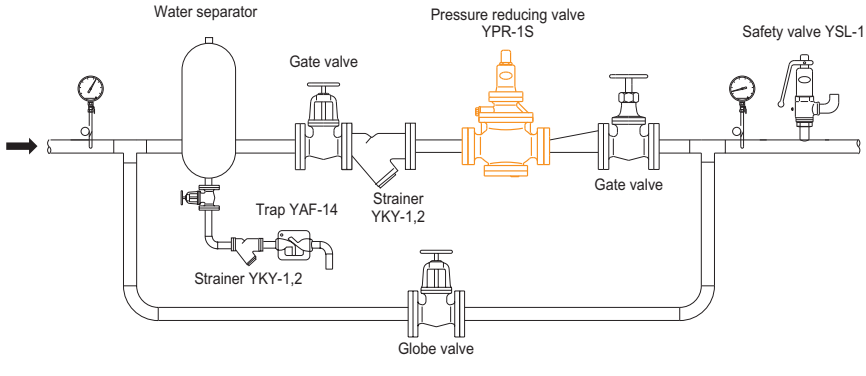
(mm)

Size	L	H1	H2	d	Cv	Weight (kg)
15(½")	152	63	230	¼"	1	8.0
20(¾")	152	63	230	¼"	2.5	8.0
25(1")	170	71	255	¼"	4	12.5
32(1¼")	200	81	265	¼"	6.5	16
40(1½")	200	81	265	¼"	9	16.5
50(2")	215	86	270	¼"	16	21
65(2½")	245	110	285	⅜"	25	29
80(3")	285	130	295	⅜"	36	39.5
100(4")	320	148	308	⅜"	64	68
125(5")	380	173	368	⅜"	100	83.3
150(6")	420	189	378	⅜"	144	101
200(8")	500	229	451	⅜"	256	183

■ Dimensional drawing

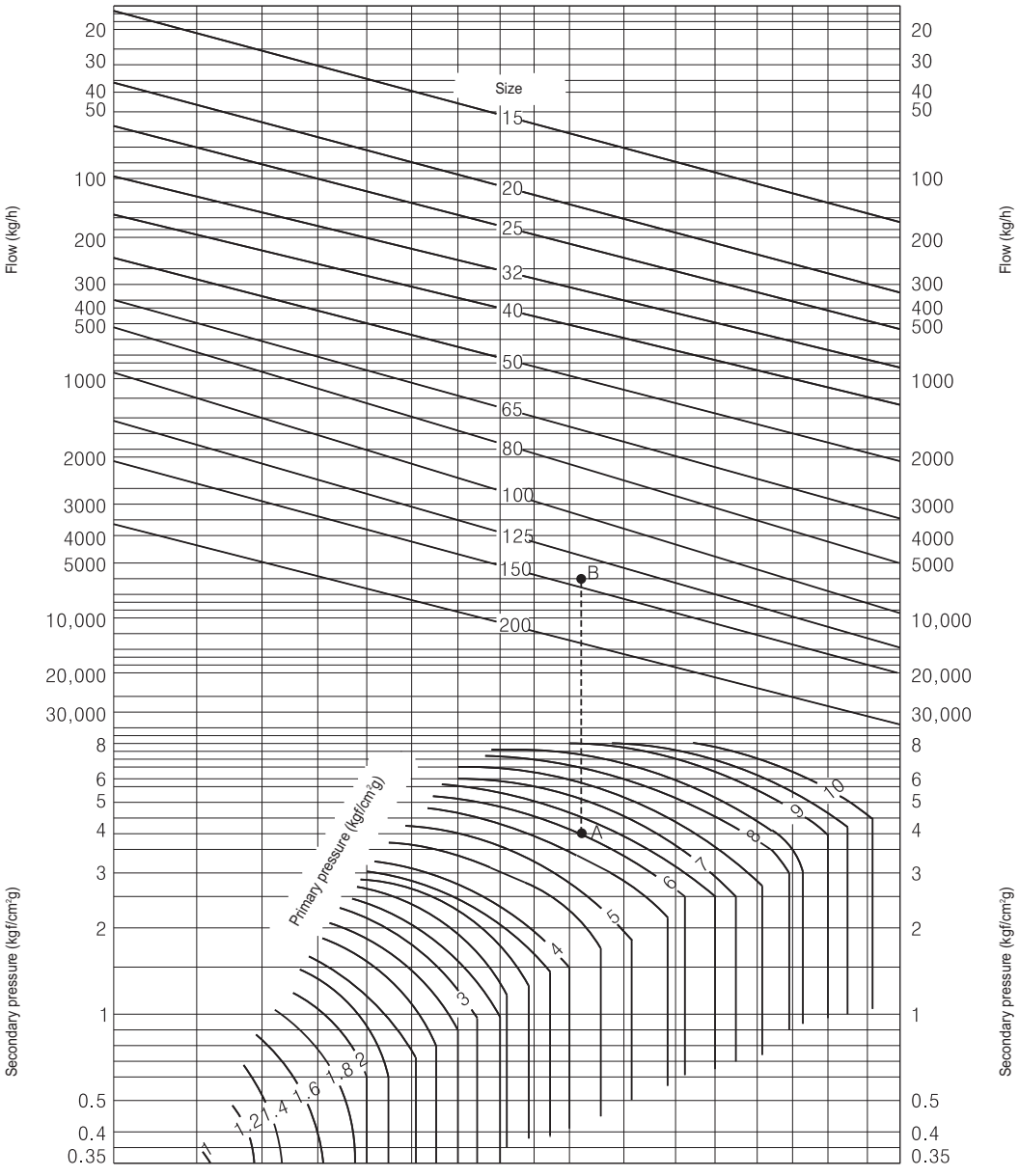


■ Application Diagram (Example)



Type YPR-1S Pressure Reducing Valve

■ Chart on selecting a size



How to select the size of a valve by the chart

Example) If the primary pressure is 6 kgf/cm²g, secondary pressure is 4 kgf/cm²g, and flow is 6,000 kg/h,

1) Determine “A,” the point of intersection between the primary pressure (6 kgf/cm²g) and secondary pressure (4 kgf/cm²g). Go down vertically from “A” to make intersection “B” with the flow (6,000 kg/h).
2) This “B” is what determines the size of the valve. It is in between a size of 125 and 150, and therefore a size of 150 should be selected.

Type YPR-50 Pressure Reducing Valve For Steam

As a direct operating pressure reducing valve for steam that can be used for pipelines and a wide array of steam facilities, this product can be employed for various purposes in an environment with small flow.

■ Features

- Direct operating pressure reducing valve for small flow for outstanding pressure control performance and wide pressure regulating range.
- Stainless steel components for corrosion resistance, long service life and durability.

■ Specifications

Applicable fluid		Steam
Primary pressure		Maximum 14 kgf/cm²g
Secondary pressure regulating range		0.2~1 kgf/cm²g (for low pressure), 1~2 kgf/cm²g (for medium pressure), 2~10 kgf/cm²g (for standard pressure)
Maximum pressure reduction ratio		10:1
Minimum differential pressure in the inlet and outlet side of the valve		0.5kgf/cm²
Fluid temperature		220°C below
Leakage allowance		0.05% less of rated flow
End connection		KS PT SCREW
Materials	Body	GC200
	Disc, seat	STS
Hydraulic test pressure		21 kgf/cm²g

▶ Strainer (over 80 Mesh) installation is required to ahead inlet when valve installing.
▶ Install a water separator at the inlet of the pressure reducing valve to ensure the removal of condensate.

■ Dimensions

(mm)

Size	L	H1	H2	Weight (kg)
15(½")	110	54	180	5.5
20(¾")	110	54	180	5.5
25(1")	144	66	256	8.6

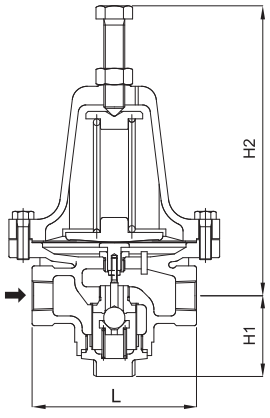
■ Capacity

(kg/h)

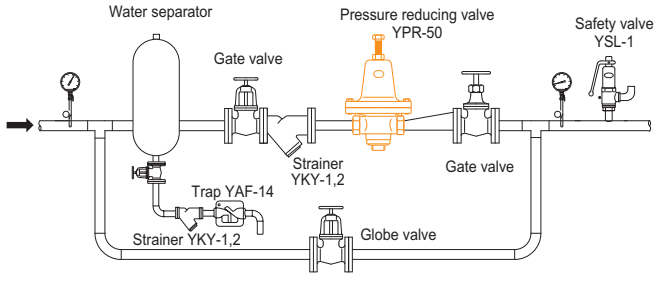
Primary pressure (kgf/cm²g)	Secondary pressure (kgf/cm²g)	Size 15(½")	Size 20(¾")	Size 25(1")
1.0	0.5	3.4	3.9	6.5
1.4	0.9	3.7	3.4	7.4
	0.5	3	3.9	4.4
2.1	1.6	4.4	5	7.9
	1	3.7	4.2	7.1
	0.2	2.3	2.8	4.2
2.8	2.3	7	8.5	13.2
	1.4	5.6	6.8	11.2
	0.3	2.8	3.9	5.4
3.5	2.8	9.1	10.1	17
	1.4	7	8.1	13.2
	0.4	3.4	4.4	6.2
4.2	3.4	9.6	10.8	18.6
	2.8	10.6	11.6	20.3
	1.3	6.3	7.3	12
	0.4	3.9	5.1	7
5.6	4.5	12.4	14.4	24
	3.8	13.1	15.8	24.8
	1.6	8.5	9.6	15.5
	0.6	4.2	5.4	7.6

Primary pressure (kgf/cm²g)	Secondary pressure (kgf/cm²g)	Size 15(½")	Size 20(¾")	Size 25(1")
7.0	5.6	14.3	17	27.9
	4.6	15.8	18.4	30.7
	2.8	13.9	16.2	26.4
	0.7	4.8	5.6	9.3
8.4	6.8	16.2	19.4	31.8
	4.9	19.4	21.9	36.4
	3.2	16.9	18.8	31.6
	0.8	7.7	8.5	13.9
10.6	8.4	20.2	23.4	38.7
	6	25.6	29.6	50
	3.9	21	24.8	41.8
	1	9.3	11.6	17.9
12.7	9.8	28.7	34.1	55.8
	8.1	30.2	35.6	60.5
	4.9	27.1	30.2	52
	1.3	11.6	13.2	21.7
14.0	9.8	32.4	36.4	61.2
	8.1	33.3	38	63.6
	5.6	30.2	34.9	58.2
	1.4	14.7	17	27.1

■ Dimensional drawing



■ Application Diagram (Example)



Type YPR-8S, 8U Pressure Reducing Valve

for Heating and Supplying Water for Each Household

Pressure reducing valves that are used to supply water to each household are designed to resolve problems that arise from a pressure imbalance in water supplied to households. They promote user convenience by allowing easy changes of the pipeline direction in accordance with field conditions.

Type YPR-8S

Type YPR-8U

Option (Check valve)

■ Features

- Irregular pressures control among households in apartment buildings : it prevents waste of water resources.
- A pressure gauge can be attached for precise identification of adjusted pressure.
- Two ways to install : horizontally or vertically.
- No damage caused by high pressure : a diaphragm with special fiber cloth ensures it.
- A constant pressure level with only a single adjustment.
- YPR-8U : as a union type, the pipeline can be changed easily according to field conditions.
- Options : (1) precise identification of adjusted pressure; (2) installation space reduction.

■ Specifications

Type		YPR-8S	YPR-8U
Size		15(½") ~ 20(¾")	
Applicable fluid		Cold/hot water	
Primary pressure		10kgf/cm²g	
High pressure regulating range		0.5~1.5kgf/cm²g (for low pressure), 1.5~3kgf/cm²g(for medium pressure), 3~5kgf/cm²g(for high pressure)	
Applicable fluid temperature		120°C below	
Maximum pressure reduction ratio		10:1	
Minimum differential pressure in the inlet and outlet side of the valve		0.5kgf/cm²	
End connection	Inlet	KS PT SCREW	KS PT UNION
	Outlet	KS PT SCREW	KS PT SCREW
Materials		Body : 15A(BsC3) 20A(Bc6) / Diaphragm: EPDM / Disc, seat: VITON or STS	
Hydraulic test pressure		15 kgf/cm²g	
Optional		Pressure gauge	Pressure gauge, Check valve

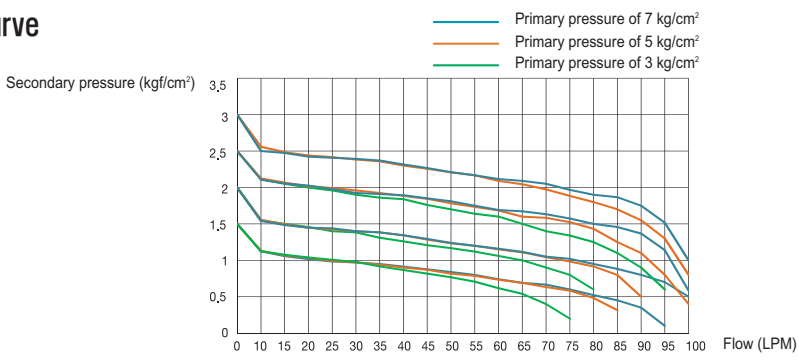
▶ Multi-step pressure reduction is needed when the cavitation index is 0.5 or lower.
▶ Strainer (over 40 Mesh) installation is required to ahead inlet when valve installing.

■ Dimensions

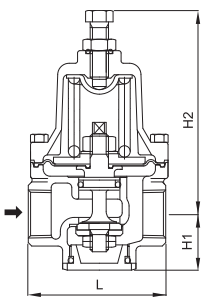
(mm)

Type	Size	L	H1	H2	Weight (kg)
YPR-8S	15(½")	60	24.5	88.5	0.54
	20(¾")	60	27	96	0.88
YPR-8U	15(½")	99	24.5	88.5	0.60
	15(½")	110	27	96	0.95

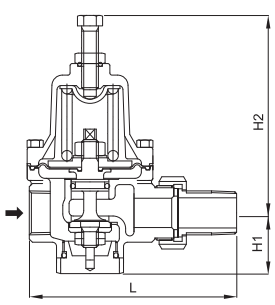
■ Flow curve



■ Dimensional drawing



Type YPR-8S



Type YPR-8U

Type YPR-8G, 8A Pressure Reducing Valve

for Heating and Supplying Water for Each Household

Pressure reducing valves that are used to supply water to each household are designed to resolve problems that arise from a pressure imbalance in water supplied to households. They promote user convenience by allowing easy changing of the pipeline direction in accordance with field conditions.

Type YPR-8G

Type YPR-8A1, 2

Optional (Check valve)

■ Features

- Irregular pressures control among households in apartment buildings : it prevents waste of water resources.
- A pressure gauge can be attached for precise identification of adjusted pressure.
- Two ways to install : horizontally or vertically.
- No damage caused by high pressure : a diaphragm with special fiber cloth ensures it.
- A constant pressure level with only a single adjustment.
- As a union type, the pipeline can be changed easily according to field conditions.
- YPR-8G, YPR-8C2, YPR-8A2, YPRC-8A2 : the built-in strainer blocks inflow of foreign substances and reduces installation space.
- YPR-8C1,2, YPRC-8A1,2 : it includes the check function so as to prevent the calorie meter from rotating idly by blocking the fluid from flowing backwards.
- The ample opening area of the angle valve minimizes resistance loss, thereby enabling use of larger flow.

■ Specifications

Type		YPR-8G	YPR-8A
Size		15(½")	
Applicable fluid		Cold/hot water	
Primary pressure		10kgf/cm²	
High pressure regulation		0.5~1.5kgf/cm²g (for low pressure), 1.5~3kgf/cm²g(for medium pressure), 3~5kgf/cm²g(for high pressure)	
Applicable fluid temperature		120° C below	
Maximum pressure reduction ratio		10:1	
Minimum differential pressure in the inlet and outlet side of the valve		0.5kgf/cm²	
End connection	Inlet	KS PT UNION	KS PT SCREW (Angle type)
	Outlet	KS PT SCREW	KS PT SCREW
Materials	Body	BsC3	
	Disc, seat	VITON, STS	
Hydraulic test pressure		15 kgf/cm²g	
Optional		Pressure gauge, Check valve	

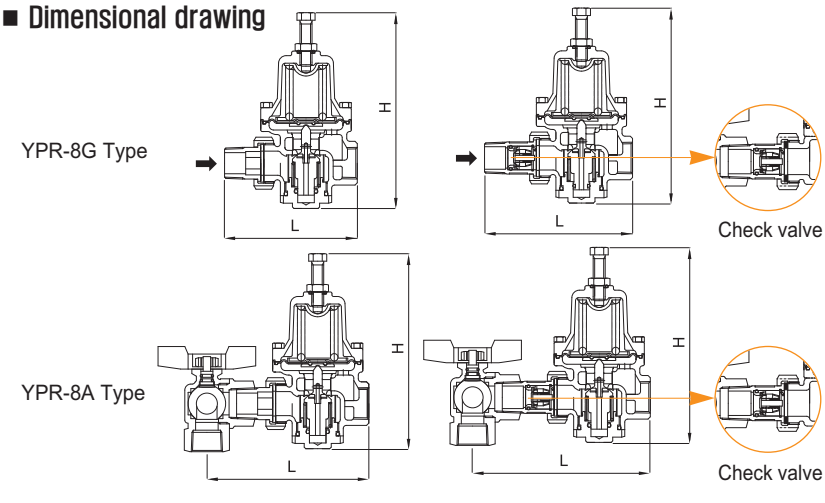
▶ Multi-step pressure reduction is needed when the cavitation index is 0.5 or lower.
▶ Strainer (over 40 Mesh) installation is required to ahead inlet when valve installing.

■ Dimensions

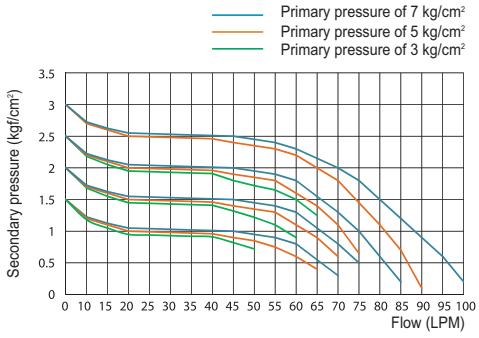
(mm)

Type	Size	L	H	Specifications
YPR-8G	15(½")	88	130	Including screen
YPR-8A1	15(½")	108	130	Angle
YPR-8A2	15(½")	114	130	Angle+Screen
YPR-8C1	15(½")	99	130	Check
YPR-8C2	15(½")	105	130	Check+Screen
YPRC-8A1	15(½")	108	130	Check+Angle
YPRC-8A2	15(½")	114	130	Check+Angle+Screen

■ Dimensional drawing



■ Flow curve



Type YPR-8N, 8H Pressure Reducing Valve

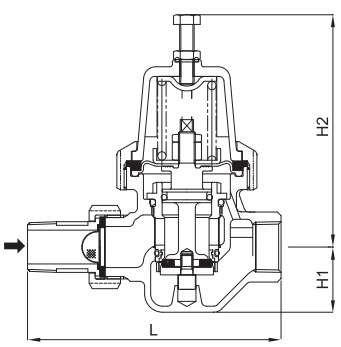
for Heating and Supplying Water for Each Household

Pressure reducing valves that are used to supply water to each household are designed to resolve problems that arise from a pressure imbalance in water supplied to households. They promote user convenience by allowing easy changing of the pipeline direction in accordance with field conditions.

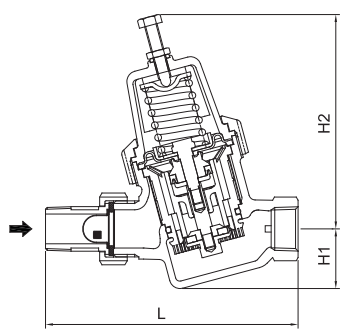
Type YPR-8N

Type YPR-8H

■ Dimensional drawing



Type YPR-8N



Type YPR-8H

■ Features

- Irregular pressures control among households in apartment buildings : it prevents waste of water resources.
- Installation is easy : the product has adopted a union coupling method.
- No additional errors resulting from the idle rotation of the flowmeter; by preventing pressure imbalance in supplied water among households and blocking countercurrents to “low-pressure” households.
- Supplying sufficient flow, based on an appropriate pressure level, even at peak load : its optimal design considers the maximum concurrent usage rate.
- Built-in strainer blocks entry of foreign substances and reduces installation space.
- Precise identification of adjusted pressure.
- Installation space reduction.
- Improvements in cross-sections polishing on the flow path minimize resistance loss and reduce noise.

■ Specifications

Type		YPR-8N	YPR-8H
Size		15A(1/2")	
Applicable fluid		Cold/hot water	
Primary pressure		10kgf/cm²	
High pressure regulation		0.5~1.5kgf/cm²g (for low pressure), 1.5~3.0kgf/cm²g(for medium pressure), 3.0~5.0kgf/cm²g(for high pressure)	
Applicable fluid temperature		120° C below	
Maximum pressure reduction ratio		10:1	
Minimum differential pressure in the inlet and outlet side of the valve		0.5kgf/cm²	
End connection	Inlet	KS PT UNION	
	Outlet	KS PT SCREW	
Materials	Body	BsC3	BC6, BsC3
	Disc, seat	VITON, SUS	VITON, PSU
Hydraulic test pressure		15 kgf/cm²g	
Optional		Pressure gauge	Check valve, Pressure gauge

▶ Strainer (over 40 Mesh) installation is required to ahead inlet when valve installing.

■ Dimensions

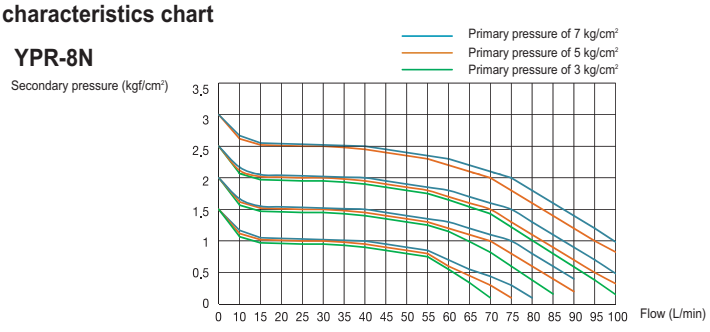
(mm)

Type	Size	L	H1	H2
YPR-8N	15(½")	105	27	96
YPR-8H	15(½")	108	28.2	100

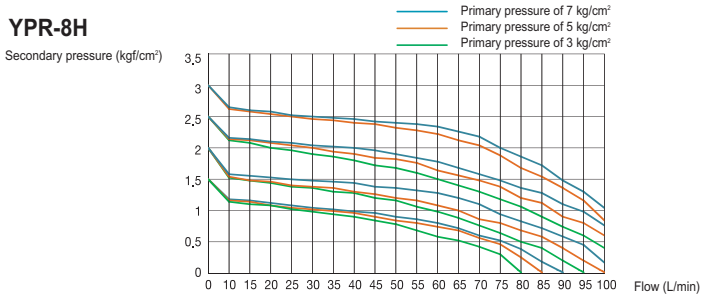
■ Characteristics chart

≫ Flow characteristics chart

YPR-8N



YPR-8H



Type YPR-8E Large Flow Pressure Reducing Valve

for Heating and Supplying Water for Each Household

Pressure reducing valves that are used to supply water to each household are designed to resolve problems that arise from a pressure imbalance in water supplied to households. They promote user convenience by allowing easy changing of the pipeline direction in accordance with field conditions.

■ Features

- Irregular pressures control among households in apartment buildings : it prevents waste of water resources.
- Installation is easy : the product has adopted a union coupling method.
- Built-in strainer blocks entry of foreign substances and reduces installation space.
- No additional errors resulting from the idle rotation of the flowmeter; by preventing pressure imbalance in supplied water among households and blocking countercurrents to “low-pressure” households.
- Pressure can be adjusted by turning the control section, without using any tools. Pressure adjustment is made even easier by checking of the indicator.
- Supplying sufficient flow, based on an appropriate pressure level, even at peak load : its optimal design considers the maximum concurrent usage rate.
- As a valve with a single-unit cartridge structure, its main components are built in unit form, thereby enabling replacement of inner parts as a unit.
- Easy temporary pipeline construction by using the product’s body : no need to install a separate temporary pipeline.
- Improvements in cross-sections polishing on the flow path minimize resistance loss and reduce noise.

■ Specifications

Size		15A(½")
Applicable fluid		Cold/hot water
Primary pressure		10kgf/cm²
Secondary pressure regulating range		1.2~5.0kgf/cm²
Applicable fluid temperature		120° C or below
Maximum pressure reduction ratio		10:1
Minimum differential pressure in the inlet and outlet side of the valve		0.5kgf/cm²
End connection	**Inlet**	KS PT UNION
	Outlet	KS PT SCREW
Materials	**Body**	BC6, BsC3
	Disc, seat	VITON, PSU
Hydraulic test pressure		15 kgf/cm²g
Optional		Pressure gauge, Check valve

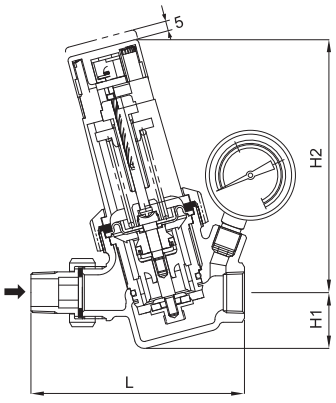
▶ Strainer (over 40 Mesh) installation is required to ahead inlet when valve installing.

■ Dimensions

(mm)

Type	Size	L	H1	H2
YPR-8E	**15(½")**	108	28.2	128

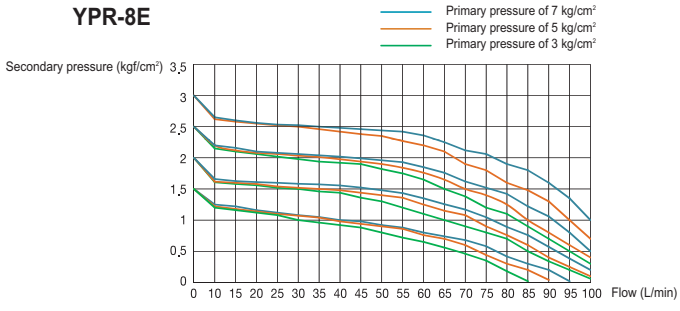
■ Dimensional drawing



■ Characteristics chart

≫ Flow characteristics chart

YPR-8E



Type YPR-2A Pressure Reducing Valve for Water

This is a direct operating pressure reducing valve for cold and hot water that can be used for small to large flows, with a small pressure fluctuation range. Used for construction facilities, this valve is employed for pressure control of each level's water supplied by an elevated water tank of a medium or high-rise building; as well as for pressure control of feed water from a directly-coupled pump and other boiler feed water.

Screwed type

Flanged type

■ Features

- Outstanding functions for controlling the pressure of water supplied by a building's elevated water tank to each floor.
- Easy to handle : small size and light weight.
- Two ways to install : horizontally or vertically.
- A constant pressure level with only a single adjustment.
- Wide flow range ability : an outstanding level of minimum adjustable flow & adjustable and stable in a wide flow range.
- All parts can be disassembled through the top of the valve : complete repairs even in limited spaces is possible.
- Built-in spring-type orifice that prevents a water hammering action.
- Linear flow pass-through method, which removes noise during operation.

■ Specifications

Applicable fluid		Water	
Primary pressure		Maximum 10 kgf/cm²g	
Secondary pressure regulating range		Outer spring	0.5~3.5kgf/cm²g
		Inner+outer spring	3~7kgf/cm²g
Maximum pressure reduction ratio		10:1	
Minimum differential pressure in the inlet and outlet side of the valve		0.5kgf/cm²	
Minimum adjustable flow		2~5 liters of water/min	
Fluid temperature		Maximum 5~80° C	
End connection		KS PT SCREW(15~25A), KS 10K FF FLANGE(32~150A)	
Materials	**Body**	GC200	
	Disc, seat	NBR, BC6	
Hydraulic test pressure		15 kgf/cm²g	

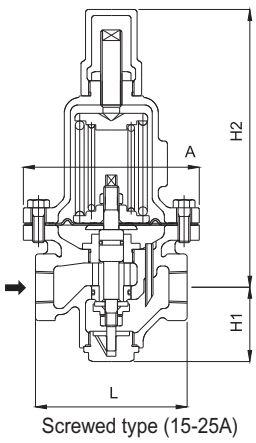
▶ Multi-step pressure reduction is needed when the cavitation index is 0.5 or lower.
▶ Strainer (over 40 Mesh) installation is required to ahead inlet when valve installing.

■ Dimensions

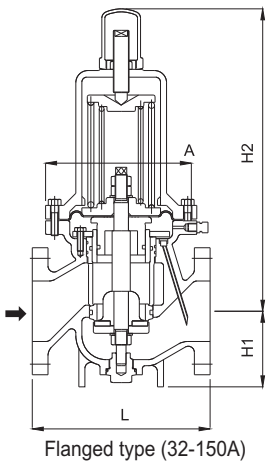
(mm)

Size	L	A	H1	H2	Cv	Weight (kg)
15(½")	100	116	50	184	2.1	3.7
20(¾")	100	116	50	184	2.1	3.7
25(1")	120	142	68	224	3.5	6.9
32(1¼")	190	174	81	327	8.0	17.0
40(1½")	190	174	81	327	8.0	17.0
50(2")	190	174	81	327	14	18.6
65(2½")	250	228	100	374	22	36.3
80(3")	250	228	100	374	32	37.4
100(4")	290	250	125	490	48	67.0
150(6")	390	340	165	655	108	150

■ Dimensional drawing



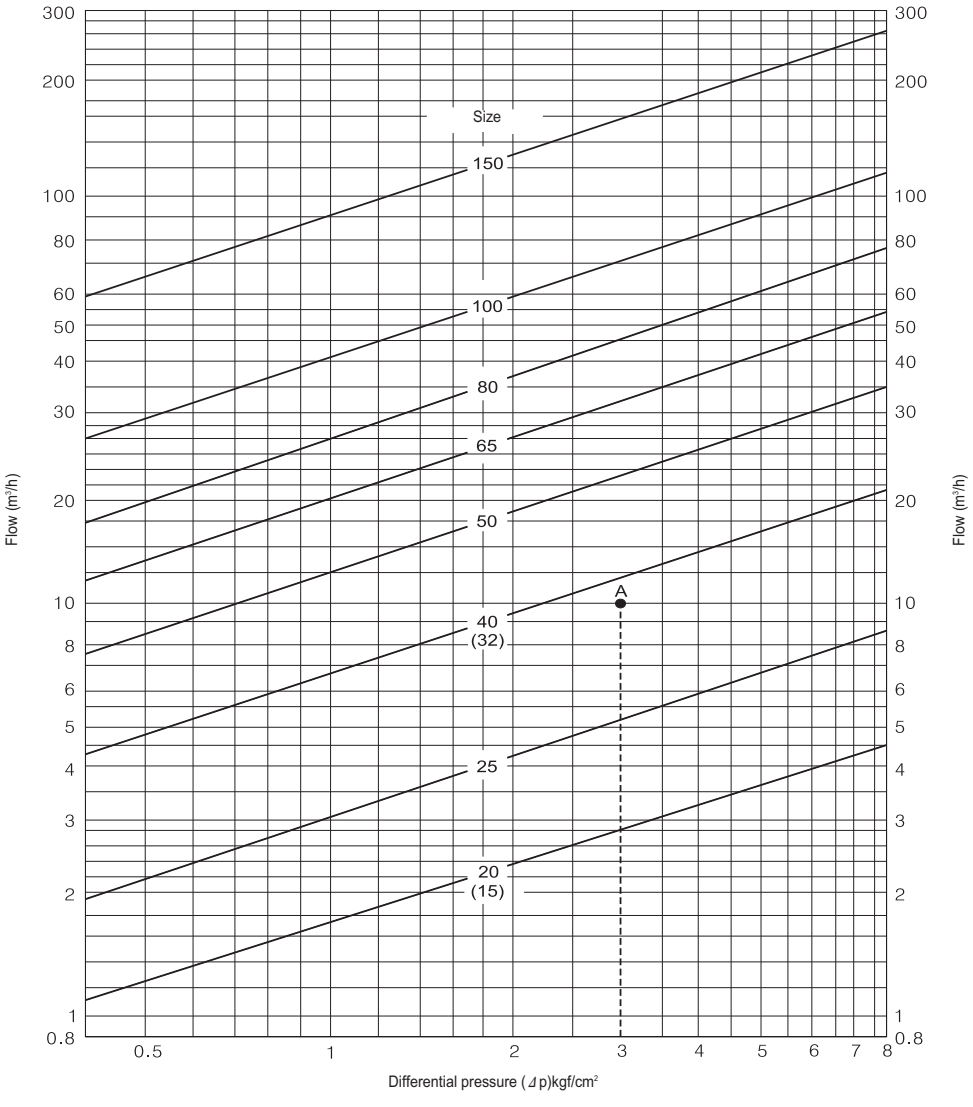
Screwed type (15-25A)



Flanged type (32-150A)

Type YPR-2A Pressure Reducing valve

■ Chart on selecting a size

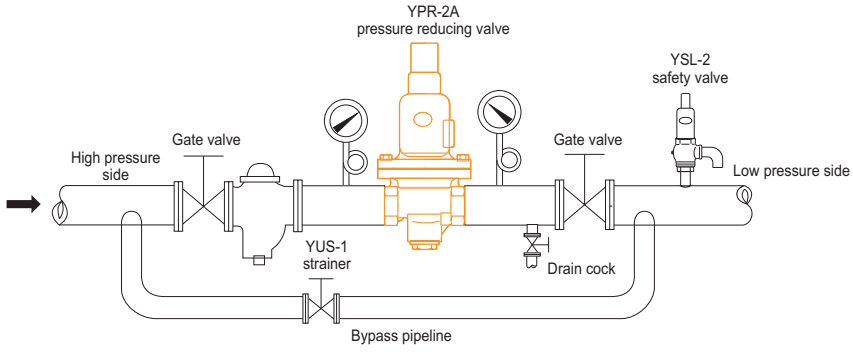


How to select the size of a valve by the chart

Example) If the primary pressure is 5 kgf/cm²g, secondary pressure is 2 kgf/cm²g, and flow is 10 cm³/h,

1) The differential pressure ($\Delta P=P_1-P_2$) between the primary pressure (5 kgf/cm²g) and secondary pressure (2 kgf/cm²g) is 3 kgf/cm².
2) Determine point "A" by vertically connecting the differential pressure (3 kgf/cm²) with the flow (10 cm³/h).
3) Now that "A" is in between a size of 25 and 40, a size of 40 should be selected.

■ Application Diagram (Example)



Type YAWR-1 Pressure Reducing Valve for Water

As a large capacity pressure reducing valve, this product is used for construction facilities, plants, and water-supplying lines for agricultural use. Because the pilot valve has a pressure balance structure, it maintains a constant secondary pressure level, regardless of changes in the primary pressure.

■ Features

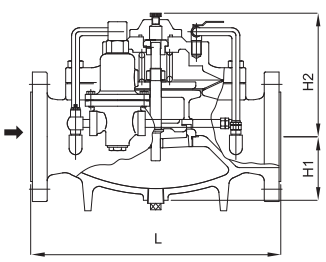
Special seat structure : it prevents a water hammer when the valve is opened and closed.

■ Specifications

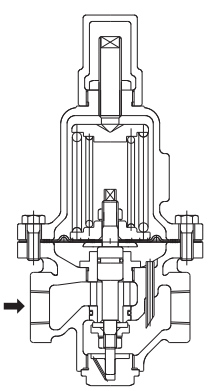
Applicable fluid		Clear water, industrial water, agricultural water	
Primary pressure		Maximum 10 kgf/cm²g	
Secondary pressure regulating range		Size of 200~250	0.5~7kgf/cm²g
		Size of 300~400	0.5~3.5kgf/cm²g 3.0~7kgf/cm²g
Maximum pressure reduction ratio		10:1	
Minimum differential pressure in the inlet and outlet side of the valve		0.5kgf/cm²	
Minimum adjustable flow		10% of rated flow	
Fluid temperature		80° C below	
End connection		KS 10K RF FLANGE	
Materials	**Body**	GC200	
	Disc, seat	NBR, BC6	
Hydraulic test pressure		15 kgf/cm²g	
Optional		Pressure gauge	

- ▶ The primary and secondary pressure gauge is attached upon client's order.
- ▶ The direct operating type (YPR-2A) should be selected for control of small flow.
- ▶ A pipeline needs to be installed in parallel with the direct operating YPR-2A if there is a need for flow control within 10% of the rated flow.
- ▶ Strainer (over 40 Mesh) installation is required to ahead inlet when valve installing.

■ Dimensional drawing



Main valve



Pilot pressure reducing valve

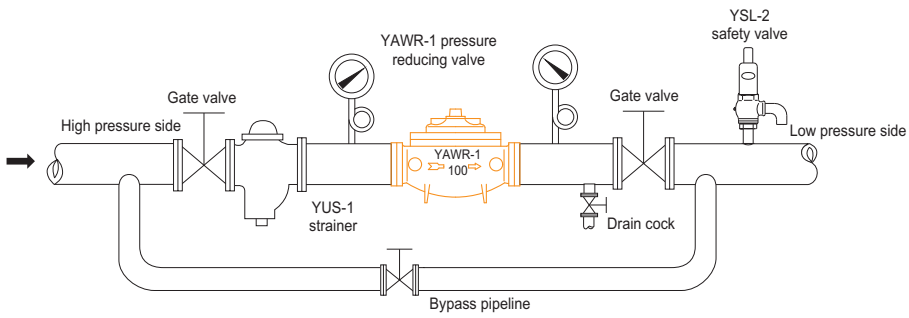
■ Dimensions

(mm)

Size	L	H1	H2	Cv	Weight (kg)
200(8")	640	210	390	640	205
250(10")	740	250	481	1000	440
300(12")	900	290	557	1440	516

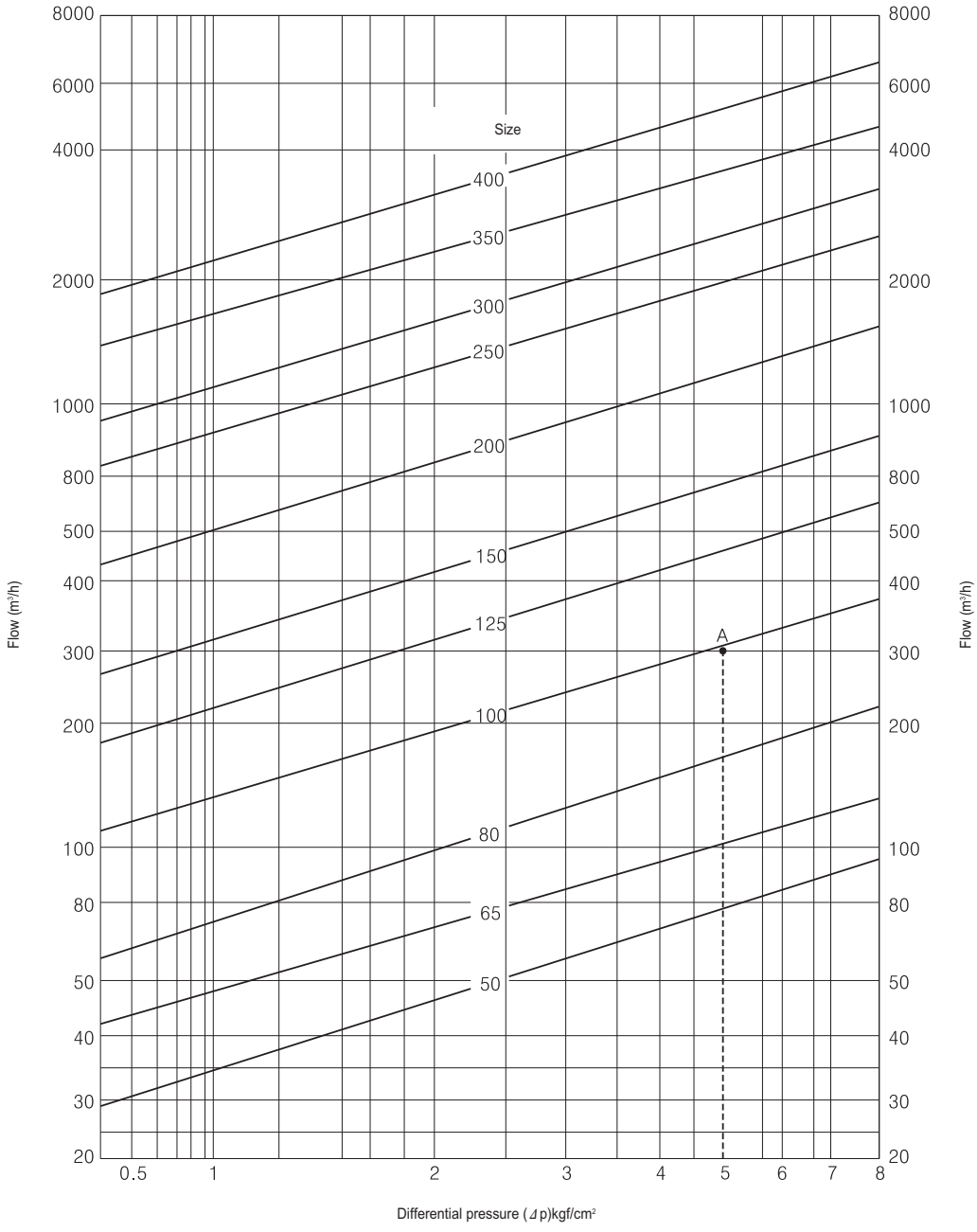
- ▶ Made-to-orders are available for valves with a size of 300A or larger.

■ Application Diagram (Example)



Type YAWR-1 Pressure Reducing Valve

■ Chart on selecting a size



How to select the size of a valve by the chart

Example) If the primary pressure is 8 kgf/cm²g, secondary pressure is 3 kgf/cm²g, and flow is 30 cm³/h,

1) The differential pressure ($\Delta P=P_1-P_2$) between the primary pressure (8 kgf/cm²g) and secondary pressure (3 kgf/cm²g) is 5 kgf/cm².
2) Determine "A" the point of intersection between the differential pressure (5 kgf/cm²) and the flow (300 cm³/h).
3) Now that "A" is in between a size of 80 and 100, a size of 100 should be selected.

Type YPR-41 Pressure Reducing Valve for Water and Vapor

■ Features

- Two ways to install : horizontally or vertically.
- A constant pressure level with only a single adjustment.
- Wide flow range ability : an outstanding level of minimum adjustable flow & adjustable and stable in a wide flow range.
- Also used as a pressure reducing valve for fire fighting equipment.

■ Specifications

Applicable fluid		Water, vapor
Primary pressure		Maximum 20 kgf/cm²g
Secondary pressure regulating range		0.5~7kgf/cm²g (for standard pressure), 7~12kgf/cm²g (for medium pressure)
Maximum pressure reduction ratio		10:1
Minimum differential pressure in the inlet and outlet side of the valve		0.5kgf/cm²
Fluid temperature		80° C below
End connection		KS 20K RF FLANGE
Materials	Body	SCPH2, STS316
	Disc, seat	NBR, STS
Hydraulic test pressure		35kgf/cm²

▶ We also manufacture the ANSI flange.
▶ Strainer (over 80 Mesh) installation is required to ahead inlet when valve installing.

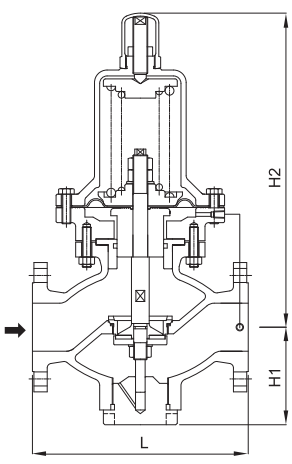
■ Dimensions

(mm)

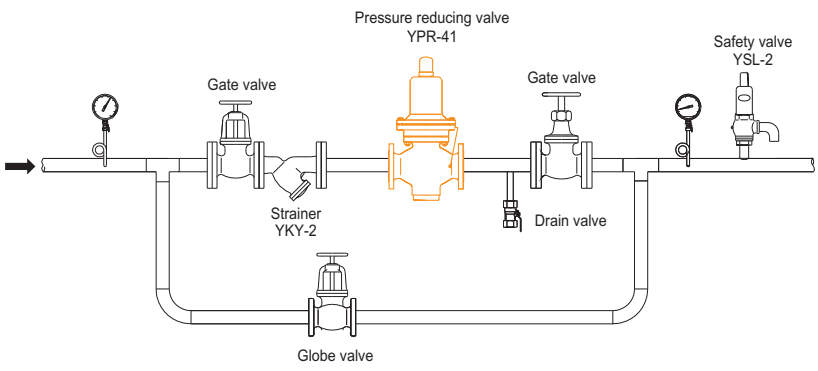
Size	L	H1	H2	Cv
15(½")	130	62	227	2.1
20(¾")	150	65	235	2.1
25(1")	197	72	264	3.5
32(1¼")	180	83	274	5.5
40(1½")	235	91	345	8.0
50(2")	267	107	365	14
65(2½")	292	132	425	22
80(3")	318	140	430	32
100(4")	368	150	535	48
125(5")	400	175	704	75
150(6")	473	210	734	108

▶ L(Length) is for 20K.

■ Dimensional drawing



■ Application Diagram (Example)



Type YPR-2W Primary Pressure Regulating Valve for Water

This is a type of relief valve and self-operating regulating valve that discharges excessive pressure resulting from load fluctuations and maintains a constant pressure level in instruments or pipelines. In case of continuous pump operation, changes are made according to fluctuations in the discharge pressure load. It is possible to install this product as a primary pressure regulating valve in the bypass circuit to relieve excessive pressure, and to adjust the discharge pressure to remain constant.

Screwed type

Flanged type

■ Features

- Easy to handle : small size and light weight.
- Two ways to install : horizontally or vertically.
- Stable operations : no such issues as hunching or vibration.
- Use of a disc made of special materials inside the valve : No water leakage when the valve is opened and closed.
- Piston-type balance structure : almost no change in the opening pressure resulting from back pressure fluctuations.
- The pressure tank can be used as a relief valve in a pipeline.

■ Specifications

Applicable fluid		Water
Primary pressure		0.5~3.5kgf/cm²g, 3~7kgf/cm²g
Fluid temperature		80° C below
End connection		KS PT SCREW(15~25A), KS 10K RF FLANGE(32~150A)
materials	**Body**	GC200
	Disc, seat	NBR/BC6
	Diaphragm	NBR
Hydraulic test pressure		15 kgf/cm²g

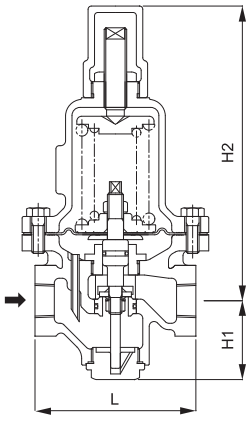
▶ Strainer (over 40 Mesh) installation is required to ahead inlet when valve installing.

■ Dimensions

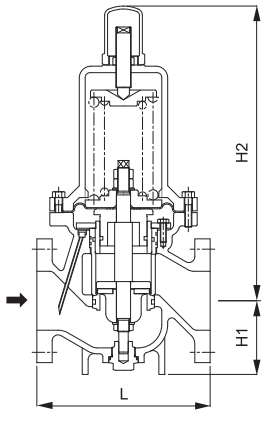
(mm)

Size	L	A	H1	H2	Cv	Weight(kg)
15(½")	100	116	50	184	2.1	3.7
20(¾")	100	116	50	184	2.1	3.7
25(1")	120	142	68	224	3.5	6.9
32(1¼")	190	174	81	327	8.0	17
40(1½")	190	174	81	327	8.0	17
50(2")	190	174	81	327	14	18.6
65(2½")	250	228	100	374	22	36.3
80(3")	250	228	100	374	32	37.4
100(4")	290	250	125	490	48	67.0
150(6")	390	340	165	655	108	150

■ Dimensional drawing



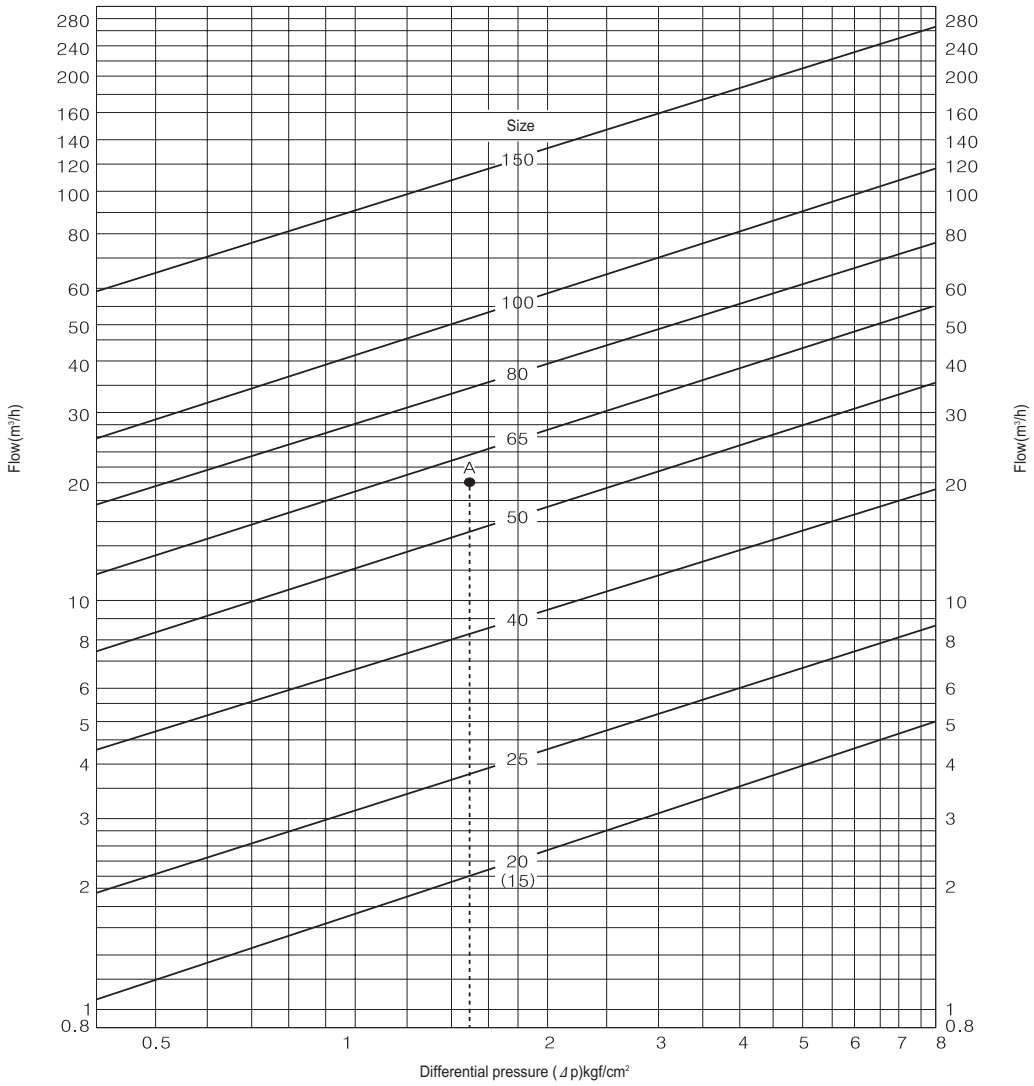
Screwed type(15A~25A)



Flanged type(32A~150A)

Type YPR-2W Primary Pressure Regulating Valve

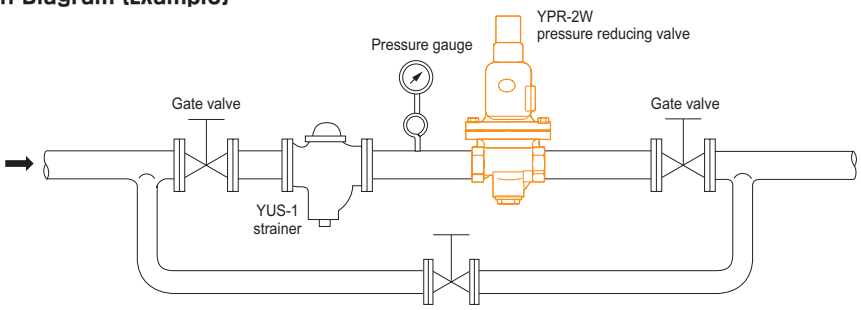
■ Chart on selecting a size



How to select the size of a valve by the chart

Example) If the opening pressure is 6 kgf/cm²g, back pressure is 4.5 kgf/cm²g, and flow is 20 m³/h,
The differential pressure is (⊿P) 6-4.5=1.5 kgf/cm²g.
Determine "A" where a vertical line from the differential pressure (⊿P) (1.5 kgf/cm²g) meets the flow (20 m³/h).
Now that "A" is in between a size of 50 and 65, the size of the valve should be 65.

■ Application Diagram (Example)



Type YAWM-1 Primary Pressure Regulating Valve for Water

The type YAWM-1 primary pressure regulating valve combines a main valve and an auxiliary valve. The main valve is operated by setting the pressure of the auxiliary valve.
As a bypass valve for large-capacity pumps, it discharges the increased amount of pressure resulting from load fluctuations and ensures that the discharge pressure of a pump remains constant.

■ Features

- Based on its auxiliary valve function, it automatically opens and closes valves with a large diameter, without external power supply.
- Pressure balance structure enables it to delicately respond to load fluctuations.
- No water leakage : the diaphragm and disc are made of NBR.
- A speed control valve (needle valve) attached : possible to adjust the opening and closing speed of the main valve.

■ Specifications

Applicable fluid		Clear water, industrial water, agricultural water
Primary pressure		200~250mm: 0.5~7kgf/cm²g
		300~400mm: 0.5~5kgf/cm²g
Fluid temperature		80° C below
End connection		KS 10K RF FLANGE
materials	Body	GC200
	Disc, seat	NBR/BC6
	Diaphragm	NBR
Hydraulic test pressure		15 kgf/cm²g
Optional		Pressure gauge

▶ Strainer (over 40 Mesh) installation is required to ahead inlet when valve installing.

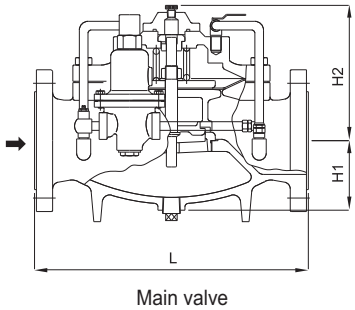
■ Dimensions

(mm)

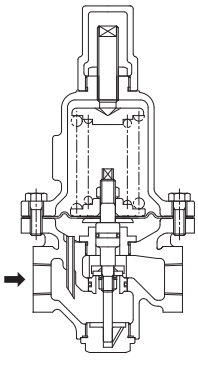
Size	L	H1	H2	Cv	Weight(kg)
200(8")	640	210	390	640	205
250(10")	740	250	481	1000	440
300(12")	900	290	557	1440	516

▶ Made-to-orders are available for valves with a size of 300A or larger.

■ Dimensional drawing



Main valve



Pilot primary pressure regulating valve

■ Cautions to be taken when installing and operating primary pressure regulating valves

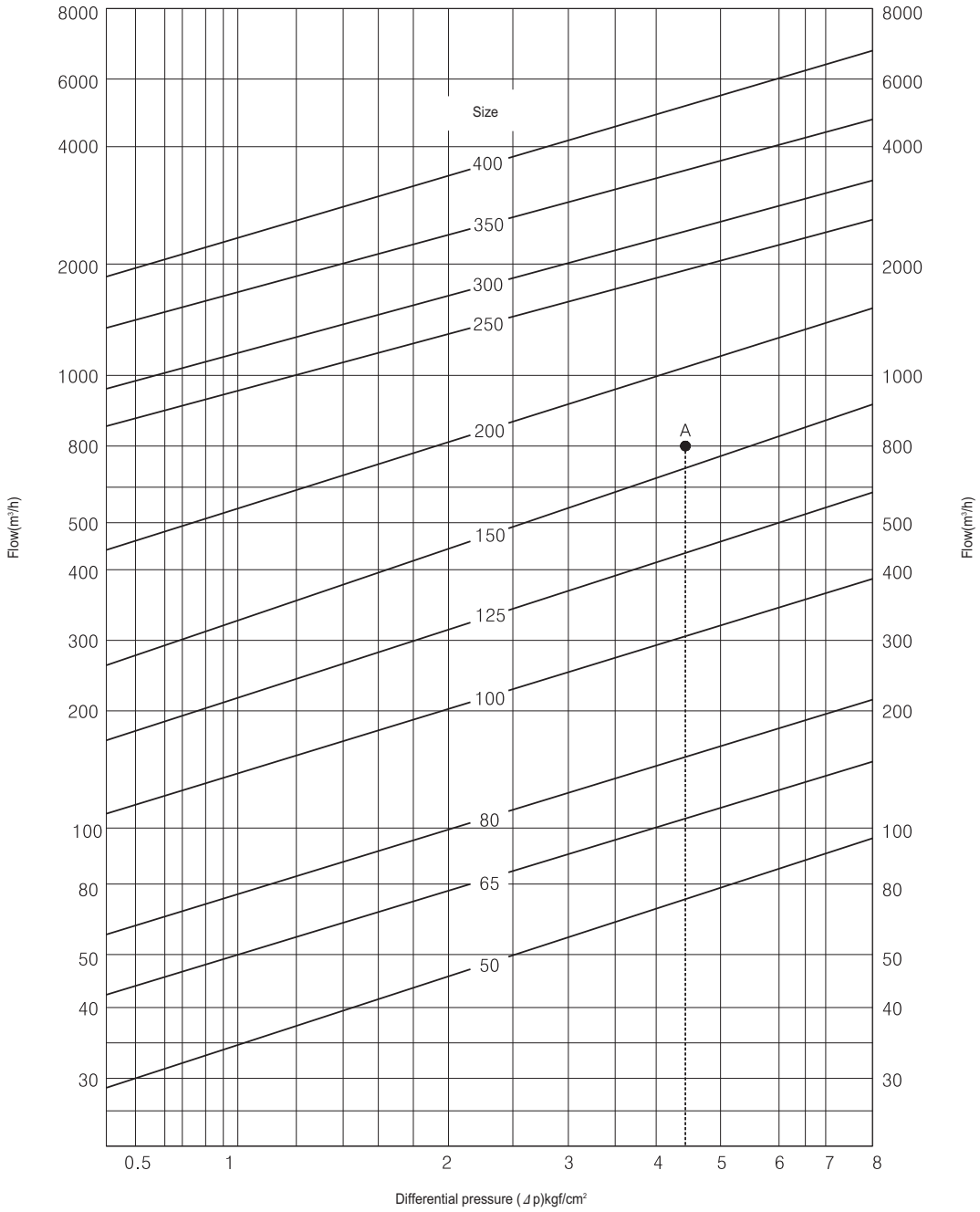
1. The control line installed outside the valve is an important part that has a direct effect on valve performance. Care should be taken so that the control line is not damaged from impact or when held by the hand in the process of moving or installing the valve.
2. Install a strainer on the inlet side to prevent valve malfunctions from foreign substances.
3. Settings for the opening/closing speed regulating device that is attached to the main body are made prior to product delivery, so the settings should not be arbitrarily changed.
4. The ball valve, installed on the main body, is for manual operations. Carry out a trial run after closing it.
5. The valve on the load device should be closed when conducting a trial run.

■ How to adjust the pressure of primary pressure regulating valves

1. Cut off the stop valve that is connected to the load device.
2. Open the top cap of the pilot valve installed on the main body.
3. Loosen up the fixing nut, and slowly turn the adjustment screw clockwise, while checking the pressure gauge on the valve inlet side, until the desired pressure is obtained.
4. Firmly tighten the fixing nut once the desired pressure is obtained.
5. Check, with sufficient time, if the pressure increases on the pressure gauge on the inlet side.
6. If the pressure on the pressure gauge is fixed at the designated pressure, then the valve is operating normally.

Type YAWM-1 Primary Pressure Regulating Valve

■ Chart on selecting a size



How to select the size of a valve by the chart

Example) If the opening pressure is 5 kgf/cm²g, back pressure is 0.5 kgf/cm²g, and flow is 800 m³/h,
The differential pressure is (⊿P) 5-0.5=4.5 kgf/cm²g.
Determine "A" where a vertical line from the differential pressure (⊿P) (4.5 kgf/cm²g) meets the flow (800 m³/h).
Now that "A" is in between a size of 150 and 200, the diameter of 200 should be selected.

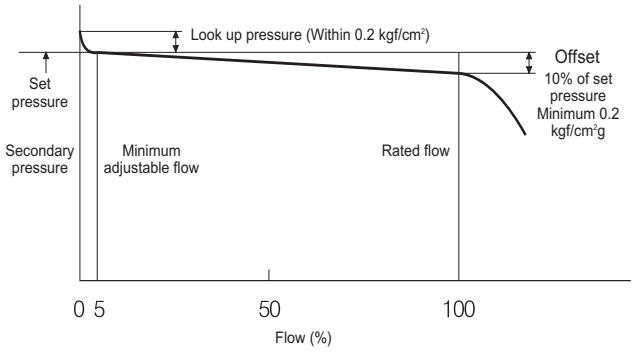
Data / Pressure Reducing Valve for Steam

■ Terminologies

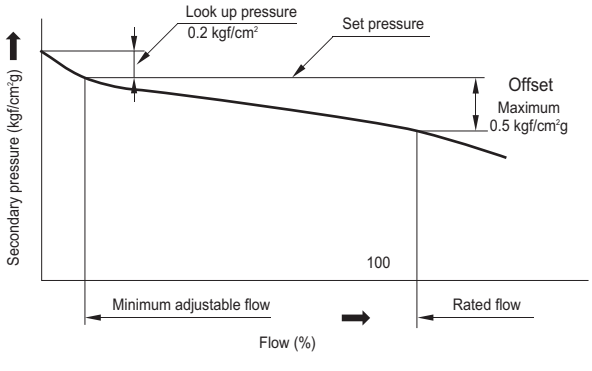
Primary pressure	Inlet-side pressure within the main body of the pressure reducing valve or pressure within the pipeline on the inlet side that is close to the pressure reducing valve
Secondary pressure	Outlet-side pressure within the main body of the pressure reducing valve or pressure within the pipeline on the outlet side that is close to the pressure reducing valve
Set pressure	Secondary pressure in terms of the minimum adjustable flow
Offset pressure	Difference between the set pressure and secondary pressure that changes when the flow is steadily increased from the minimum adjustable flow to the rated flow, while maintaining a constant primary pressure level
Look up pressure	Difference between the set pressure and the pressure that increases when the secondary valve of the pressure reducing valve is cut off
Minimum adjustable flow	Minimum flow of the pressure reducing valve in a state where a stable flow can be maintained
Rated flow	Maximum flow that can be guaranteed within a certain fixed off-set, while maintaining a constant primary pressure

■ Flow characteristics curve

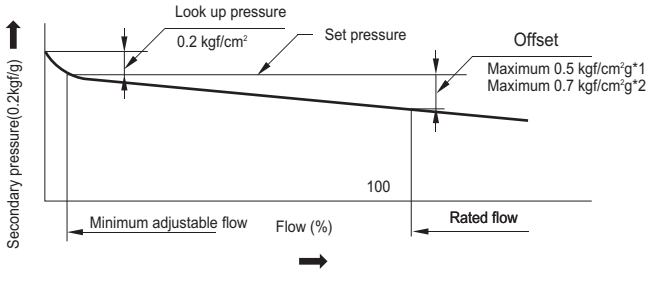
● YPR-100, 100A (Pilot diaphragm type)



● YPR-1S (Pilot type)

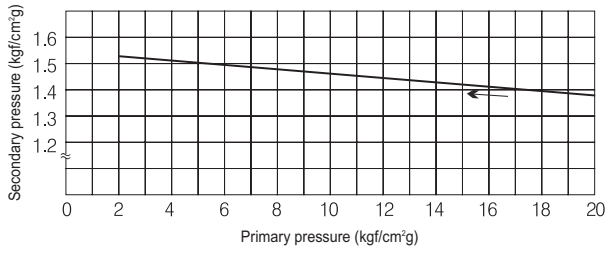


● YPR-2A (Direct operating)

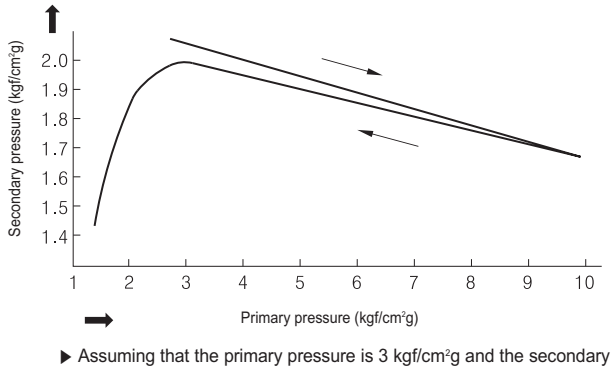


1. Regulating spring range: 0.5~3.5 kgf/cm²g
2. Regulating spring range: 3~7 kgf/cm²g

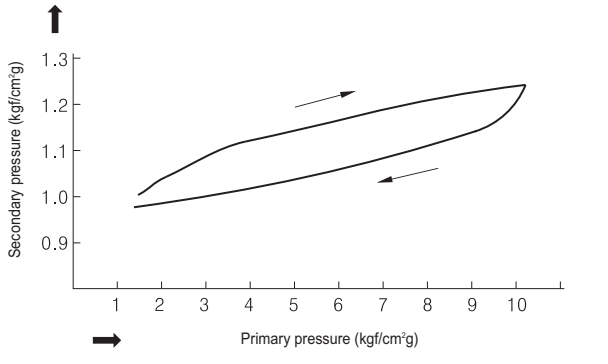
■ Pressure characteristics curve



▶ Assuming that the primary pressure is 17.5 kgf/cm²g and the secondary pressure is set to 1.4 kgf/cm²g, this shows changes in the secondary pressure when the primary pressure is changed to between 2 and 14 kgf/cm²g.



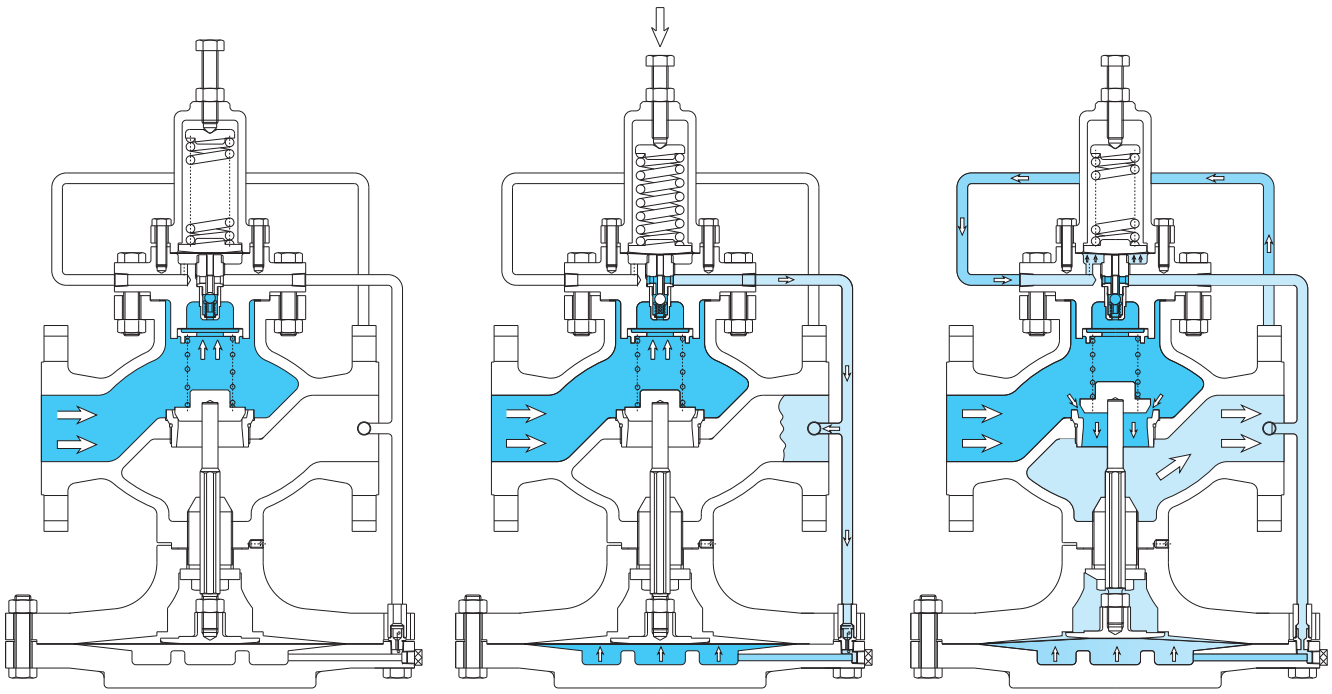
▶ Assuming that the primary pressure is 3 kgf/cm²g and the secondary pressure is set to 2 kgf/cm²g, this shows changes in the secondary pressure when the primary pressure is changed from 3 kgf/cm²g to 10 kgf/cm²g, and then inversely from 10 kgf/cm²g to 1.5 kgf/cm²g.



▶ Assuming that the primary pressure is 1.5 kgf/cm²g and the secondary pressure is set to 1 kgf/cm²g, this shows changes in the secondary pressure when the primary pressure is increased from 1.5 kgf/cm²g to 10 kgf/cm²g, and then decreased from 10 kgf/cm²g to 1.5 kgf/cm²g.

Data / Pressure Reducing Valve for Steam

■ How pressure reducing valves work



① The secondary pressure, which was reduced through the main valve, actuates the pilot diaphragm through the pressure sensing tube.
②This reduced secondary pressure adjusts the secondary pressure by responding to the force of the pressure regulating spring that is installed on the upper part of the pilot diaphragm.

① When the secondary pressure drops, the force of the pressure regulating spring becomes bigger than the force of the lower part of the pilot diaphragm, resulting in the diaphragm pushing downwards to open the pilot valve.
② When the pilot valve opens, the steam of the primary goes through the pressure regulating tube and reaches the lower part of the main diaphragm located at the lower end of the pressure reducing valve's body.
③ The main diaphragm overcomes the pressure of the return spring and opens the main valve. Steam is supplied to the secondary and thus the secondary pressure is adjusted.

① When the secondary pressure rises, it actuates the pilot diaphragm, thus adjusting the opening percentage of the pilot valve. The return spring pushes the main valve, and the steam of the lower part of the main diaphragm moves along the pipe and is discharged through the orifice.
② The steam pressure and pressure of the lower part of the main diaphragm adjusts the opening degree of the main valve according to load fluctuations, based on a balance maintained by the opening percentage of the pilot valve. This is how a constant secondary pressure level is maintained immediately after pressure changes or load fluctuations.

■ Notes for selecting a size

1. When selecting a size, make room for an additional 10 to 20% of flow, in consideration of such matters as pressure loss. There is especially a need to make substantial room when the pressure reduction ratio is high or the set pressure is 1 kgf/cm^{2}g or less.
2. The secondary pressure of a pressure reducing valve changes according to fluctuations in the primary pressure as well as the flow. There is a need to determine a set pressure after considering the look up pressure and offset, and then select a size. (Refer to the pressure and flow characteristics curves.)
3. When the primary and secondary pressures are not constant, and change within a certain range, there is a need to select a size based on the primary and secondary pressures that have the minimum differential pressure.
4. It is only natural that the flow becomes smaller when the size is too small. There are also issues when the flow is substantially bigger than needed. Such issues include hunching, chattering, and abnormal abrasion. Also, the minimum adjustable flow of a pressure reducing valve is 5% of the rated flow. It is recommended to avoid selecting a size that is based on this flow or smaller. When there are severe changes in summer and winter, attach two pressure reducing valves, one big and one small, and use the valve appropriate for the needed flow.

Data / Pressure Reducing Valve for Steam

■ Size of pipeline from a pressure reducing valve' s inlet to outlet

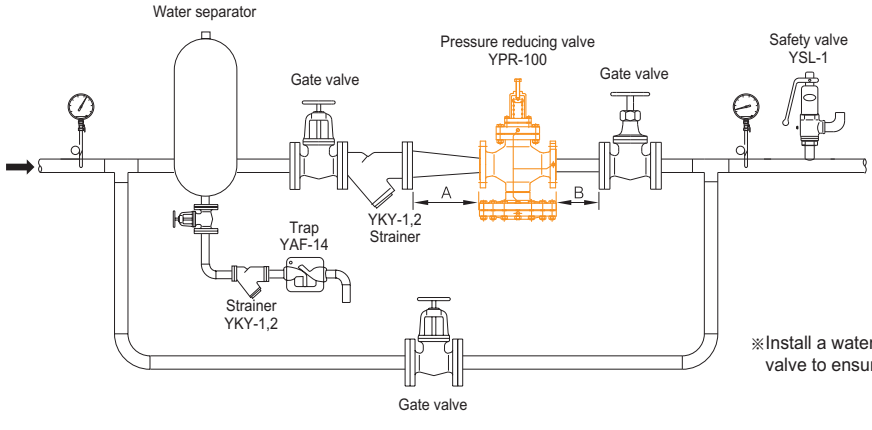
Though the size of a pressure reducing valve can be determined based on the valve's size selection chart or Cv formula, the size of the pipeline from the pressure reducing valve's inlet to outlet should be determined based on the fluid's standard flow velocity. If the size of the pipeline is too small, it is affected by the flow of the fluid, resulting in excessive pipeline pressure, or a negative effect on the pipeline. As such, there is a need to sufficiently consider the standard flow velocity when selecting the pipeline size.

≫ Standard flow velocity chart for steam

Category	Steam type	Standard flow velocity
Small pipeline	Saturated steam (2~5 kgf/cm²g)	15~20
	Saturated steam (5~15kgf/cm²g)	20~30
Steam main	Saturated steam	20~30
	Superheated steam	30~40

■ Standard piping diagram

≫ For steam

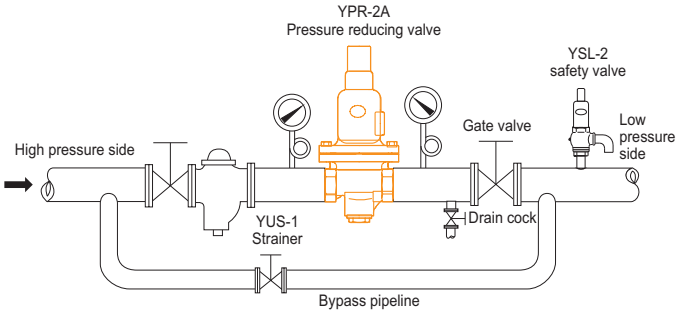


※Install a water separator at the inlet of the pressure reducing valve to ensure the removal of condensate.

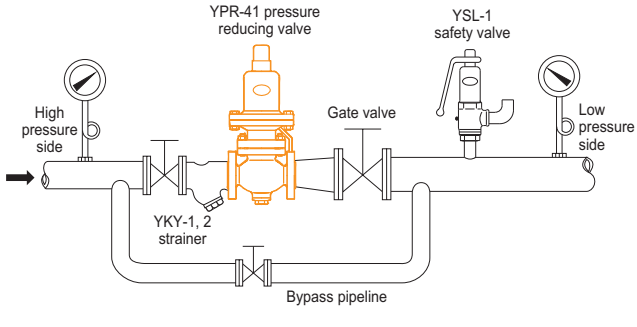
≫ Dimensions

Size of valve	Length of straight section	
	A(mm)	B(mm)
15~40	400	900
50~100	900	1,500
125~200	1,200	2,500

■ For liquid



■ For air



Data / Pressure Reducing Valve for Steam

■ Selection of a secondary safety valve of a pressure reducing valve

A safety valve should be attached to the secondary of a pressure reducing valve to protect equipment from a rise in pressure resulting from a breakdown of the pressure reducing valve. (Installation of safety valves is for an alarming purpose, and is irrelevant to laws and regulations.)

1. Set pressure of safety valve

A set pressure of a safety valve should be chosen based on the following table, in consideration of the look up pressure of the pressure reducing valve and static pressure of the safety valve.

Set pressure of pressure reducing valve (kgf/cm²g)	Set pressure of safety valve (kgf/cm²g)
1 or less	Set pressure of pressure reducing valve + 0.5 or more
More than 1 and less than 4	Set pressure of pressure reducing valve + 0.8 or more
4 or more and less than 6	Set pressure of pressure reducing valve + 1.0 or more
6 or more and 8 or less	Set pressure of pressure reducing valve + 1.2 or more

2. Flow table of safety valve

A safety valve that is approximately 10% of the maximum flow of the pressure reducing valve should be chosen, unless there are special instructions to do otherwise.

≫ Saturated steam

(kg/h)

Size \ P	0.5	1	2	3	4	5	6	7	8	9	10
15(½")	9.93	13.0	19.3	25.4	31.5	37.5	43.4	49.3	55.2	61.0	66.8
20(¾")	16.5	21.8	32.2	42.4	52.5	62.6	72.5	82.3	92.1	101	111
25(1")	28.9	38.2	56.3	74.2	91.9	109	126	143	161	178	194
40(1½")	66.5	87.4	129	169	210	250	290	329	368	407	446
50(2")	107	142	209	276	341	406	471	535	599	662	725

≫ Air

(kg/h)

Size \ P	0.5	1	2	3	4	5	6	7	8	9	10
15(½")	14.4	19.2	28.8	38.4	48.1	57.7	67.3	76.9	86.6	96.2	105
20(¾")	24.0	32.1	48.1	64.2	80.3	96.3	112	128	144	160	176
25(1")	42.0	56.1	84.2	112	140	168	196	224	252	280	308
40(1½")	96.3	128	192	256	321	385	449	513	577	642	706
50(2")	156	208	313	417	521	626	730	834	939	1043	1147

3. Safety valve

≫ Specifications

Applicable fluid		Steam, air, liquid, vapor
Set pressure range		0.35~10kgf/cm²g
Fluid temperature		220℃ or below
End connection		KS PT Screw
Material	Body	GC
	Disc, seat	STS
Hydraulic test pressure		15 kgf/cm²g

≫ Dimensions

(mm)

Size	L1	L2	YSL-1	YSL-2
			H1	H2
15(½")	40	41	127	112
20(¾")	50	50	137	122
25(1")	55	60	162	148
40(1½")	70	75	230	216
50(2")	80	80	257	245

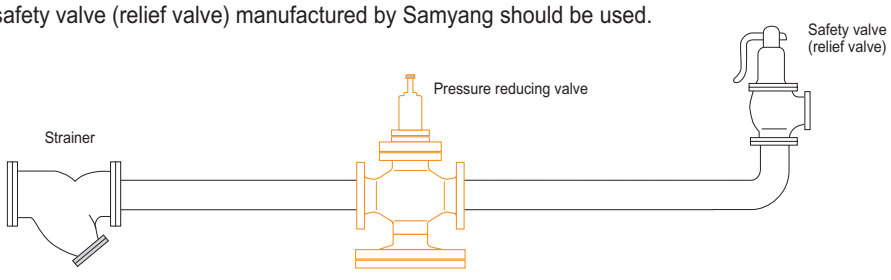
Data / Pressure Reducing Valve for Steam

■ Cautions for installation and usage

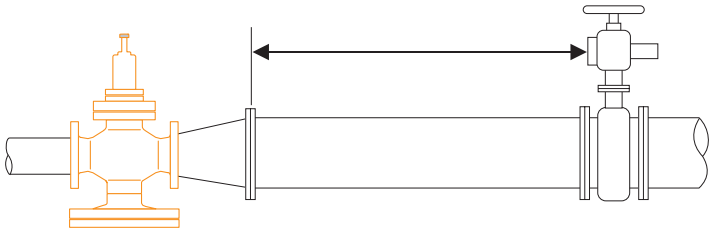
1. Vertically install the pressure reducing valve on a horizontal pipeline.

2. Install a straight pipeline at the inlet and outlet of the pressure reducing valve, as shown in the standard piping example, and also install a strainer, a safety valve, a pressure gauge, and a bypass pipeline. Install a globe valve on the inlet side. In case of leakage and repair after installment of a gate valve, the pressure reducing valve should not be disassembled.

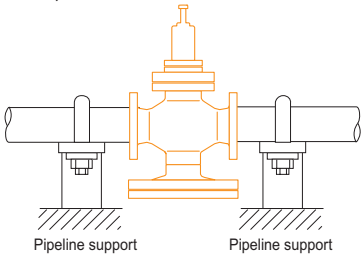
3. A strainer and a safety valve (relief valve) manufactured by Samyang should be used.



4. Length of secondary pipeline
   If an electronic valve or other valve for rapid opening and closing is installed on the secondary of a pressure reducing valve, have it located as far away from the pressure reducing valve as possible. Failure to do so may cause, in some cases, noises and vibrations.

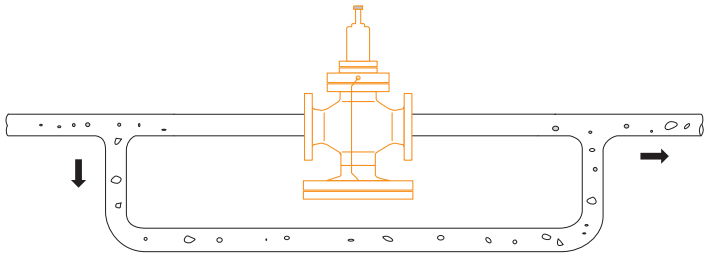


5. Inspection and disassembling space
   To enable disassembling and inspection, secure enough space above the center of the pipeline that is at least 3 times the H2 length of the pressure reducing valve dimensions; and below the center of the pipeline that is at least 5 times the H1 length of the dimensions. (Refer to pressure reducing valve dimensions.)



6. Pipeline support
   Set or support the pipeline at the inlet and outlet of a pressure reducing valve so that the gravity or thermal stress of the pipeline is not directly inflicted upon the pressure reducing valve.

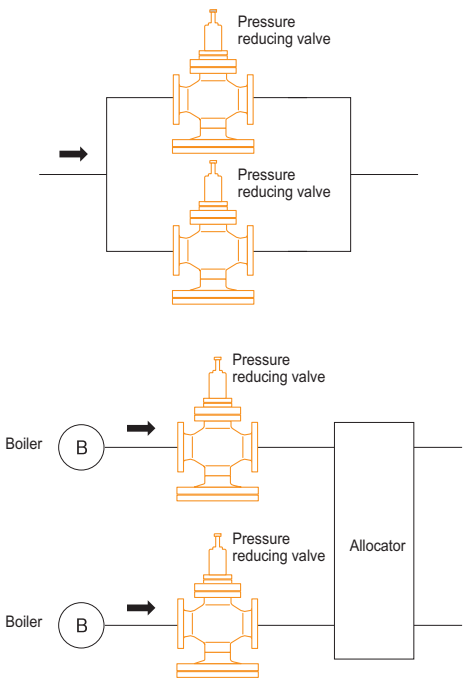
7. Pipeline cleaning
   In new pipelines, most pressure reducing valve breakdowns are caused by foreign substances. Before having steam pass through the pressure reducing valve, completely remove foreign substances within the pipeline by blowing them out through the bypass.



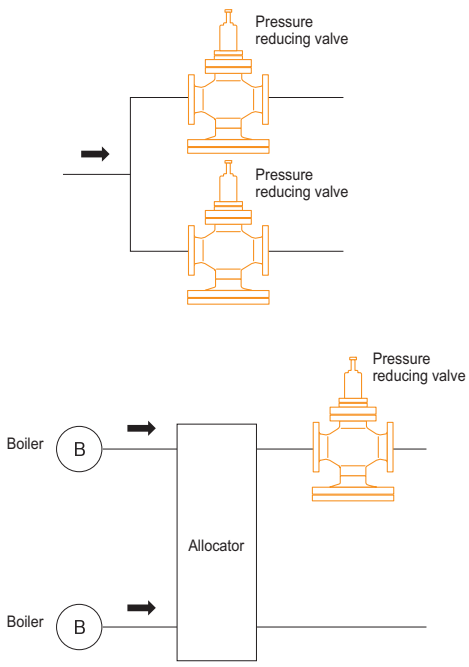
8. Parallel use

There are cases where two pressure reducing valves are used in parallel because of the lack of flow with one valve. In case of parallel use, pressure reducing valves are self-operated valves, and thus there is a difference in pressure sensitivity. This is why the set pressure needs to be different. It is also recommended that each valve be used independently as much as possible.

≫ Example of a bad case



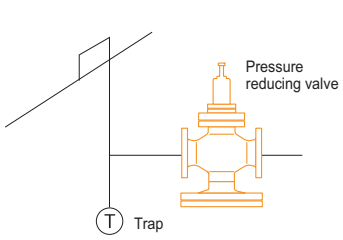
≫ Good example

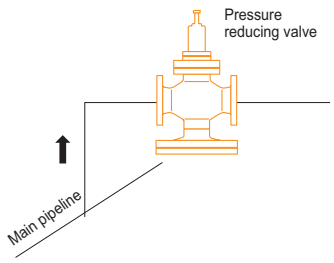


9. Measure against condensate

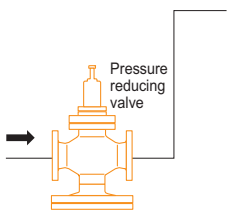
Hunching or vibration can occur if condensate gets into a pressure reducing valve. This is why there is a need to adopt a piping method that blocks condensate entry or to remove condensate.

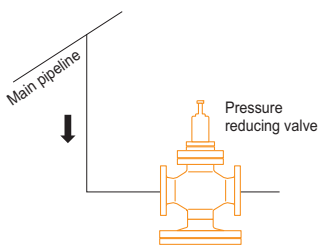
≫ Good example





≫ Example of a bad case





Data / Pressure Reducing Valve for Steam

■ How to select a size of a pressure reducing valve using the Cv calculation formula

Fluid	Pressure condition	Formula	Symbols
Steam	When , $\Delta P < \frac{P_1}{2}$ When , $\Delta P \geq \frac{P_1}{2}$	$Cv = \frac{WK}{13.67\sqrt{\Delta P(P_1+P_2)}}$ $Cv = \frac{WK}{11.9P_1}$	W = Maximum flow (kg/h) V = Maximum flow (m^3/h) P_1 = Primary pressure [kgf/cm^2(abs)] P_2 = Secondary pressure [kgf/cm^2(abs)] ΔP = P1 - P2kgf/cm^2 K = 1+(0.0013 x Degree of superheat ° C) Q = Maximum flow (Nm^3/h): When in standard state (15° C, 760 mmHg abs) G = Specific gravity (Air=1, Water=1) T = Temperature(° C)
Vapor	When , $\Delta P < \frac{P_1}{2}$ When , $\Delta P \geq \frac{P_1}{2}$	$Cv = \frac{Q}{287}\sqrt{\frac{G(273+t)}{\Delta P(P_1+P_2)}}$ $Cv = \frac{Q\sqrt{G(273+t)}}{249P_1}$	
Liquid		$Cv = \frac{1.167 \times V\sqrt{G}}{\sqrt{P_1-P_2}}$	

■ Example of calculation of Cv value (for steam)

Assuming that the primary pressure is 4.5 kgf/cm^2g, secondary pressure is 2 kgf/cm^2g, and saturated steam flow is 600 kg/h, the following shows how to select a size of a pressure reducing valve using the Cv calculation formula.

P1 = 4.5+1 = 5.5 kgf/cm^2(abs)
P2 = 2+1 = 3 kgf/cm^2(abs)

ΔP = 5.5-3 = 2.5kgf/cm^2

$\frac{P_1}{2}$ = 2.75 kgf/cm2 and $\Delta P < \frac{P_1}{2}$, use the following formula:

Cv = $\frac{WK}{13.67\sqrt{\Delta P(P_1+P_2)}}$ use the formula

$\therefore Cv = \frac{600 \times 1}{13.67\sqrt{2.5(5.5+3)}}$ 9.5

(The K value is saturated steam. Its value is 1 since the degree of superheat is 0.)

The resulting Cv value of 9.5 is in between 40 and 50 in the steam category of the table below (YPR-1S). There is a need to choose 50 to ensure that there is no harmful stress on the pipeline. The same value will be obtained when using the pressure reducing valve's size selection table (Page 4) to determine a valve's size, based on the conditions above.

■ Caution during installation

1. Align the arrow direction of the valve's body and the fluid's direction, and thus install the valve horizontally on the pipeline.
2. Install the straight sections at the inlet and outlet of the pressure reducing valve, and install a strainer, a safety valve, a pressure gauge, and a bypass line. Install a globe valve on the inlet side. Install a gate valve on both the inlet and outlet sides, and a globe valve on the bypass line.
3. If an electronic valve or other valve for rapid opening and closing is installed on the secondary of a pressure reducing valve, have it located as far away from the pressure reducing valve as possible.
4. In new pipelines, most pressure reducing valve breakdowns are caused by foreign substances within the pipeline. Before having steam pass through the pressure reducing valve, completely remove foreign substances within the pipeline by blowing them out through the bypass.
5. Hunching or vibration can occur if condensate gets into a pressure reducing valve. This is why there is a need to install a water separator on the inlet side of the pressure reducing valve to remove condensate.

■ Cv chart for each type of pressure reducing valve

Category / Size	For steam			For water			For vapor
	YPR-100	YPR-1S	YPR-50	YAWR-1	YPR-2A	YPR-41	YPR-41
15(½")	5	1	0.8	-	2.1	2.1	2.1
20(¾")	7.2	2.5	0.8	-	2.1	2.1	2.1
25(1")	10.9	4	1	-	3.5	3.5	3.5
32(1¼")	14.3	6.5	-	-	8	3.5	3.5
40(1½")	18.8	9	-	-	8	8	8
50(2")	32	16	-	40	14	14	14
65(2½")	60	25	-	62.5	22	22	22
80(3")	78	36	-	90	32	32	32
100(4")	120	100	-	160	48	48	48
125(5")	160	144	-	250	-	75	75
150(6")	245	256	-	360	108	108	108
200(8")	-	-	-	640	-	-	-
250(10")	-	-	-	1000	-	-	-
300(12")	-	-	-	1440	-	-	-
350(14")	-	-	-	1960	-	-	-
400(16")	-	-	-	2560	-	-	-

■ How pressure reducing valves work

1. Importance of pressure reducing valves

If water pressure is inappropriate in a water supply and distribution piping system, use of water becomes inconvenient and water facilities cannot be efficiently used.

- If water pressure is too high: Increased water supply, increased leakage, and abrasion of the connected sections of the water distribution piping system and reduced life span of the system
- If water pressure is too low: Short flow supply, resulting from lack of supply pressure

2. Types of pressure reducing valves

1) Direct operating type

It regulates the water pressure on the outlet side by operating the valve based on the spring's elasticity and outlet-side water pressure.

-How it works-

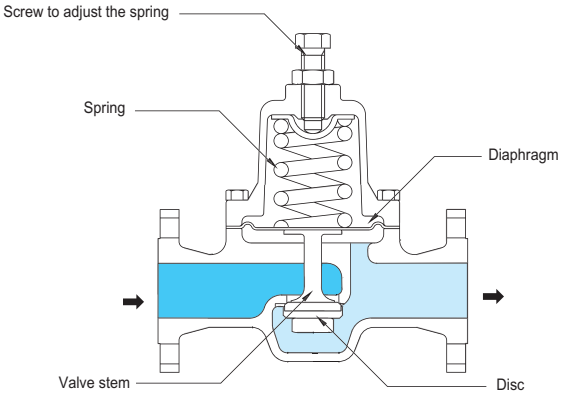
① Outlet-side water pressure < Spring force
② Valve opens
③ Water on the inlet side flows to the outlet side
④ Outlet-side water pressure > Spring force
(If only a small amount of water is used or is not used at all on the inlet side)
⑤ Valve closes
⑥ The balance between the outlet side and spring force maintains a certain set pressure level

2) Pilot type

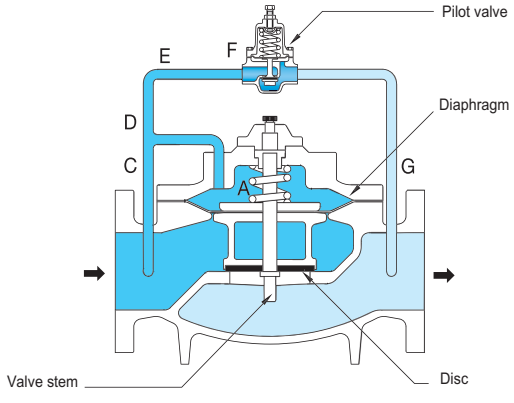
A main valve and an auxiliary valve exist as a set, and the auxiliary valve is referred to as the pilot. The auxiliary valve is a small, direct operating pressure reducing valve. The valve opens and closes based on the water pressure on the outlet side and the spring force. Water that passes through activates the main valve.

-How it works-

① Outlet-side water pressure < Spring force
② The auxiliary valve opens
③ Water from the main valve passes through points D, E, and F, and flows in the direction of point G
④ Water at A, the upper part of the main valve diaphragm, flows in the direction of point D(If only a small amount of water is used or is not used at all on the inlet side)
⑤ Volume of water that was filled up at A goes down
⑥ The diaphragm moves upwards
⑦ The valve closes
⑧ Water on the inlet side flows to the outlet side
⑨ Hydro pressure on the outlet side rises
⑩ Hydro pressure on the outlet side of the pilot pushes the diaphragm in the direction of the spring, resulting in the pilot closing
⑪ Flow from point F to point G is cut off
⑫ Water on the inlet side of the main valve passes through points C and D and moves to point A
⑬ The diaphragm is pushed in the disc direction, and the valve closes
⑭ The set pressure on the outlet side is maintained through the repetition of the process above



Dimensional drawing of direct operating type pressure reducing valve



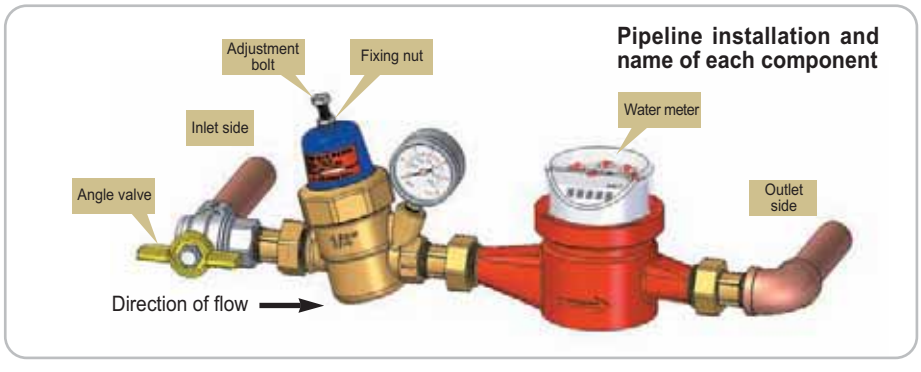
Dimensional drawing of pilot type pressure reducing valve

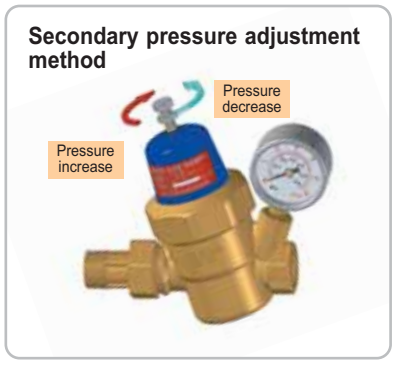
Data / Pressure Reducing Valve for Heating and Supplying Water for Each Household

■ Required information when placing an order

• Model name • Type of fluid • Pressure conditions (Maximum pressure used, set pressure kgf/cm²) • Maximum temperature used
• Pipeline diameter and end connection • Maximum flow used (LPM) • Order specifications (Valve features)

■ Secondary pressure adjustment method





• The secondary pressure of a pressure reducing valve is adjusted according to field conditions before the product is delivered to the customer, thereby eliminating the need for the customer to adjust the secondary pressure. However, it may be necessary to adjust the secondary pressure when there is a design or capacity change in the system.
• With regards to a pressure reducing valve for water supply, if a pressure gauge is not attached to the valve body (optional) or a pressure gauge is not installed at the outlet of the valve, the secondary pressure (set pressure) cannot be accurately adjusted. It is therefore recommended that the secondary pressure not be adjusted arbitrarily, if possible.

≫ YPR-8E

1. Pull the top pressure adjustment handle upwards.
2. Open the angle valve (cut-off valve) on the inlet side to raise the inlet-side pressure.
3. Close the water tap on the outlet side (cut-off valve). Slowly turn the pressure adjustment handle clockwise (counter clockwise), while looking at the outlet pressure gauge. The secondary pressure will go up (down).
5. Check if the secondary pressure (set pressure) is correct, while opening and closing the water tap on the outlet side (cut-off valve).
6. Once pressure adjustment is completed, push the pressure adjustment handle to prevent arbitrary adjustment of pressure by other personnel.

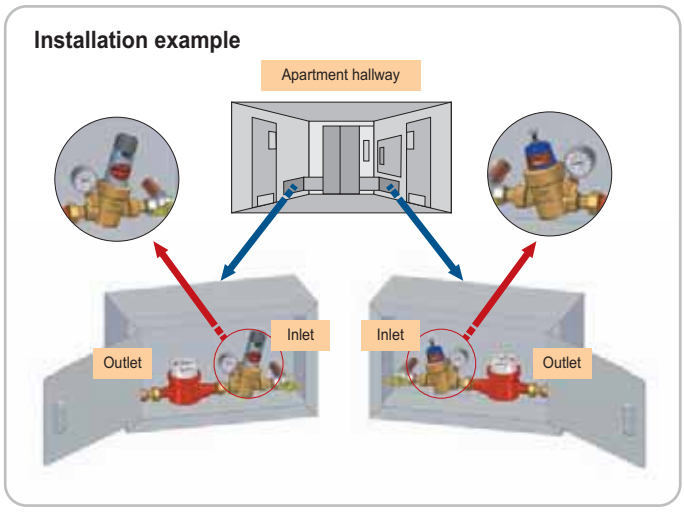
≫ YPR-8N, 8H

1. Loosen the fixing nut installed on the adjustment bolt on the top.
2. Open the angle valve on the inlet side (cut-off valve) to raise the inlet-side pressure.
3. Close the water tap on the outlet side (cut-off valve). Slowly turn the adjustment bolt clockwise (counter clockwise), while looking at the outlet pressure gauge. The secondary pressure will go up (down).
4. Check if the secondary pressure (set pressure) is correct, while opening and closing the water tap on the outlet side (cut-off valve).
5. Once pressure adjustment is completed, tighten the fixing nut to prevent arbitrary adjustment of pressure by other personnel.

■ Installation and maintenance

The following should be paid attention to when handling the product so that it can be operated at maximum performance.

• Do not cause impact on the product.
• Take special care so that foreign substances do not get inside the product.
• Completely remove scales, sand, dregs, etc. when attaching the product to a pipeline.
• If possible, install the product at a location that allows easy maintenance and inspection.
• Regularly clean the strainer that is attached to the pressure reducing valve to prevent malfunctions due to foreign substances.
• A malfunction of the pressure reducing valve would entail a water hammer, attributable to an abnormal pressure buildup inside the pipeline, as well as damage or shortening of the life span of other instruments located at the valve outlet. This is why there is a need to periodically check to see if the secondary pressure remains constant.
• There is no need to adjust the set pressure, since it is fully checked at the plant prior to product delivery.



Safety Valve

2

Safety Valve

Safety valves protect systems from excessive pressure usually from air or steam generators. They instantaneously release pressure when the fluid's pressure exceeds a set value.

Full bore type

Type	Size	Applicable fluid	Applicable pressure (kgf/cm²g)	Materials		End connection	Page
				Body	Disc, seat		
YSF-1	25(1")~80(3")	Steam, air	1~10	GC200	STS	KS 10K RF FLANGE	52
YSF-2		Liquid					
YSF-3	25(1")~200(8")	Steam, air	1~30	SCPH2		KS 10, 20, 30K RF FLANGE	53
YSF-4		Liquid					
YSF-5	20(¾")~50(2")	Steam, air	1~10	GC200		KS PT SCREW	54
YSF-6		Liquid					
YSF-3(open)	25(1")~200(8")	Steam	1~30	SCPH2		KS 10, 20, 30K RF FLANGE	55

Low lift type

Type	Size	Applicable fluid	Applicable pressure (kgf/cm²g)	Materials		End connection	Page
				Body	Disc, seat		
YSL-1	15(½")~50(2")	Steam, air	0.35~10	GC200	STS	KS PT SCREW	56
YSL-2		Water					

Pump relief type

Type	Size	Applicable fluid	Applicable pressure (kgf/cm²g)	Materials		End connection	Page
				Body	Disc, seat		
YRV-1	25(1")~80(3")	Water	1.0~10	GC200	STS	KS 10K RF FLANGE	57
YRV-2			1.0~30	SCPH2		KS 10, 20, 30K RF FLANGE	

Types of caps

Lever type		Mainly for steam, this cap is used to check regular operation.	Cap type		Used for gas-tight on the exhaust side, this cap is a standard type for liquid and vapor.

Type YSF-1, 2 Safety Valve (Full Bore Type) Steam Boiler Pressure Vessel

Type YSF-1

Type YSF-2

■ Features

- Simple structure and outstanding performance.
- Superb performance, followed by strict quality control procedure.
- High impact resistance and good abrasion resistance : The disc and seat are stainless steel welded with satellite.
- Test lever attached : Periodical performance inspections can be conducted.
- Approval from the Korea Occupational Safety and Health Agency (KOSHA).

■ Specifications

Type		YSF-1	YSF-2
Test lever		Yes	Optional
Applicable fluid		Steam, air	Liquid
Set pressure range		1~10kgf/cm²g	
Fluid temperature		220° C below	
End connection	Inlet	KS B 6216 10K RF FLANGE	
	Outlet	KS B 1511 10K FF FLANGE	
Material	Body	GC200	
	Disc, seat	STS (Stellite welding)	
Hydraulic test pressure		15kgf/cm²g	

▶ The JIS and ANSI flanges are available by made-to-orders.

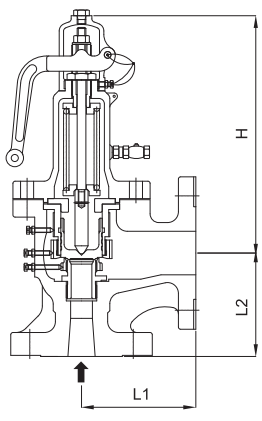
■ Dimensions

(mm)

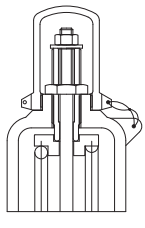
Size Inlet X Outlet	Seat diameter	Throat diameter	Throat area	Lift	Face to Face		Height(h)		Flange thickness	Weight(kg)	
di X do	Ds	dt	a(mm²)	ℓ	L1	L2	YSF-1	YSF-2	t	YSF-1	YSF-2
25(1")X40(1½")	22	19	0283.5	05.0	105	095	218	214	20	10.8	10.3
40(1½")X65(2½")	35	30	0706.8	07.5	125	120	297	278	20	20.1	19.2
50(2")X80(3")	45	38	1134.1	09.5	135	129	346	346	22	26.0	25.1
65(2½")X100(4")	58	49	1885.7	12.5	155	140	404	404	24	44.4	43.1
80(3")X125(5")	71	61	2922.5	15.5	175	160	487	487	24	63.4	61.7

■ Dimensional drawing

Size of 25 to 65

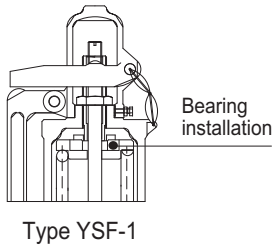


Type YSF-1



Type YSF-2

Size of 80



Type YSF-1

Type YSF-3, 4 Safety Valve (Full Bore Type) Steam Boiler Pressure Vessel

Type YSF-3

Type YSF-4

■ Features

- Simple structure and outstanding performance.
- Superb performance, followed by strict quality control procedure.
- High impact resistance and good abrasion resistance : The disc and seat are stainless steel welded with satellite.
- Test lever attached : Periodical performance inspections can be conducted.
- Approval from the Korea Occupational Safety and Health Agency (KOSHA).

■ Specifications

Type		YSF-3(Close Bonnet)	YSF-4
Test lever		Yes	Optional
Applicable fluid		Steam, air	Liquid
Set pressure range		1~10kgf/cm²g, 10~20kgf/cm²g, 20~30kgf/cm²g	
Fluid temperature		220° C below	220° C below
End connection	Inlet	KS B 6216 10, 20, 30K RF FLANGE	
	Outlet	KS B 1511 10K FF FLANGE	
Material	Body	SCPH2	
	Disc, seat	STS (Stellite welding)	
Hydraulic test pressure		1.5 times of applicable flange rating	

▶ The JIS and ANSI flanges are available by made-to-orders.

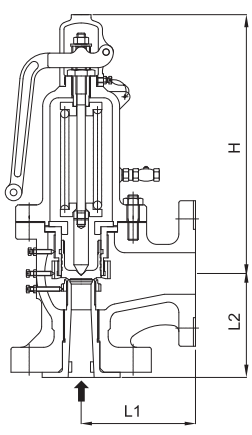
■ Dimensions

(mm)

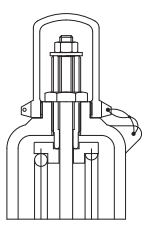
Size Inlet X Outlet	Seat diameter	Throat diameter	Throat area	Lift	Face to Face		Height(h)		Weight(kg)	
di X do	Ds	dt	a(mm²)	ℓ	L1	L2	YSF-3	YSF-4	YSF-3	YSF-4
25(1")X40(1½")	22	19	283.5	5.0	115	100	249	264	13	12.4
40(1½")X65(2½")	35	30	706.8	7.5	130	125	340	316	25	14
50(2")X80(3")	45	38	1134.1	9.5	141	135	380	380	35.6	34.4
65(2½")X100(4")	58	49	1885.7	12.5	161	160	480	480	57	55.8
80(3")X125(5")	71	61	2922.5	15.5	179	180	535	535	79	77.2
100(4")X150(6")	88	76	4536.5	19.0	209	205	668	668	132	129
125(5")X200(8")	111	95	7088.2	24.0	232	240	846	828	273	269.5
150(6")X200(8")	134	115	10386.9	29.0	262	250	935	916	325	320
200(8")X250(10")	176	152	18145.8	38.0	355	300	1115	1135	645	633

■ Dimensional drawing

Size of 25 to 100

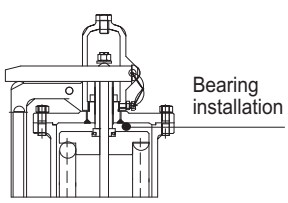


Type YSF-3



Type YSF-4

Size of 125 to 200



Type YSF-3

Type YSF-5, 6 Safety Valve (Full Bore Type) Steam Boiler Pressure Vessel

Type YSF-5

Type YSF-6

■ Features

- Simple structure and outstanding performance.
- Superb performance, followed by strict quality control procedure.
- High impact resistance and good abrasion resistance : The disc and seat are stainless steel welded with satellite.
- Test lever attached : Periodical performance inspections can be conducted.
- Approval from the Korea Occupational Safety and Health Agency (KOSHA).

■ Specifications

Type	YSF-5	YSF-6
Test lever	Yes	Optional
Applicable fluid	Steam, air	Liquid
Set pressure range	1~10kgf/cm²g	
Fluid temperature	220° C below	
End connection	KS PT SCREW	
Materials	GC200 : Cast iron, Disc, seat: STS (Stellite welding)	
Hydraulic test pressure	15kgf/cm²g	

▶ The JIS and ANSI flanges are available by made-to-orders.

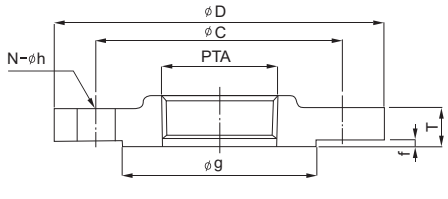
■ Dimensions

(mm)

Size Inlet X Outlet	Seat diameter	Throat diameter	Throat area	Lift	Face to Face		Height(h)		Connection size		Weight(kg)	
di X do	Ds	dt	a(mm²)	ℓ	L1	L2	YSF-5	YSF-6	IN	OUT	YSF-5	YSF-6
20(¾")X25(1")	18	15	176.5	3.8	50	74	182	180	1"	1"	33	5.0
25(1")X32(1¼")	22	19	283.3	5.0	60	85	215	212	1¼"	1¼"	5.2	9.2
40(1½")X50(2")	35	30	706.5	7.5	80	100	295	293	2"	2"	9.6	16.0
50(2")X65(2½")	45	38	1133.5	9.5	90	115	335	332	2½"	2½"	16.0	3.2

■ For reference

In order to install the type YSF-5, 6 as a flange, a coupling flange is required by made-to-order.

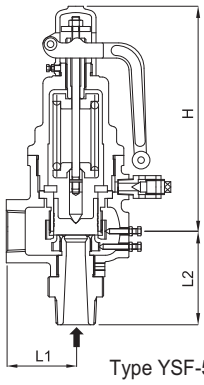


≫ Dimensions (KS B 6216 10K RF FLANGE)

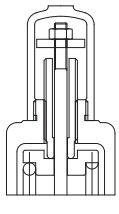
(mm)

Category / Size	PTA	øD	øC	øg	N-øh	f	T
20(¾")	1"	125	90	67	4-19	1	18
25(1")	1¼"	135	100	76	4-19	2	20
40(1½")	2"	155	120	96	8-19	2	20
50(2")	2½"	175	140	116	8-19	2	22

■ Dimensional drawing



Type YSF-5



Type YSF-6

Type YSF-3 Safety Valve (Open Bonnet Type, Full Bore Type) Steam Boiler

■ Features

- No instability in high temperatures : The maximum operating temperature of 450°C so that YSF-3 can be used without any changes in spring characteristics commonly occur in high temperatures.
- High impact resistance and good abrasion resistance : The disc and seat are stainless steel welded with satellite.
- Simple structure reduces maintenance costs & offers outstanding performance.
- High-strength stainless steel inner core components.
- Test lever attached : Periodical performance inspections can be conducted.
- Approval from the Korea Occupational Safety and Health Agency (KOSHA).

■ Specifications

Type		YSF-3 (Open Bonnet)
Test lever		Yes
Applicable fluid		Steam
Set pressure range		1~30kgf/cm²g
Fluid temperature		350° C
End connection	Inlet	KS B 6216 10, 20, 30K RF FLANGE
	Outlet	KS B 1511 10K FF FLANGE
Materials	Body	SCPH2
	Disc, seat	STS (Stellite welding)
Hydraulic test pressure		1.5 times of applicable flange rating

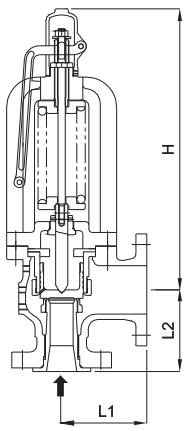
▶ The JIS and ANSI flanges are available by made-to-orders.

■ Dimensions

(mm)

Size Inlet×Outlet	Seat diameter	Throat diameter	Throat area	Lift	Face to Face		Height(h)	Weight(kg)
di X do	Ds	dt	a(mm²)	ℓ	L1	L2	H	YSF-3
25(1")X40(1½")	22	19	283.5	5.0	115	100	320	15.2
40(1½")X65(2½")	35	30	706.8	7.5	130	125	425	28.6
50(2")X80(3")	45	38	1134.1	9.5	141	135	465	42.7
65(2½")X100(4")	58	49	1885.7	12.5	161	160	560	64
80(3")X125(5")	71	61	2922.5	15.5	179	180	630	89
100(4")X150(6")	88	76	4536.5	19.0	209	205	795	143
125(5")X200(8")	111	95	7088.2	24.0	232	240	1010	290
150(6")X200(8")	134	115	10386.9	29.0	262	250	1110	342
200(8")X250(10")	176	152	18145.8	38.0	355	300	1415	684

■ Dimensional drawing



Type YSL-1, 2 Safety Valve (Low Lift Type)

Boiler | Heat Exchanger | Secondary Side of Pressure Reducing Valve

The type YSL can be commonly used for various types of fluid (steam, vapor, liquid). It has a simple structure and is made of materials with a superb level of corrosion resistance. It is a safety valve that can be used for various purposes, such as a pressure vessel, safety device for various instruments and equipment, hot water boiler, water (including hot water) supplying equipment, cooling and heating facility, and safety device of pressure reducing valves.

Type YSL-1

Type YSL-2

■ Features

- Simple structure and outstanding performance.
- Disc and seat are free from leakage or transformation issues, thanks to a precision machining process.
- Test lever attached : Periodical performance inspections can be conducted.
- Approval from the Korea Occupational Safety and Health Agency (KOSHA).

■ Specifications

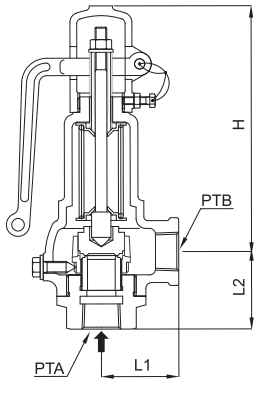
Type		YSL-1	YSL-2
Test lever		Yes	No
Applicable fluid		Steam, air	water
Set pressure range		0.35~10kgf/cm²g	
Fluid temperature		220° C below	
End connection		KS PT SCREW	
Materials	Body	GC200	
	Disc, seat	STS	
Hydraulic test pressure		15 kgf/cm²g	

■ Dimensions

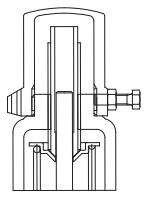
(mm)

Size	Seat diameter	Lift	Effective area (mm)		Face to Face		Height(h)		Connection size		Weight(kg)	
	D	ℓ	πD ℓ	πD2/4	L1	L2	YSL-1	YSL-2	IN	OUT	YSL-1	YSL-2
15(½")X15(½")	15	0.4	18.8	176.6	40	41	127	112	½"	½"	1.1	1
20(¾")X20(¾")	20	0.5	31.4	314	50	50	137	122	¾"	¾"	1.8	1.7
25(1")X25(1")	25	0.7	54.9	490.8	55	60	162	148	1"	1"	3	2.9
40(1½")X40(1½")	40	1.0	125.6	1256.6	70	75	230	216	1½"	1½"	6.4	6.1
50(2")X50(2")	50	1.3	204.1	1963.5	80	80	245	245	2"	2"	9.3	9

■ Dimensional drawing



Type YSL-1



Type YSL-2

Type YRV-1, 2 Relief Valve (for Pump Relief) For Pump Only

Type YRV-1

Type YRV-2

■ Features

- Specifically developed for pump use : Safe operation even in case of continuous relief.
- NOTE : Possibility of hunching or a water hammer if a safety valve is used as a relief valve of a pump.

■ Specifications

Type		YRV-1	YRV-2
Size		25A~80A	
Applicable fluid		Water	
Set pressure range		1.0~10kgf/cm²g	1.0~30kgf/cm²g
Fluid temperature		Max. 220° C	
End connection	Inlet	KS B 6216 10K RF FLANGE	KS B 6216 10, 20, 30K RF FLANGE
	Outlet	KS B 1511 10K RF FLANGE	
Materials	Body	GC200	SCPH2
	Disc, seat	STS	
Hydraulic test pressure		1.5 times of applicable flange rating	

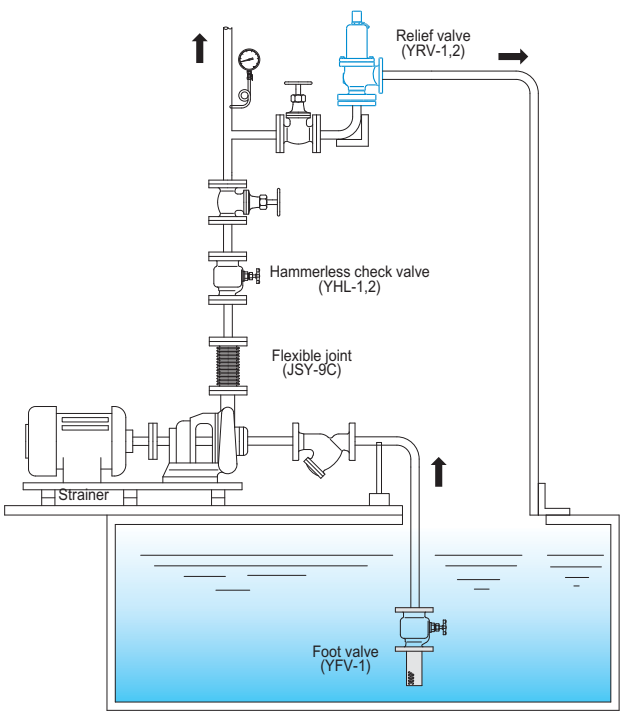
▶ The JIS and ANSI flanges are available by made-to-orders.

■ Dimensions

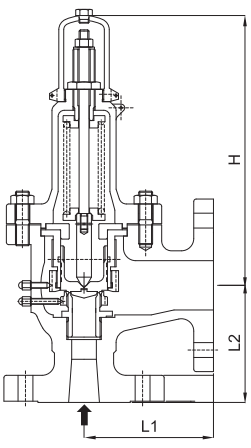
Size Inlet×Outlet	Seat diameter	Throat diameter	Throat area	Lift	Face to Face (L)		Height(h)		Weight(kg)	
di X do	Ds	dt	a(mm²)	ℓ	YRV-1	YRV-2	YRV-1	YRV-2	YRV-1	YRV-2
25(1")X40(1½")	22	19	283.5	5.0	105	115	214	264	10.3	12.4
40(1½")X65(2½")	35	30	706.8	7.5	125	130	278	316	19.2	24
50(2")X80(3")	45	38	1134.1	9.5	135	141	346	380	25.1	34.3
65(2½")X100(4")	58	49	1885.7	12.5	155	161	404	480	43.1	55.8
80(3")X125(5")	71	61	2922.5	15.5	175	179	487	535	61.7	77.2

▶ Valves with a size of 100A or larger are available by made-to-orders.

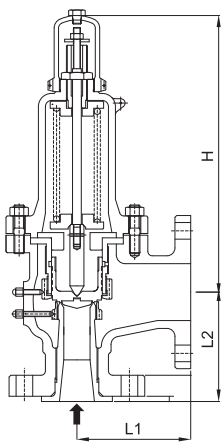
■ Application Diagram (Example)



■ Dimensional drawing



Type YRV-1



Type YRV-2

Data / KS B 6216 Regulations on Safety Valves for Steam

■ Terminologies related to safety valves

Terminology	Definition
Safety valve	This valve automatically begins operation when the pressure on the inlet side reaches a pre-determined level. If the pressure decreases, this valve returns it to normal status. It has the ability to discharge fluid (steam or gas) based on the rated relieving capacity.
Set pressure	In the case of safety valves that require an opening pressure, this refers to the opening pressure that was determined in the design. In the case of safety valves that require a start-to-discharge pressure, this refers to the start-to-discharge pressure that was determined in the design. It is the pressure indicated on the product label.
Start-to-discharge pressure	This refers to the pressure when the safety valve begins to discharge. It is the pressure on the inlet side when an extremely small amount of fluid (steam or gas) discharge is detected on the outlet side.
Opening pressure	This refers to the inlet-side pressure when fluid is discharged as a result of operation of a safety valve. It is a pressure when the lift level becomes measurable, or a continuous discharge can be recognized.
Flow rating pressure	This pressure determines the rated relieving capacity regulated in the appendix.
Closing pressure	This is the inlet-side pressure when the safety valve has closed, resulting from the pressure dropping from the opening pressure, and the flow of the fluid has practically come to a stop, leading to a lift level of 0.
Blowdown	In terms of safety valves that require an opening pressure, this refers to the difference between the opening pressure and closing pressure. In terms of safety valves that require a start-to-discharge pressure, this refers to the difference between the start-to-discharge pressure and closing pressure.
Lift	The axial direction movement amount of a valve stem or a disc, from the valve closing location to the valve opening location during a safety valve discharge.
Rated relieving capacity	This refers to a discharge capacity that is guaranteed for each safety valve. It is determined according to regulations stipulated in 3.2.4(2) of KS B 6352 (discharge coefficient measurement method for safety valves) or in the appendix.
Certified coefficient of discharge	This is a coefficient applied to the rated relieving capacity. It is determined based on regulations set forth in 3.2.4(1) of KS B 6352 or a method that is recognized as being equivalent to the regulations.
Hole diameter of disc seat	This is the inner diameter of the interface of a disc and a disc seat (Refer to the attached chart in the appendix).
Effective discharge area	This refers to the area of the part that determines the flow passing through a safety valve. It is used for calculating the rated relieving capacity (Refer to the attached chart in the appendix).
Throat diameter	This refers to the inner diameter of the narrowest part of the nozzle extending from the fluid inlet to the disc seat surface.
Back pressure	This is the pressure on the outlet side of a safety valve. It has the following two kinds: (a) Pressure that is built on the outlet side of a safety valve as a result of exhaust-side resistance when the safety valve discharges. (b) Pressure that already exists on the exhaust side before the safety valve begins to discharge.

Data / KS B 6216 Regulations on Safety Valves for Steam

■ Types and performance

1. Types

Safety valves are categorized into the following types according to whether a valve has a flow-restricting fixture and sealing structure.

Type	Flow-restricting fixture	Standard flow velocity (m/s)
A	Lift type : The lift of the safety valve is 1/40 or larger and smaller than 1/4 of the disc seat hole diameter. The area of the fluid passage of the disc seat hole is the minimum when the disc is open.	Sealed
B		Open
C	Full bore type : The disc seat hole diameter is at least 1.15 times the throat diameter. The area of the fluid passage of the disc seat hole is at least 1.05 times the throat area when the disc is open. The area of the fluid passage within the pipeline and the inlet of the safety valve should be at least 1.7 times the throat area.	Sealed
D		Open

2. Opening pressure allowance

(1) The following shows the opening pressure allowance for a spring safety valve for steam.
(2) The permissible range for a spring safety valve for gas is from the set pressure to less than 1.1 times the set pressure.

Unit: kgf/cm²(MPa)

Set pressure		Allowance
	Less than 5(0.5)	±0.14(0.14)
5(0.5) or higher	Less than 23(2.3)	±(3% of set pressure)
23(2.3) or higher	Less than 70(7.0)	±0.7(0.07)
	Less than 70(7.0)	±(1% of set pressure)

▶ The opening pressure allowance of safety valves for steam, other than boilers, is ±3% (minimum value of ±0.14 kgf/cm²g) of the set pressure.

3. Blowdown

(1) The blowdown of a spring safety valve for steam should be carried out as follows, based on the opening pressure.

Unit: kgf/cm²(MPa)

Opening pressure	Blowdown
4(0.4) or less	0.3(0.03) or less
Higher than 4(0.4)	7%(4%) or less of opening pressure

▶ Notes : It is possible to decide on the value in the parenthesis, according to an agreement between relevant parties.
However, if the opening pressure of safety valves for steam that are used for once-through boilers, reheat pipes, etc. exceeds 3 kgf/cm2g, it can be 10% or less of the set pressure.

(2) The blowdown pressure of the spring safety valve for gas and spring safety valve for steam that is installed on surplus pipeline is as follows, based on the opening pressure or set pressure.

Unit: kgf/cm²(MPa)

Set pressure	Blowdown	
	Without using a soft seat on disc seat surface	Using a soft seat on disc seat surface
2(0.2) or less	Maximum 0.3(0.03)	Maximum 0.5(0.05)
Higher than 2(0.2)	Maximum 15% of set pressure	Maximum 25% of set pressure

▶ Notes : A soft seat has a disc seat surface treated with a synthetic resin.

2

■ Calculation of discharge capacity

● **KS B 6216 standard on safety valves for steam and gas**

A. For steam

$W = 0.5145 \times A \times (P+1) \times K \times C \times 0.9$

Here,

W : Rated relieving capacity (kg/h)

A : Minimum steam passage area (mm^2)

In case of low lift, high lift, and warm lift types, $A = \pi DL$

In case of full bore types, $A = \frac{\pi}{4} d^2$

D : Valve seat diameter (mm)

L : Valve lift (mm)

Lift type $L = \frac{D}{40} \sim \frac{D}{15}$

D : Throat diameter (mm)

P: Flow rating pressure (kgf/cm^2g)

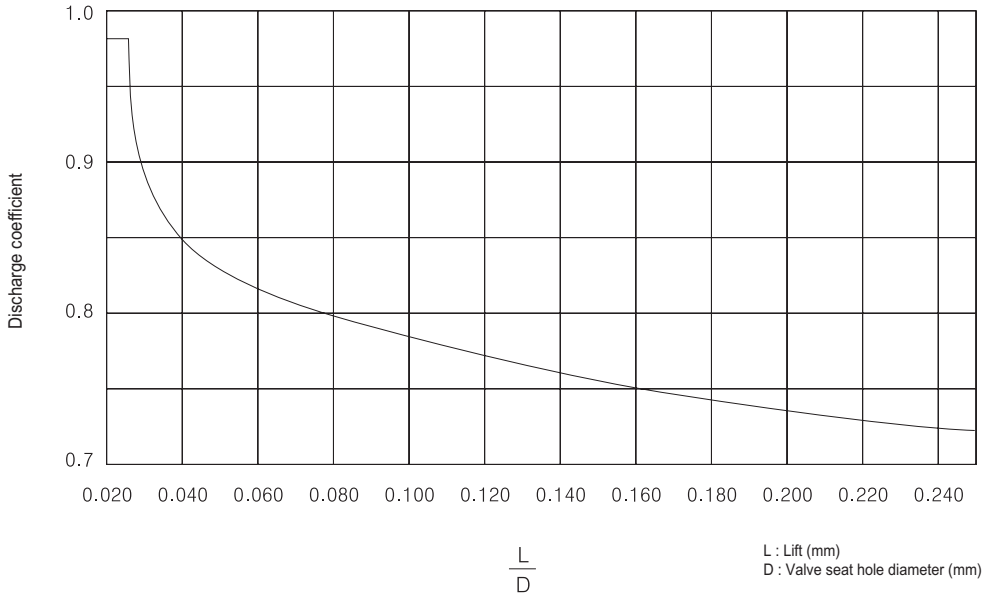
If not specifically stated otherwise, this is 1.03 times the opening pressure if the maximum pressure used exceeds 1 kgf/cm^2g. A total of 0.2 kgf/cm^2g is added to the opening pressure if the maximum pressure used is 1 kgf/cm^2g or less. If specifically stated otherwise, the corresponding value should be used.

K: Certified coefficient of discharge (Refer to Chart 1)

C: Coefficient based on steam characteristics (Refer to Chart 2)

If the certified coefficient of discharge of a safety valve is not measured, the rated relieving capacity can be calculated by using the K' value determined based on Chart 1, instead of the K value in the calculation formula above; provided that K' equals 0.864 in case of full bore type safety valves.

〉Chart 1. Certified coefficient of discharge



Temperature / Absolute pressure kg/cm²(MPa)	Saturated temperature	200	220	240	260	280	300	320	340	360	380	400	420	440	460	480	500	520	540	560	580	600	620	640	660	680	700
5(0.5)	1.005	0.996	0.972	0.951	0.931	0.913	0.896	0.879	0.864	0.849	0.835	0.822															
10(1.0)	0.987	0.981	0.983	0.960	0.938	0.919	0.901	0.884	0.868	0.853	0.838	0.825															
15(1.5)	0.977	0.976	0.970	0.972	0.947	0.925	0.906	0.888	0.872	0.856	0.841	0.828															
20(2.0)	0.972		0.967	0.964	0.955	0.932	0.912	0.893	0.876	0.860	0.845	0.830	0.817	0.804	0.792	569	0.780										
25(2.5)	0.969			0.961	0.961	0.937	0.918	0.898	0.880	0.863	0.848	0.833	0.819	0.806	0.793	925	0.782										
30(3.0)	0.967			0.962	0.957	0.949	0.924	0.903	0.885	0.867	0.851	0.836	0.822	0.808	0.795	85	0.783	0.763	0.748	0.742	0.730	0.721	0.712	0.703	0.695	0.687	0.679
40(4.0)	0.965				0.958	0.954	0.934	0.915	0.894	0.875	0.857	0.841	0.826	0.813	0.799	142	0.787	0.763	0.755	0.744	0.735	0.725	0.715	0.705	0.696	0.688	0.680
50(5.0)	0.966					0.955	0.953	0.927	0.904	0.884	0.865	0.848	0.832	0.817	0.803	249	0.790	0.766	0.755	0.747	0.737	0.723	0.717	0.708	0.697	0.689	0.681
60(6.0)	0.968					0.962	0.953	0.941	0.911	0.891	0.872	0.854	0.838	0.822	0.808	569	0.794	0.769	0.758	0.747	0.739	0.729	0.719	0.710	0.698	0.690	0.682
70(7.0)	0.971						0.958	0.954	0.924	0.901	0.881	0.861	0.844	0.827	0.812	925	0.798	0.772	0.761	0.749	0.739	0.731	0.721	0.708	0.702	0.691	0.683
80(8.0)	0.975						0.967	0.956	0.937	0.912	0.897	0.868	0.850	0.833	0.817	85	0.802	0.776	0.763	0.752	0.741	0.731	0.719	0.710	0.701	0.692	0.684
90(9.0)	0.980							0.962	0.957	0.926	0.909	0.876	0.856	0.838	0.822	142	0.807	0.779	0.766	0.754	0.743	0.733	0.722	0.711	0.702	0.693	0.685
100(10.0)	0.986							0.971	0.961	0.936	0.926	0.883	0.863	0.844	0.827	249	0.811	0.782	0.769	0.757	0.745	0.735	0.724	0.712	0.703	0.695	0.686
120(12.0)	0.999								0.975	0.964	0.956	0.903	0.876	0.857	0.838	569	0.818	0.789	0.775	0.762	0.750	0.739	0.728	0.718	0.706	0.697	0.688
140(14.0)	1.016								1.002	0.980	0.988	0.920	0.893	0.868	0.846	925	0.828	0.797	0.782	0.768	0.755	0.743	0.732	0.721	0.711	0.699	0.691
160(16.0)	1.036									1.000	1.004	0.942	0.907	0.883	0.858	85	0.838	0.803	0.787	0.774	0.760	0.748	0.736	0.725	0.714	0.704	0.693
180(18.0)	1.063									1.038	1.028	0.972	0.929	0.895	0.873	142	0.848	0.810	0.794	0.779	0.766	0.752	0.740	0.728	0.717	0.707	0.697
200(20.0)	1.094										1.072	1.006	0.953	0.914	0.885	249	0.861	0.818	0.801	0.786	0.770	0.757	0.744	0.732	0.720	0.710	0.700
220(22.0)	1.129											1.033	0.982	0.932	0.900	569	0.872	0.827	0.805	0.793	0.777	0.761	0.749	0.736	0.724	0.713	0.702
240(24.0)												1.059	1.016	0.958	0.915	925	0.885	0.837	0.815	0.797	0.783	0.766	0.752	0.740	0.727	0.716	0.705
260(26.0)												1.099	1.055	0.982	0.935	85	0.899	0.848	0.825	0.804	0.786	0.772	0.756	0.741	0.731	0.719	0.708
280(28.0)												1.167	1.096	1.013	0.956	142	0.913	0.853	0.834	0.811	0.793	0.776	0.762	0.747	0.735	0.720	0.710
300(30.0)													1.132	1.047	0.977	249	0.931	0.867	0.838	0.821	0.799	0.781	0.763	0.753	0.735	0.724	0.715
320(32.0)													1.169	1.089	1.009	569	0.952	0.877	0.849	0.824	0.805	0.787	0.770	0.753	0.742	0.729	0.714
340(34.0)														1.136	1.032	925	0.968	0.888	0.859	0.835	0.812	0.792	0.775	0.757	0.746	0.729	0.718
360(36.0)														1.191	1.063	85	0.989	0.899	0.869	0.842	0.818	0.798	0.780	0.761	0.761	0.734	0.723
380(38.0)															1.098	142	1.016	0.913	0.878	0.850	0.823	0.804	0.785	0.765	0.750	0.739	0.726
400(40.0)															1.137	249	1.037	0.927	0.888	0.858	0.832	0.807	0.790	0.769	0.754	0.742	0.725
420(42.0)																569	1.064	0.944	0.901	0.868	0.839	0.815	0.792	0.774	0.758	0.75	0.729
440(44.0)																925	1.092	0.954	0.914	0.876	0.846	0.821	0.800	0.779	0.762	0.748	0.731
460(46.0)																925	1.122	0.971	0.924	0.888	0.854	0.828	0.805	0.785	0.766	0.753	0.738

▶ Remarks - The intermediate value of pressure and temperature in this chart is calculated according to the rule of three.

2

■ Calculation of discharge capacity

B. For Gas

① In case P_2 / P_1 value is below threshold value

$$W = C \times K \times A \times P_1 \times \sqrt{\frac{M}{Z \times T}} \times 0.9$$

Here,

W : Rated relieving capacity (kg/h)

C : In case coefficient following the isentropic exponent of gas (see graph 3), it is set as C=234.

A : Effective discharge area (mm^2)

Lift type $A = \pi DL$

Full bore type $A = \frac{\pi}{4} d^2$

D : Valve seat diameter (mm)

L : Valve lift (mm)

Lift type $L = \frac{D}{40} \sim \frac{D}{15}$

D : Throat diameter (mm)

P_1 : It is the absolute pressure(kgf/cm^2) of the flow rating pressure.
If not specifically stated otherwise, this is 1.1 times the set pressure.

P_2 : Absolute pressure of back pressure (kgf/cm^2)

M : Molecular weight of gas (Refer to Chart 4)

Z : Compression coefficient

T : Absolute temperature of gas with regard to flow rating pressure

② In case the value of P_1 / P_2 exceeds threshold value

$$W = C \times K \times A \times P_1 \sqrt{\frac{k}{k-1}\left\{\left(\frac{P_2}{P_1}\right)^{2/k} - \left(\frac{P_2}{P_1}\right)^{\frac{k+1}{k}}\right\}} \sqrt{\frac{M}{Z \times T}} \times 0.9$$

Here,

K, W, A, P_1, P_2, M, Z, T follows the regulation of 1.

κ equals 1,000.

κ equals the value of isentropic exponent in P_1.

If the value in P_1 is unclear, it takes the value of standard conditions, and if this value is also unclear, κ equals 1,001.

In case the certified coefficient of discharge of the safety valve is not measured, rated relieving capacity(kg/h) can be calculated using K' value obtained from Chart 1 instead of k value from the calculation formula above. Provided that K' equals 0.864 in case of full bore type safety valves.

❯ Chart 1. C' value

k	C'	k	C'	k	C'	k	C'
1.00	234	1.20	251	1.40	265	1.60	277
1.02	237	1.22	252	1.42	266	1.62	278
1.04	238	1.24	254	1.44	267	1.64	280
1.06	240	1.26	255	1.46	268	1.66	281
1.08	242	1.28	257	1.48	270	1.68	282
1.10	244	1.30	258	1.50	271	1.70	283
1.12	245	1.32	260	1.52	272	1.80	289
1.14	246	1.34	261	1.54	274	1.90	293
1.16	248	1.36	263	1.56	275	2.00	298
1.18	250	1.38	264	1.58	276	2.20	307

■ (Chart 4) Physical properties of air and gas

Type of fluid	Molecular formula	Molecular weight	Adiabatic index	Critical temperature	Critical pressure	Liquid	
						Specific gravity	Temperature
ACETYLEN	C_2H_2	26.04	1.26	308.7	63.7	-	-
AIR	NH_3	28.96	1.40	132.5	38.4	-	-
AMMONIA	Ar	17.03	1.31	405.6	116.9	0.817	-79
ARGON	C_6H_6	39.95	1.67	150.8	50.4	1.650	-233
BENZENE	iso-C_4H_{10}	78.12	1.12	562.8	50.6	0.879	20
ISO-BUTANE	n-C_4H_{10}	58.13	1.10	408.2	37.7	0.557	20
N-BUTANE	CS_2	58.13	1.09	425.5	38.2	0.579	20
CARBON DISULFIDE	CO_2	76.14	1.21	549.2	78.0	1.263	20
CARBON ACID GAS	CO	44.00	1.29	304.2	77.8	0.101	-37
CARBON MONOXIDE	Cl_2	28.01	1.40	133.0	36.9	0.814	-194
CHLORINE	C_6H1_2	70.91	1.36	417.2	79.8	1.560	-34
CYCLOHEXANE	n-$C_{10}H_{22}$	84.16	1.09	481.6	41.4	0.779	20
N-DECANE	C_2H_6	142.29	1.03	618.4	21.7	0.734	15.6
ETHANE	C_2H_5OH	30.07	1.19	305.4	49.9	0.546	-88
ETHYL ALCOHOL	C_2H_4	46.07	-	516.2	65.0	0.789	20
ETHYLENE	n-$CH_3(CH_2)_5CH_3$	28.05	1.24	282.7	51.9	0.566	-102
HELIUM	n-C_7H_{16}	4.00	1.66	5.3	5.4	-	-
N-HEPTANE	n-C_6H_{14}	100.21	1.05	540.2	27.8	-	-
N-HEXANE	HCl	86.18	1.06	507.7	30.9	0.659	20
HYDROCHLORIC ACID	H_2	36.46	1.41	324.7	86.0	-	-
HYDROGEN	H_2S	2.02	1.41	33.2	13.5	0.079	-253
SULFURETED HYDROGEN	CH_4	34.08	1.321	373.6	93.4	-	-
METHANE	CH_3OH	16.04	1.31	190.9	48.0	0.415	-164
METHYL ALCOHOL	CH_3Cl	32.04	1.20	512.6	81.8	0.792	20
METHYL CHLORIDE	N_2	50.49	1.20	416.3	68.8	0.952	0
NITROGEN	N_2O	28.01	1.40	126.3	35.4	1.026	-252
NITROUS OXIDE	n-$CH_3(CH_2)_7CH_3$	44.01	1.30	309.3	75.4	1.226	-89
N-NONAN	O_2	128.26	1.04	594.7	23.5	0.718	20
OXYGEN	n-$CH_3(CH_2)_3CH_3$	32.00	1.40	154.7	52.5	1.426	-252
N-PENTANE	n-$CH_3CH_2CH_3$	72.15	1.07	470.1	34.2	0.631	15.6
NPROPANE	H_2O	44.11	1.13	370.0	43.5	0.585	-45
STEAM	SO_2	18.02	1.33	647.1	225.8	1.000	4
SULPHUR DIOXIDE	$C_6H_5CH_3$	64.06	1.29	593.6	43.1	0.906	20
TOLUENE	CH_3CHCH_2	92.15	1.09	593.6	43.1	0.866	20
PROPYLENE	C_8H_{18}	42.08	1.15	365.1	46.9	0.609	-47
OCTANE		114.00	1.05	-	-	-	-

Data / Discharge Capacity Table of Safety Valves (KSB6216) for Steam

● Full bore type

$$W = 0.5145 \times K \times A \times P \times Ksh \times 0.9$$

(kg/h)

Type	P / size dt	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
YSF-1 YSF-3 YSF-5	20X 25	146	218	291	364	437	509	582	655	728	800	873	946	1,018	1,091	1,164	1,237	1,309	1,382	1,455	1,528	1,600	1,673	1,746	1,819	1,891	1,964	2,037	2,109	2,182	2,255
	25X40	234	351	468	584	701	818	935	1,052	1,169	1,285	1,402	1,519	1,636	1,753	1,870	1,986	2,103	2,220	2,337	2,454	2,570	2,687	2,804	2,921	3,038	3,155	3,271	3,388	3,505	3,622
	40X65	583	875	1,166	1,457	1,748	2,040	2,331	2,622	2,913	3,205	3,496	3,787	4,078	4,370	4,661	4,952	5,243	5,535	5,826	6,117	6,408	6,700	6,991	7,282	7,574	7,865	8,156	8,447	8,739	9,030
	50X80	936	1,403	1,871	2,338	2,805	3,274	3,740	4,207	4,675	5,142	5,609	6,077	6,544	7,011	7,479	7,946	8,413	8,881	9,348	9,815	10,283	10,750	11,217	11,685	12,152	12,619	13,087	13,554	14,021	14,489
	65X 100	1,556	2,333	3,110	3,888	4,665	5,442	6,219	6,996	7,773	8,550	9,327	10,104	10,881	11,658	12,435	13,212	13,989	14,766	15,543	16,320	17,097	17,875	18,652	19,429	20,206	20,983	21,760	22,537	23,314	24,091
	80X 125	2,412	3,616	4,821	6,025	7,229	8,434	9,638	10,842	12,046	13,251	14,455	15,659	16,864	18,068	19,272	20,477	21,681	22,885	24,089	25,294	26,498	27,702	28,907	30,111	31,315	32,520	33,724	34,928	36,132	37,337
	100X 150	3,744	5,614	7,483	9,352	11,222	13,091	14,961	16,830	18,699	20,569	22,438	24,308	26,177	28,046	29,916	31,785	33,654	35,524	37,393	39,263	41,132	43,001	44,871	46,740	48,610	50,479	52,348	54,218	56,087	57,957
	125X 200	5,850	8,711	11,699	14,613	17,534	20,455	23,376	26,292	29,217	32,138	35,059	37,980	40,901	43,822	46,743	49,664	52,584	55,505	58,426	61,347	64,268	67,189	70,110	73,031	75,952	78,872	81,793	84,714	87,635	90,556
	150X 200	8,573	12,853	17,133	21,414	25,694	29,974	34,254	38,534	42,815	47,095	51,375	55,655	59,935	64,216	68,496	72,776	77,056	81,336	85,617	89,897	94,177	98,457	102,737	107,018	111,298	115,578	119,858	124,138	128,419	132,699
	200X 250	14,977	22,454	29,932	37,409	44,887	52,364	59,842	67,319	74,797	82,274	89,751	97,229	104,706	112,184	119,661	127,139	134,616	142,094	149,571	157,049	164,526	172,004	179,481	186,959	194,436	201,914	209,391	216,869	224,346	231,824
	300X 400	34,292	51,412	68,533	85,654	102,775	119,896	137,017	153,137	171,258	188,379	205,500	222,621	239,741	256,862	273,983	292,104	308,225	325,346	342,466	359,587	376,708	393,829	410,950	428,071	445,191	462,312	479,433	496,554	513,675	530,796

$$W = \frac{1.03P+1}{22} \quad AC\cdots\cdots C=1$$

W : Discharge capacity
P : Opening pressure (kg/cm²g)
A : Throat area (π DL)
L : Lift (mm)
D: Seat diameter

● Low lift type

(kg/h)

Model	P / size	0.5	1	2	3	4	5	6	7	8	9	10
YSL-1	15		15	23	31	39	46	54	62	69	77	85
	20	0.4395	26	38	51	64	77	90	103	116	129	142
	25	1.0956	45	67	90	112	135	158	180	203	226	248
	40	1.7579	102	154	206	257	309	361	413	464	516	568
	50	2.9229	166	250	334	418	502	586	670	754	839	923

● **Full bore type**

$$W = 220A(P+1)\sqrt{\frac{M}{T}} \quad \cdots\cdots \quad \begin{matrix} M = 28.96 \\ T = 293 \end{matrix}$$

(kg/h)

Type	P / size dt	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
YSF-1 YSF-3 YSF-5	20X25	295	447	599	751	903	1055	1207	1359	1511	1663	1815	1968	2120	2272	2424	2576	2728	2880	3032	3184	3336	3488	3640	3792	3944	4096	4248	4400	4553	4705
	25X40	473	717	961	1205	1449	1693	1937	2181	2425	2669	2913	3157	3401	3645	3889	4133	4377	4621	4864	5108	5352	5596	5840	6084	6328	6572	6816	7060	7304	7548
	40X65	1180	1788	2396	3005	3613	4221	4830	5438	6046	6655	7263	7871	8480	9088	9696	10305	10913	11521	12129	12738	13346	13954	14563	15171	15779	16388	16996	17604	18213	18821
	50X80	1892	2868	3844	4802	5796	6772	7748	8724	9700	10676	11652	12628	14580	14580	15556	16532	17508	18484	19460	20436	21412	22388	23364	24339	25315	26291	27267	28243	29219	30195
	65X 100	3147	4769	6392	8015	9638	11260	12883	14506	16129	17751	19374	20997	24242	24242	25865	27488	29111	37033	32356	33979	35602	37224	38847	40470	42093	43715	45338	46961	48584	50206
	80X 125	4877	7392	9907	12422	14937	17452	19967	22484	24997	27512	30027	32541	37571	37571	40086	42601	45116	47631	50146	52661	55176	57691	60206	62721	65236	67751	70266	72781	75296	77811
	100X 150	7570	11474	15378	19282	23186	27090	30994	34897	38801	42705	46609	50513	58321	58321	62225	66129	70033	73937	77840	81744	85648	89552	93456	97360	101264	105168	109072	112976	116880	120783
	125X 200	11828	17928	24028	30127	36227	42327	48427	54527	60626	66726	72826	78926	91125	91125	97225	103325	109425	115524	121624	127724	133824	139924	146023	152123	158223	164323	170423	176522	182622	188722
	150X 200	17333	26271	35210	44148	53087	62025	70964	79902	88841	97779	106718	115656	133533	133533	142472	151410	160349	169287	178226	187164	196103	205041	213980	222918	231857	240795	249734	258672	267611	276549
	200X 250	30280	45895	61511	77126	92742	108357	123973	139588	155204	170819	186435	202050	233281	233281	248896	264512	280127	295743	311358	326974	324589	358205	378820	389436	405051	420667	436282	451898	467513	483128
	300X 400	69330	105084	140838	176592	212346	248100	283854	319608	355362	391116	426871	462625	534133	534133	596887	605641	641395	677149	712903	748657	784411	820165	855919	891673	927427	963181	998935	1034 689	1070 443	1106 197

● **Low lift type**

$$A = W/CKF\sqrt{\frac{M}{T}} \quad \cdots\cdots \quad \begin{matrix} C = 265,\ P_1 = P+1.03 \\ K = 0.87,\ M = 28.96,\ T = 293 \end{matrix}$$

(kg/h)

Type	P / size	1	2	3	4	5	6	7	8	9	10
YSL-1	15	31	48	64	80	96	112	128	145	161	177
	20	52	79	106	133	160	188	215	242	269	296
	25	92	139	186	233	281	328	375	422	470	517
	40	210	318	426	534	642	750	858	966	1074	1182
	50	341	516	692	867	1043	1219	1394	1570	1746	1921

$W = 5070AK\sqrt{PG}$ ····· K = 0.6, Accumulation 15%
G = 1

W : Discharge capacity (kg/h)
P : Opening pressure (kg/cm²g)
dt : Throat diameter (mm)
A : Throat area (cm²g)
$A = \pi dt^2/4$

● **Full bore type**

(kg/h)

Type	size / dt	P 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
YSF-6	20 / 15	8.6	12.1	14.9	17.2	19.3	21.2	22.8	24.3	25.8	27.2																				
	25 / 19	9.24	13.0	16.0	8.4	20.6	22.6	24.4	26.1	27.7	29.2																				
	40 / 30	23.0	32.5	39.9	46.0	51.5	56.4	60.9	65.1	69.1	72.8																				
	50 / 38	36.9	52.2	61.0	73.9	82.6	90.5	97.8	104	110	116																				
YSF-2 YSF-4 YRV-1 YRV-2	25 / 19	9.24	13.0	16.0	18.4	20.6	22.6	24.4	26.1	27.7	29.2	30.6	32.0	33.3	34.5	35.7	36.9	38.1	39.2	40.2	41.3	42.3	43.3	44.3	45.2	46.2	47.1	48.0	48.9	49.7	50.6
	40 / 30	23.0	32.5	39.9	46.0	51.5	56.4	60.9	65.1	69.1	72.8	76.4	79.8	83.0	86.2	89.2	92.1	95.0	97.7	100	102	105	108	110	112	115	117	119	121	124	126
	50 / 38	36.9	52.2	64.0	73.9	82.6	90.5	97.8	104	110	116	122	128	133	138	143	147	152	156	161	165	169	173	177	181	184	188	192	195	199	202
	65 / 49	61.4	86.9	106	122	137	150	162	173	184	194	203	212	221	230	238	245	253	260	267	274	281	288	294	301	307	313	319	325	331	336
	80 / 61	95.2	134	165	190	213	233	252	269	285	301	316	330	343	356	369	381	392	404	415	426	436	446	456	466	476	485	495	504	513	521
	100 / 76	147	209	256	295	330	362	391	418	443	467	490	512	533	553	572	591	609	627	644	661	677	693	799	724	739	754	768	782	796	810
	125 / 95	231	326	400	462	516	566	611	653	693	730	766	800	833	864	895	924	952	980	1007	1033	1059	1084	1108	1132	1155	1178	1200	1222	1244	1265
	150 / 115	338	478	586	677	757	829	896	957	1015	1070	1123	1173	1221	1267	1311	1354	1396	1436	1476	1514	1551	1588	1624	1659	1693	1726	1759	1792	1823	1854

$W = 5070AK\sqrt{PG}$ ····· K = 0.55, Accumulation 10%
G = 1

● **Low lift type**

(kg/h)

Type	size / P	1	2	3	4	5	6	7	8	9	10
YSL-2	15	0.549	0.777	0.952	1.09	1.22	1.34	1.45	1.55	1.64	1.73
	20	0.918	0.29	1.59	1.83	2.05	2.24	2.42	2.59	2.75	2.90
	25	1.60	2.27	2.78	3.21	3.59	3.93	4.24	4.54	4.81	5.07
	40	3.67	5.19	6.36	7.34	8.21	8.99	9.71	10.3	11.0	11.6
	80	5.96	8.44	10.3	11.9	13.3	14.6	15.7	16.8	17.9	18.8

■ Cautionary measures

● Cautionary measures when handling safety valves

Safety valves cannot be used in good conditions unless the following cautionary measures are taken. This is because impacts can lead to changes in the precisely adjusted opening pressure.

(1) Safety valves should be protected from external impact.
(2) In order to prevent the entry of foreign substances into the inside of the valve, the cover plate should not be removed until the safety valve is installed.
(3) When installing the valve, completely remove scales, sand, dregs, etc. and do not remove the cover plate.
(4) If the opening pressure is different from the pressure gauge readings, check the pressure gauge first.
(5) Install the valve vertically, and do not remove the attached seal.

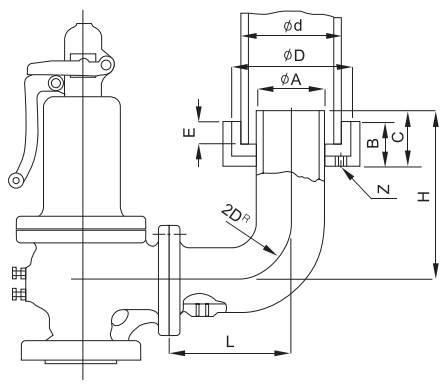
● Cautionary measure during installation

Install the safety valve vertically, in an upright position, in a pressure pipeline or coupling device. Install it as closely as possible to ensure the smooth flow of fluid between the pipeline and valve.

● Outlet pipeline

(1) A discharge pipeline should be installed, and at a safe place.
(2) The discharge pipeline should be bigger than the size on the outlet side to lower the back pressure to the same level as the atmospheric pressure. If possible, it should not be bent and should be short.
(3) The discharge pipeline should be fixed to a building or other structure so that it withstands vibration caused by outside atmospheric pressure changes or rapid flow of fluid during discharge.
(4) An appropriate bellows type expansion pipe joint should be installed on the outlet side in cases where inappropriate results might occur from heat expansion of the discharge pipeline.

※ The length of the discharge pipes should be set as follows, based on the size of the valve.



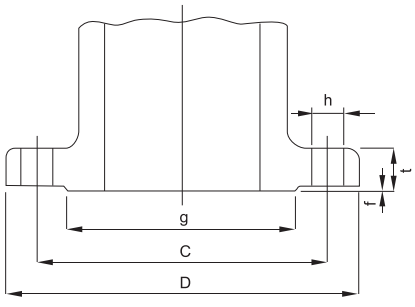
〉Dimensions

(kg/h)

Size on outlet side	D	d	A	B	C	E	L	H	N
40	40	65	130	60	80	30	130	220	PT3/8"
50	50	80	150	60	90	40	150	230	PT1/2"
65	65	100	200	60	100	40	180	270	PT1/2"
80	80	125	200	70	120	50	200	310	PT1/2"
100	100	150	250	70	140	60	250	370	PT3/4"
125	125	200	300	80	160	70	300	430	PT1"
150	150	200	300	80	180	80	350	500	PT1"
200	200	250	380	100	220	80	450	610	PT1"

Data / KS B 6216 Regulations on Full Bore Type Safety Valves

■ Table on standards for flanges on the inlet side of full bore type safety valves



Nominal pressure of safety valve		Size	Flange				Bolt hole			Nominal size of bolt screw
			D	t(Minimum)	f	g	c	Water	h	
New type	10K	20	125	18	1	67	920	4	19	M16
		25	135	20	2	76	100	4	19	M16
		32	140	20	2	81	105	4	19	M16
		40	155	20	2	96	120	8	19	M16
		50	175	22	2	116	140	8	19	M16
		65	200	24	2	132	160	8	23	M20
		80	210	24	2	145	170	8	23	M20
		(90)	225	26	2	160	185	8	23	M20
		100	270	26	2	195	225	8	25	M22
		125	305	28	2	230	260	12	25	M22
		150	350	30	2	275	305	12	25	M22
		200	430	34	2	345	380	12	27	M24
	20K	25	130	20	1	70	95	4	19	M16
		25	140	22	2	80	105	4	19	M16
		32	160	22	2	90	120	4	23	M20
		40	165	22	2	105	130	8	19	M16
		50	200	26	2	130	160	8	23	M16
		65	210	28	2	140	170	8	23	M20
		80	230	30	2	150	185	8	25	M22
		(90)	240	32	2	160	195	8	25	M22
		100	275	36	2	195	230	8	25	M22
		125	325	38	2	235	275	12	27	M24
		150	370	42	2	280	320	12	27	M24
		200	450	48	2	345	390	12	33	M30 X 3
Old type	10K	20	125	22	1	70	90.0	4	19	M16
		25	130	22	1	75	95	4	19	M16
		32	140	24	2	85	105	4	19	M16
		40	155	24	2	100	120	8	19	M16
		50	165	26	2	110	130	8	19	M16
		65	200	28	2	135	160	8	23	M20
		80	210	30	2	145	170	8	23	M20
		(90)	225	30	2	160	185	8	23	M20
		100	245	32	2	180	205	8	23	M20
		(115)	270	32	2	195	225	8	25	M22
		125	280	34	2	205	235	12	25	M22
		150	325	36	2	250	280	12	25	M22
		200	385	38	2	300	335	12	27	M24
	20K	20	130	22	1	70	95	4	19	M16
		25	135	22	1	75	100	4	19	M16
		32	160	24	2	90	120	4	23	M20
		40	165	24	2	105	130	8	19	M16
		50	185	26	2	115	145	8	23	M20
		65	210	30	2	140	170	8	23	M20
		80	230	32	2	150	185	8	25	M22
		(90)	240	34	2	160	195	8	25	M22
		100	265	36	2	185	220	8	25	M22
		(115)	275	38	2	195	230	8	25	M22
		125	290	38	2	210	245	12	25	M22
		150	350	42	2	260	300	12	27	M24
		200	410	46	2	310	350	12	27	M24

▶Notes: It is recommended that the size in the parenthesis not be used.

Steam Trap

3

Steam Trap

Steam traps automatically discharge condensate only, without steam leakages, thereby minimizing thermal loss and preventing condensate disturbance, such as a water hammer.

Steam trap

Type	Size	Applicable pressure (kgf/cm^2g)	Structure	Materials		End connection	Page
				Body	Disc, seat		
YAF-14S	15(½")~50(2")	Maximum 14	Float type	GCD450	STS	KS PT SCREW	70
YAF-14F						KS 10K RF FLANGE	
YBT-4	15(½")~25(1")	Maximum 17	Inverted bucket type			KS PT SCREW	71
YSP-1, 2		0.35~12	Disc type	GC200			72
YSP-5		0.1~8 or 0.3~16	Disc type (Bimetallic)	STS			74
YSP-6	8(¼")~10(⅜")	0.1~16	Disc type				
YRS-3	15(½")~20(¾")	0.1~1.5 or 1.5~3	Thermo-wax type	C3771			75

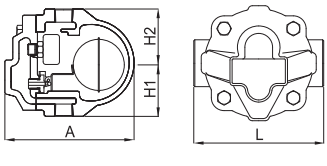
Type YAF-14S, 14F Ball Float Type Steam Trap

This is a lever float type steam trap that can be used where pressure is high and where a large volume of condensate is generated, such as heat exchangers, room heating and water heating facilities, and air-conditioning and heating facilities.

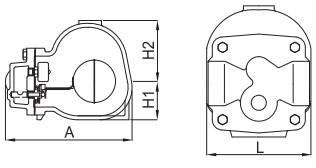
Type YAF-14S

Type YAF-14F

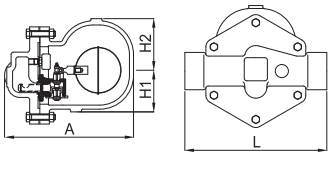
■ Dimensional drawing



15, 20A



25, 32A



40, 50A

■ Features

- Outstanding performance in continuous discharge, regardless of load fluctuations of condensate.
- Built-in automatic Air Vent ensuring no air binding.
- Easy repair and inspections : simply remove the cover for repair and inspections. The float assembly is attached to the cover.

■ Specifications

Type		YAF-14S	YAF-14F
Size		15, 20, 25, 32, 40, 50A	
Applicable pressure		4.5, 10, 14kgf/cm²g	
Applicable temperature		220° C below	
End connection		KS PT SCREW	KS 10K RF FLANGE
Materials	Body	GCD450	
	Seat	STS	
	Float, lever	STS	
	Air vent	Bimetals	
Hydraulic test pressure		1.5 times of applicable flange rating	

■ Maximum applicable differential pressure

Type	Differential pressure (kgf/cm²)
YAF-14(4.5)	4.5
YAF-14(10)	10
YAF-14(14)	14

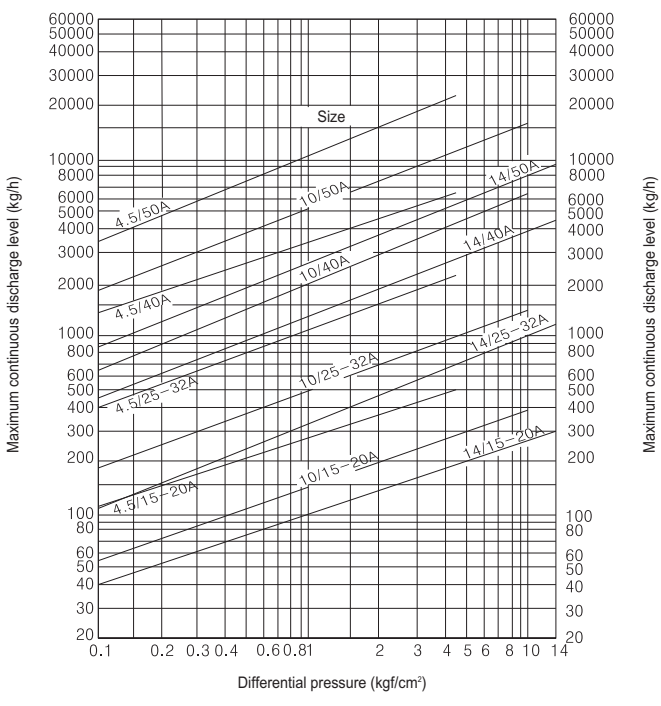
■ Dimensions

(mm)

Size	L	H1	H2	A	Weight(kg)
15(½")	122 (170)	61	61	147	2.9
20(¾")	122 (170)	61	61	147	2.9
25(1")	122 (200)	67.5	108	223	6.8
32(1¼")	160 (210)	67.5	108	238	7.2
40(1½")	270 (270)	80.5	125.5	285	17.5
50(2")	300 (300)	90	142	295	22.0

▶ The dimensions in parenthesis are for YAF-14F.

■ Size selection chart



YBT-4 Bucket Trap

As an optimal trap for drain discharge for steam pipelines and headers, it has a simple structure that ensures easy maintenance.

■ Features

- Simple structure & extremely strong parts : durability and effective operations are guaranteed.
- No air binding : inverted structure of the bucket.
- No need to attach a separate strainer : bucket trap with built-in screen.
- Easy repair : simply remove the cover.

■ Specifications

Type		YBT-4
Applicable pressure		Maximum 17 kgf/cm^{2}g
Fluid temperature		220° C below
End connection		KS PT SCREW
Materials	Body	GCD450
	Disc, seat	STS
Hydraulic test pressure		25 kgf/cm^{2}g

■ Maximum applicable differential pressure

Size	Applicable differential pressure (Psi)
15(½")	80 / 125 / 230
20(¾")	
25(1")	

■ Dimensions

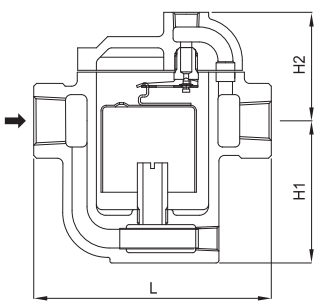
(mm)

Size	L	H1	H2	D	Weight(kg)
15(½")	127	78	65	½"	2.7
20(¾")	127	78	65	¾"	2.7
25(1")	127	100	65	1"	3.0

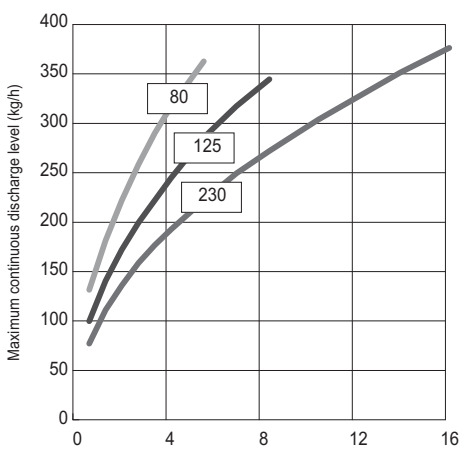
■ Cautions during installation

- After installing a bypass line and before operating the trap, blow out and remove foreign substances from inside the pipeline.
- The trap should be installed horizontally.
- The location of trap installation in the pipeline should be the lowest point of the facility or the end of the pipeline. If the outlet side is vertically standing, the height of the trap should be within the allowed back pressure range.

■ Dimensional drawing



■ Flow curve



Type YSP-1, 2 Disc Steam Trap (Pipeline)

As a disc type trap, it effectively uses the difference in the thermodynamic characteristics between steam and condensate. It is appropriate for places where there is a high possibility of freezing damages, including where the outlet or a steam main is exposed to the atmosphere.

Type YSP-1

Type YSP-2

■ Features

- Economical Trap (YSP-1 : no need for a separate bypass pipeline & simple handle operation blows foreign substances out and discharges condensed water.)
- No air binding during the start-up & easy repair.
- Easy installation in a pipeline : compact product & either the screwed type or flanged type can be used according to installation conditions.

■ Specifications

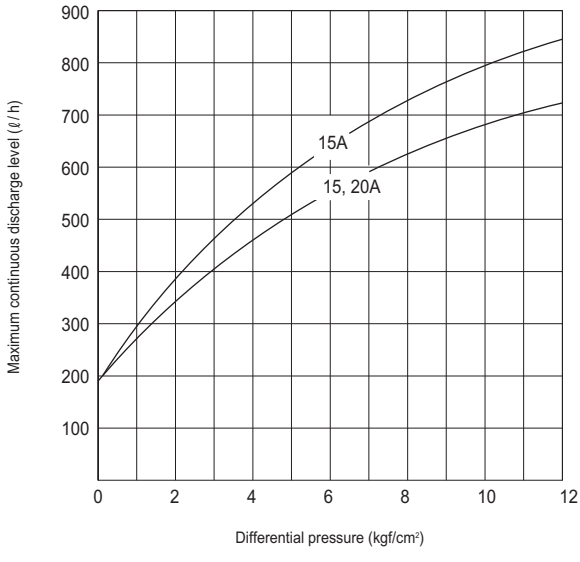
Type		YSP-1, YSP-2
Applicable pressure		0.35~12kgf/cm²g
Fluid temperature		220° C below
End connection		KS PT SCREW
Materials	Body	GC200
	Disc, seat	STS
Hydraulic test pressure		18 kgf/cm²g

■ Dimensions

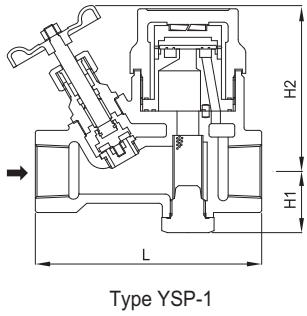
(mm)

Type	Size	L	H1	H2	Weight(kg)
Type YSP-1	15(½")	120	33	95	2.0
	20(¾")	125	33	95	2.0
	25(1")	135	37	97	2.6
Type YSP-2	15(½")	80	33	84	1.5
	20(¾")	84	33	84	1.5
	25(1")	88	37	87	2.0

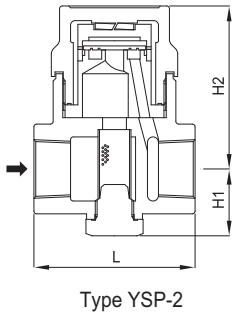
■ Flow curve



■ Dimensional drawing



Type YSP-1
(Bypass valve attached)

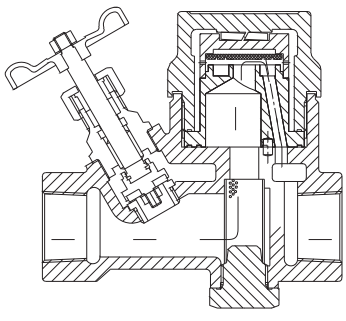


Type YSP-2

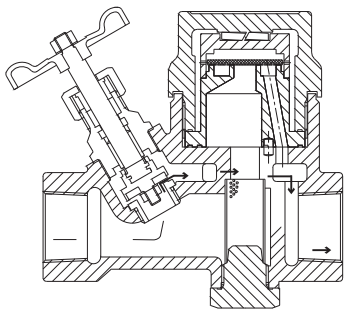
Type YSP-1, 2 Disc Steam Trap (Pipeline)

◎ Type YSP-1 Steam Trap for Bypass

■ Features



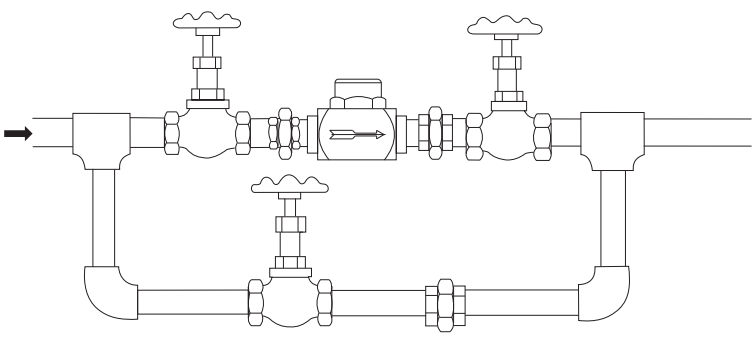
When the bypass valve is closed



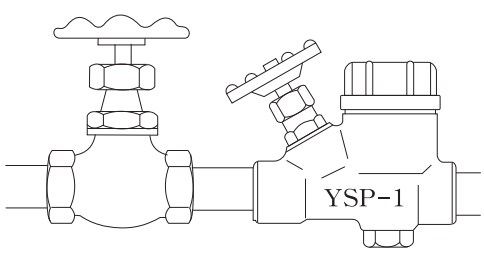
When the bypass valve is open

- 2 different functions : (1) Trap-when the bypass valve is closed; (2) Condensed water discharge device-when the bypass valve is open.
- Built-in strainer.
- No need for a bypass pipeline.
- Simple structure : easy operation & repair.

■ Pipeline installation method



When a bypass steam trap is not attached

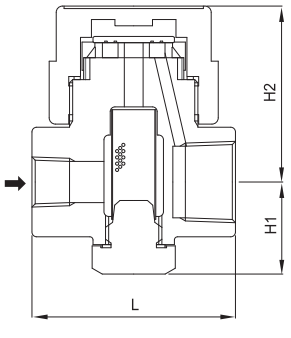


When a bypass steam trap is attached

Type YSP-5 Steam Trap

As a disc type trap, this product guarantees perfect operations and features parts that are all made of highly durable stainless steel. Because it has a built-in bimetal, there is no air binding and no concern of freezing damages.

■ Dimensional drawing



■ Features

- Built-in bimetal preventing air binding.
- Built-in strainer preventing malfunctioning caused by foreign substances.
- Made of stainless steel : outstanding durability and a high degree of hardness.

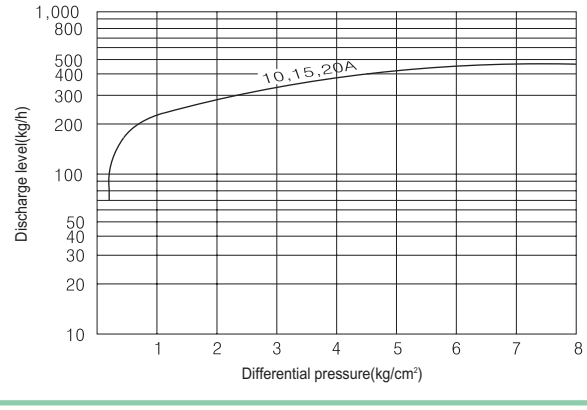
■ Specifications

Type		YSP-5
Applicable pressure		0.1~8, 0.3~16kgf/cm²g
Fluid temperature		220° C below
End connection		KS PT SCREW
Materials	Body	STS
	Disc, seat	STS
Hydraulic test pressure		24 kgf/cm²g

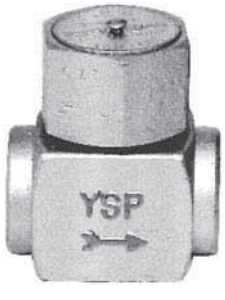
■ Dimensions

(mm)

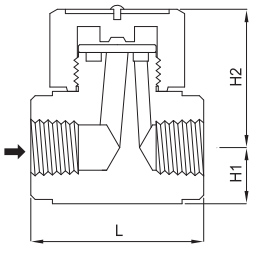
Type	Size	L	H1	H2	Weight(kg)
Type YSP-5	15(½")	65	30	55	1.0
	20(¾")	65	30	55	1.0
	25(1")	65	30	55	1.2



Type YSP-6 Steam Trap



■ Dimensional drawing



■ Features

- Compact & lightweight : easy to install.
- Superb discharge performance & a long life span.
- Made of stainless steel : a high degree of hardness & corrosion-free.

■ Specifications

Type		YSP-5
Applicable pressure		0.1~16kgf/cm²g
Fluid temperature		220° C or below
End connection		KS PT SCREW
Materials	Body	STS
	Disc, seat	STS
Hydraulic test pressure		24 kgf/cm²g

■ Dimensions

(mm)

Size	L	H1	H2	Weight(kg)
6(¼")	40	13	32	0.23
9(⅜")	40	13	32	0.23

Type YRS-3 Radiator Trap

This is a thermo-wax type radiator trap that is used for heating radiators.

■ Features

- No concern about freezing damages : no condensate remaining in the trap.
- No steam leakage : discharging condensate only when it is 100°C or below.
- Quickly discharging condensate and air.
- Compact & strong : The product can be used almost permanently. If needed, just replace the element.
- Distance among surfaces and the union nipple part - Same regulations on heating radiator traps KS B 6403 are applied.

■ Specifications

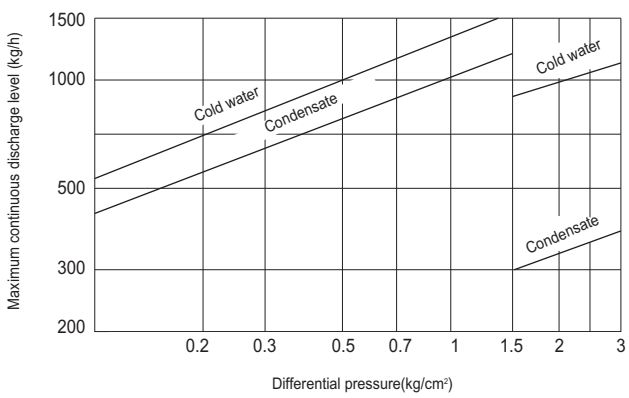
Applicable pressure		0.1~1.5, 1.5~3kgf/cm²g
Fluid temperature		150° C below
End connection	Inlet	KS PT SCREW (Union nipple)
	Outlet	KS PT SCREW
Materials	Body	C3771
	Disc, seat	STS
Hydraulic test pressure		4.5 kgf/cm²g

■ Dimensions

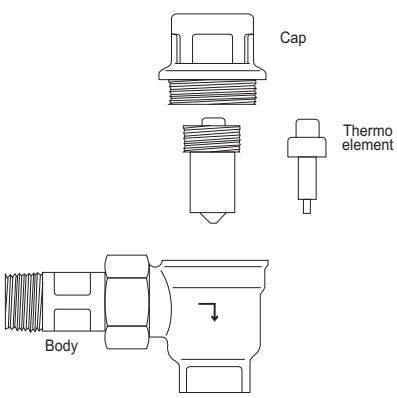
(mm)

Size	L	H1	H2	d	Weight(kg)
15(½")	80	35	40	½"	0.6
20(¾")	87	41	40	¾"	0.6

■ Flow curve

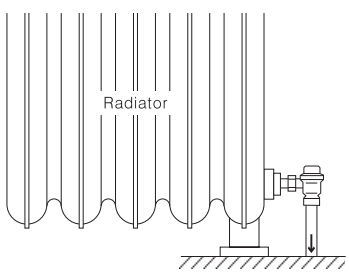


■ Changing the thermo element

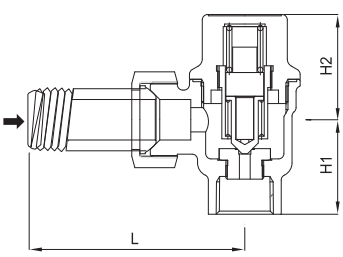


The element can be changed simply by loosening the cap.

■ Iustallatim example



■ Dimensional drawing



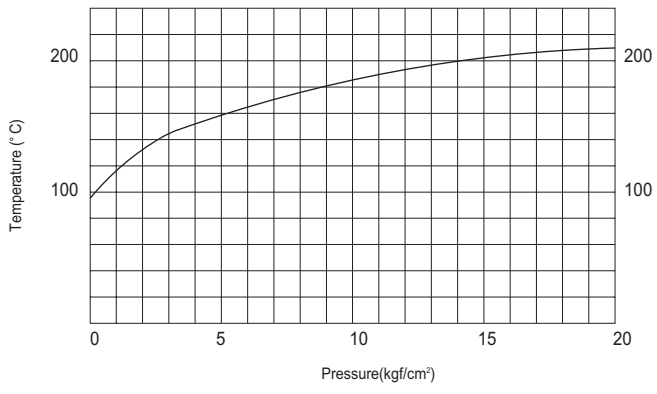
Data / Steam Trap

■ Steam characteristics and terminologies

● Steam curve

Water boils at 100°C when it is heated while placed in an open container.
When water inside an airtight container is heated, the pressure rises and the saturation temperature goes up as well.
Diagram 1 shows the relationship between pressure and temperature.

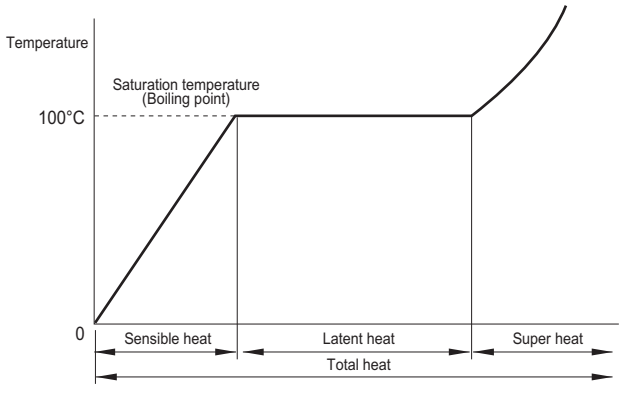
〉Diagram 1. Steam curve



● Heat

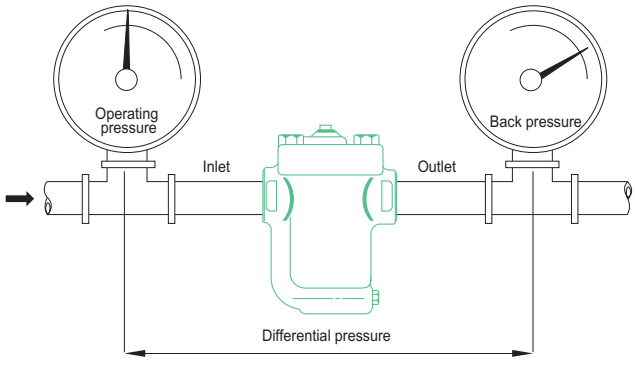
- Sensible heat: Heat required to heat a unit weight of water so that it reaches the saturation temperature, while the pressure remains constant.
- Latent heat: Heat required to convert a unit weight of saturated water in saturation temperature state into saturated steam. (Also referred to as evaporation heat.)
- Super heat: Heat required to convert a unit weight of saturated steam into super heated steam.
- Total heat: Total heat that steam has in a certain state.
- Diagram 2 shows the relationship between temperature and heat.

〉Diagram 2. Heat curve



● Operation-related terminologies

Operating Pressure	Pressure on the inlet side of a trap
Back Pressure	Pressure on the outlet side of a trap
Differential Pressure	Difference between the operating pressure and back pressure
Operating Temperature	Temperature on the inlet side of the trap under operating conditions
Maximum Operating	Temperature Maximum temperature allowed for the inlet side of a trap
Maximum Operating	Pressure Maximum pressure allowed for the inlet side of a trap



Data / Steam Trap

■ Types of steam traps

● Functions of a steam trap

A steam trap should quickly discharge condensate, air, and CO^2 gas from a steam system, and should not leak live steam.

● Types of steam traps

Category	Type
Mechanical Steam Trap	1. Float Trap 2. Inverted Bucket Trap 3. Open Bucket Trap
Thermostatic Steam Trap	1. Bellows Trap 2. Thermo Wax Trap 3. Bimetallic Trap
Thermodynamic Steam Trap	1. Disc Trap

● Comparison of characteristics among different trap types

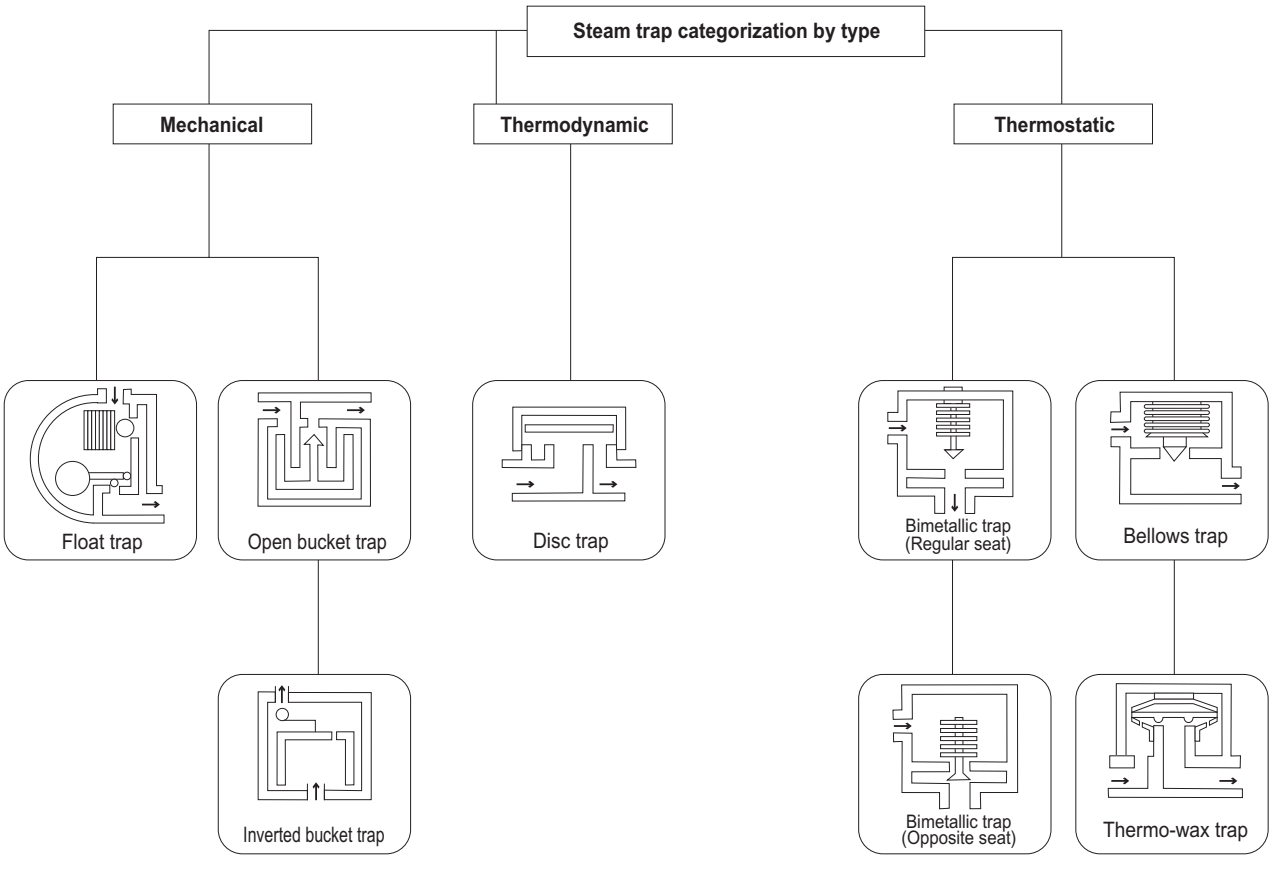
	Category / Characteristics	Inverted bucket trap	Float trap	Disc trap	Thermostatic trap
		YBT-4	YAF-14	YSP-1, 2 YSP-5, 6	YRS-3
1	Operation cycle	Intermittent operation	Continuous operation	Intermittent operation	Continuous operation
2	Energy conservation (during operation)	○	○	×	●
3	Abrasion resistance	●	●	○	●
4	Corrosion resistance	●	●	●	●
5	Fluid's impact resistance	○	×	●	●
6	Discharge of air and CO^2 at steam temperature	○	×	×	×
7	Air discharge capability at ultra low pressure (0.117 kgf/cm²g)	×	●	×	●
8	Air load handling capability during start-up	○	●	×	●
9	Operation based on back pressure	●	●	×	●
10	Freezing resistance	○	×	●	●
11	Operation performance in terms of small load	○	●	×	●
12	Hindrance by foreign substances	●	●	×	●
13	External size	Large	Large	Smail	Smail
14	Re-evaporated steam handling capability	○	×	×	●
15	Orifice closing state before operation	Open	Closed	Closed	Open
	Legend	● Excellent ○ Good × Open			

Data / Steam Trap

■ Steam trap selection

● Selection of a type

Steam traps have different characteristics according to their type. This is why there is a need to first decide on a specific type when selecting a steam trap.
A type should be selected based on past experience. For details, review informational materials and consult with the manufacturer.



● Selection of a size

A decision on a size of a steam trap should be made in consideration of the generated condensate amount, differential pressure, back pressure, and safety factor of steam equipment.

1) How to calculate the generated condensate amount
- Materials provided by the steam equipment manufacturer
- Calculation using a formula

$$W = \frac{Q \cdot \Delta T \cdot Cp}{L}$$

W : Generated condensate amount (kg/h)
Q : Heated liquid flow (kg/h)
⊿P : Temperature increase (℃)
Cp : Specific heat (kcal/kg℃)
L : Heat reduction of steam (kcal/kg)

2) Differential pressure: Difference in pressure (back pressure) between the inlet side and outlet side of a trap

3) Safety factor: Apply a safety factor to steam equipment by considering the maximum condensate load during initial operation.

≫ Safety factor of different types of equipments

Steam main	3
Heat exchanger	2
Tracing line	2
Heating facility	3

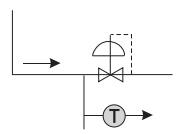
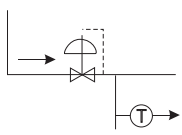
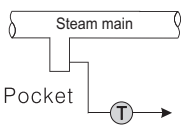
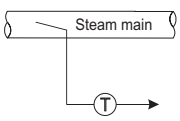
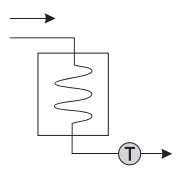
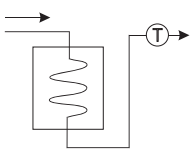
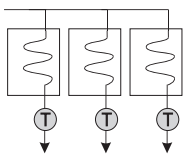
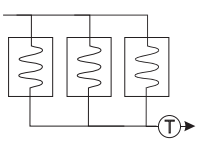
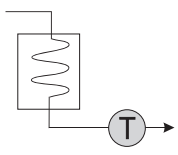
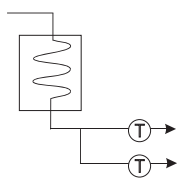
■ Cautionary measures for trap installation and examples of installation in a pipeline

● Cautions for trap installation

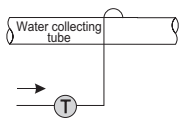
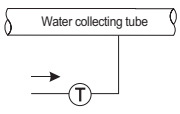
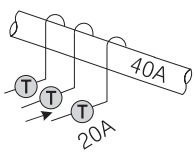
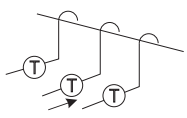
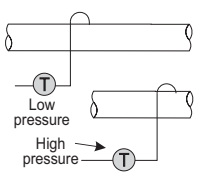
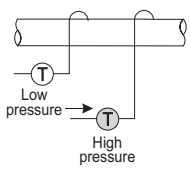
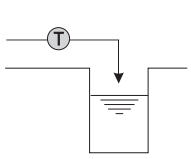
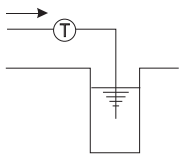
- Remove scales, dust, etc. from the pipeline before installing a trap.
- Install the trap where easy maintenance and inspections can take place.
- Install the trap near the steam equipment.
- Have the pipeline inclined so that condensate flows into the trap by force of gravity.

● Application Diagram (Example)

≫ In case of inlet side

Example of a good case	Example of a bad case	Explanation
		Install the trap on the inlet side to improve the performance of an automatic valve, including a pressure reducing valve.
		In case of steam main, install the trap in the pipeline after installing a pocket.
		Install the trap at the lowest end of the steam equipment.
		If there is more than one steam equipment, install a trap for each.
		Avoid parallel pipeline installation of steam traps.

≫ In case of outlet side

Example of a good case	Example of a bad case	Explanation
		If the outlet side is vertically standing, connect the trap on the upper part of the water collecting tube.
		The pipe size of the condensate collecting tube should be bigger than the sum of the cross sections of the trap pipeline.
		Install separate water collecting tubes for steam usage areas that have a different pressure level (of at least 50%).
		The outlet side of the trap should be at a higher location than the water level of the condensate tank.

■ Troubleshooting

1) Bucket trap (YBT-4)

Troubles	Possible reasons	Measures
Not discharging	The running pressure is higher than the trap's applicable pressure. The orifice is clogged due to foreign substances.	Replace the trap with another one that has an appropriate pressure level. Disassemble and clean.
Small discharge volume	There is insufficient discharge capacity. The operating differential pressure is insufficient due to excessive back pressure.	Replace the trap with another one that has enough capacity. Check the pressure level on the inlet and outlet side of the trap and the piping system.
Steam leakage	There is a foreign substance in between the disc and seat. The disc and seat are worn. The bypass valve is defective.	Disassemble and clean. Change the disc and seat. Check or replace the bypass valve.

2) Float trap (YAF-14S, YAF-14F)

Troubles	Possible reasons	Measures
Not discharging	The float has been damaged. The running pressure is higher than the trap's applicable pressure.	Change the float. Replace the trap with another one that has an appropriate pressure level.
Small discharge volume	The trap does not have enough discharge capacity. The operating differential pressure is insufficient due to excessive back pressure. The strainer on the inlet side of the trap is clogged.	Replace the trap with the one that has enough capacity. Check the pressure level on the inlet and outlet side of the trap and the piping system. Disassemble and clean.
Steam leakage	There is a foreign substance in between the disc and seat. There is a foreign substance in the air vent valve or the valve has been damaged. The bypass valve is defective.	Disassemble and clean the disc and seat. Check or replace the air vent valve.

3) Disc trap (YSP-1,2, YSP-5,6)

Troubles	Possible reasons	Measures
Not discharging	The trap's operating differential pressure is insufficient. The back pressure is high because the outlet side is vertically standing. The trap's discharge capacity is insufficient. The strainer on the inlet side is clogged.	Check the pressure on the inlet and outlet side of the trap. Check the piping system. Replace the trap with the one that has enough capacity. Disassemble and clean.
Small discharge volume	There is a foreign substance in between the disc and seat. The disc and seat are worn. The bypass valve is defective.	Disassemble and clean. Disassemble and polish, or replace the disc and seat. Check or replace the bypass valve.
Steam leakage	The back pressure is excessive. The running pressure is lower than the trap's minimum operating pressure.	Check the piping patterns on the outlet side. Replace the trap with a more appropriate one.

Control Valves for District Cooling and Heating

4

Control Valves for District Cooling and Heating

As valves used in construction facilities for cooling and heating, they comprise automatic flow control valves (per household, per apartment building), constant flow temperature control valves, differential pressure flow control valves, and differential pressure control valves.

Automatic flow control valves

Type	Size	Applicable pressure (kgf/cm²g)	Operating differential pressure range (kgf/cm²)	Structure	Materials		End connection	Page
					Body	Disc, seat		
YFC-2N	15(½")~50(2")	Maximum 10	0.3~5.0	Automatic balancing (per household)	BsC1	C3604BE	KS PT SCREW	82
YFC-1S	32(1¼")~50(2")		0.15~1.5	Automatic balancing	C3604	STS		84
YFC-1F	50(2")~200(8")		0.3~4		SPPS		KS 10K FF FLANGE	
YFC-2F			0.5~7		GC200		KS 10K RF FLANGE	86
YFC-20F		Maximum 20	0.5~20		SCPH2		KS 20K RF FLANGE	
YBC-2F		Maximum 10		Manual balancing	GC200		KS 10K RF FLANGE	87
YBC-20F		Maximum 20			SCPH2		KS 20K RF FLANGE	

Constant flow temperature control valves

Type	Size	Applicable pressure (kgf/cm²)	Operating differential pressure range(kgf/cm²)	Structure	Materials		End connection	Page
					Body	Disc, seat		
YTF-20	15(½")~25(1")	Maximum 10	0.3~5.0	Diaphragm type	BsC3	EPDM	Inlet : KS PT Screw Outlet : KS PT Union	89
YFC-20						EPDM,VITION		
YTC-20	15(½")~20(¾")			Direct operating type	C3771			

Differential pressure flow control valves

Type	Size	Applicable pressure (kgf/cm²)	Operating differential pressure range (kgf/cm²)	Structure	Materials		End connection	Page
					Body	Disc, seat		
YDF-2F	25(1")~150(6")	Maximum 10	0.1~1.5	Diaphragm type	GC200	C3604	KS 10K RF Flange	90
			0.5~2.1					
YDF-20F		Maximum 20	1.5~5.0		SCPH2		KS 20K RF Flange	
DR-08 (Control)	25~25A	Maximum 10	0.05~0.3	Diaphragm type	BS	BS	-	92
DR-08 (Fixing)	25~25A		0.17					

Differential pressure control valves

Type	Size	Applicable pressure (kgf/cm²)	Operating differential pressure range (kgf/cm²)	Structure	Materials		End connection	Page
					Body	Disc, seat		
YDP-1F	25(1")~150(6")	Maximum 10	0.05~1.0	Diaphragm type Direct operating type	GC200	BC6	KS 10K RF Flange	93
			0.5~2.0					
			1.5~5					
YDP-20F		Maximum 20	0.05~1.0		SCPH2		KS 20K RF Flange	
			0.5~2.0					
			1.5~5					

Type YFC-2N Automatic Flow Control Valve (per Household)

An automatic flow control valve per household limits the maximum flow, thereby distributing an appropriate flow to each place of use. It maintains the flow balance of each place of use by automatically adjusting the flow during the instrument's constant flow rate operations, thereby stabilizing the overall system.

■ Features

- Perfect Pressure-Balancing Type valve: it can be used independently from pressure changes, etc.
- Diaphragm operation method, instead of the usual cartridge method : less set flow variation.
- Variable flow control function : easy to change and adjust the set flow on the field, without disassembling.
- The employment of an optimal design for fluid flow reduces noise and vibration.
- Structure that allows a constant flow is only slightly affected by foreign substances and ensures easy disassembling and maintenance.
- Easy to remove foreign substances, thanks to an embedded strainer in the valve union.
- Easy to select a piping direction since both sides of the product are set up with unions.

■ Specifications

Type		YFC-2N (per household)
Applicable fluid		Cold/hot water
Automatic differential pressure range		0.3~5kgf/cm²
Flow variation		±2.5%~±5% of set flow
Fluid temperature		120° C below
End connection	Inlet	KS PT UNION
	Outlet	KS PT UNION(15A, 20A, 25A), SCREW(32A, 40A, 50A)
Material	Body	BsC3
	Disc	C3604BE
	Diaphragm	EPDM
Hydraulic test pressure		15 kgf/cm²g

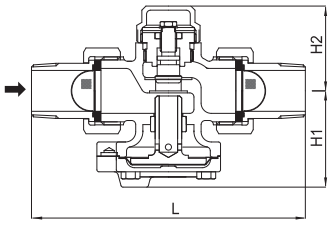
▶ Made-to-orders for unions are available only for the inlet or outlet side.
▶ Strainer (over 40 Mesh) installation is required to ahead inlet when valve installing.

■ Dimensions

(mm)

Category	Size	L	H1	H2
Standard	15(½")	134	47	41.5
	20(¾")	134	47	41.5
	25(1")	150	51	41.5
	32(1¼")	114	45	60
	40(1½")	132	55	69
	50(2")	165	60	83
Large flow	15(½")	95	39	49
	20(¾")	95	39	49
	25(1")	100	39	49

■ Dimensional drawing

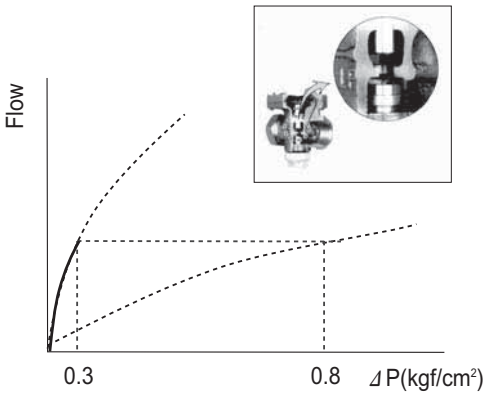


■ Flow setting range

Category	Size	Applicable differential pressure range	Flow setting range
Standard	15(½")	0.3~0.8	1.5~10
	20(¾")		1.5~10
	25(1")		1.5~14
	32(1¼")	0.3~3.0	5~40
	40(1½")		10~60
	50(2")		16~80
Large flow	15(½")	0.3~0.8	20
	20(¾")		30
	25(1")		30

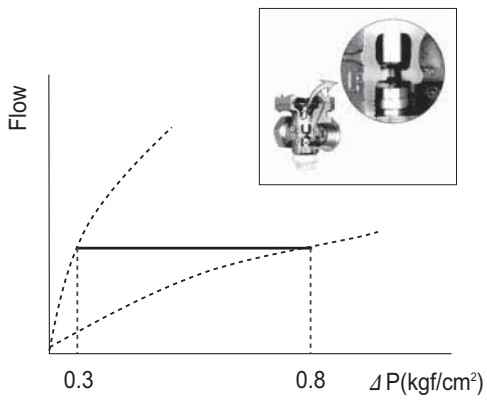
Type YFC-2N Automatic Flow Control Valve (per Household)

■ Control range (Constant flow control valve for household)



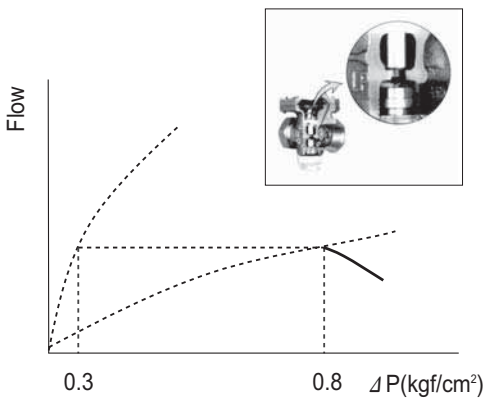
• When it is smaller than the automatic differential pressure range of an automatic flow control valve

Because the differential pressure is low, the pressure level is smaller than the pressure needed to actuate an automatic flow control valve. If actuated below the 0.3 kgf/cm² range, the automatic flow control valve is a normal open type. This is why the flow proportionally increases to a maximum of 0.3 kgf/cm², which is the operating differential pressure range, according to an increase in differential pressure.



• When it is within the automatic differential pressure range of an automatic flow control valve

The differential pressure within the pipeline is within the pressure range needed to actuate an automatic flow control valve. Within the range of 0.3 kgf/cm², a constant flow level is maintained within ±2.5~5.0% of the set flow, based on pressure balancing of the pressure regulating spring and diaphragm, according to differential pressure fluctuations.



• When it is higher than the operating differential pressure range of an automatic flow control valve

As pressure (at least 0.8 kgf/cm²) that is higher than the operating differential pressure range is delivered to the upper part of the diaphragm, the valve slowly closes and the flow decreases according to an increase in differential pressure.

Type YFC-1S, 1F Constant Flow Control Valve

What is needed for effective and efficient use of heating energy in tandem with the diversification of buildings is enhancing thermal efficiency by automatically controlling the appropriate flow of each piping system and thus supplying precisely based on the designed flow value. Samyang's type YFC-1 is the most cost-effective and practical product that features a wide array of functions as a constant flow control valve.

Type YFC-1S

Type YFC-1F

■ Features

- Free from troubles, abrasion and corrosion thanks to an extremely simple structure.
- Can be installed in any direction-horizontally, vertically, or acutely and almost no flow changes resulting from the installation direction.
- Offer a wide selection range for the set flow, and maintains an outstanding performance even in case of a water hammer, vibration, or rapid pressure changes.
- Can be easily handled and installation costs are extremely low.

■ Specifications

Type		YFC-1S	YFC-1F
Size		32~50A	50~200A
Automatic differential pressure range		0.15~1.5kgf/cm², 0.3~4kgf/cm², 0.5~7kgf/cm²	
Applicable fluid		Cold/hot water	
Fluid temperature		300° C below	
Flow variation		±5% of set flow	
End connection		KS PT SCREW	KS 10K FLANGE
Materials	Body	C3604	SPPS
	Main part	STS	
Hydraulic test pressure		15 kgf/cm²g	

■ Dimensions

≫ YFC-1S

(mm)

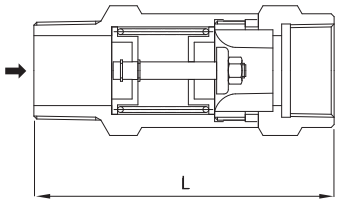
Size	L	Weight(kg)	Differential pressure range (kgf/cm²)	Flow (LPM)
32(1¼")	120	2.2	0.15~1.5 (0.3~4)	14~65 (20~65)
40(1½")	145	2.5		30~130 (50~130)
50(2")	164	2.9		50~250 (80~250)

≫ YFC-1F

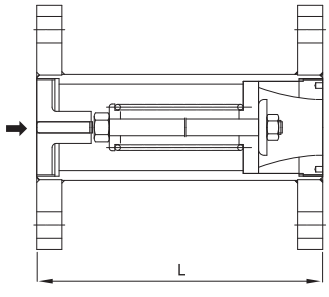
(mm)

Size	L	Weight(kg)	Differential pressure range (kgf/cm²)	Flow (LPM)
50(2")	165	10	0.3~7	59~360
65(2½")	205	12		100~600
80(3")	225	13		150~700
100(4")	290	16.5		235~1000
125(5")	335	26		368~1200
150(6")	335	37		530~2000
200(8")	450	49		940~3500

■ Dimensional drawing



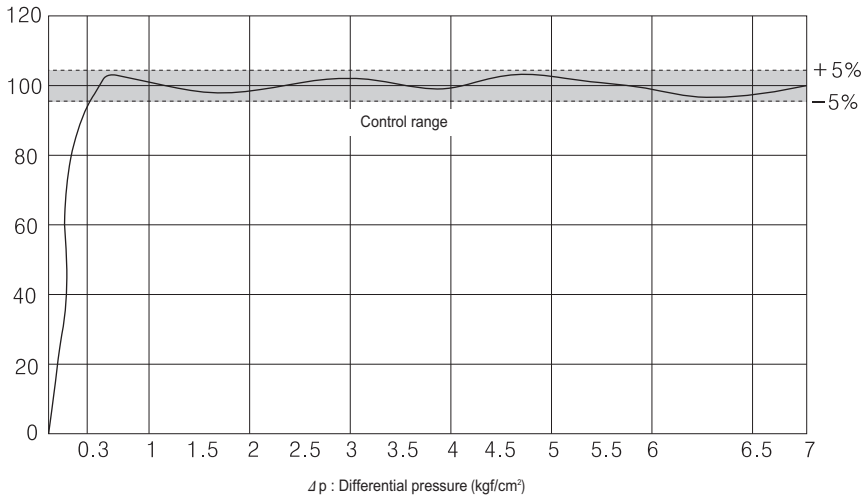
Type YFC-1S



Type YFC-1F

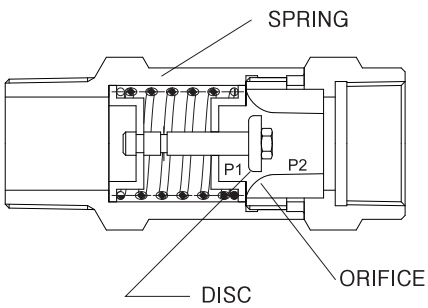
Type YFC-1S, 1F Constant Flow Control Valve

■ Features



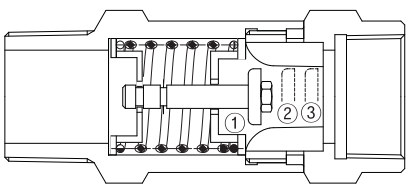
As seen in the chart above, if the differential pressure (Δp) remains within the range of 0.3 to 7 kgf/cm^2, a constant flow is maintained, with flow changes that are within ±5%..

■ How it works



- The spring absorbs the differential pressure (Δp=P1=P2) between the front and rear of the disc that arises from the flow of fluid. The opening area of the orifice changes according to the spring's movements.
- It automatically adjusts the opening area to become smaller when the differential pressure increases as per increased flow velocity, and adjusts the opening to become bigger when the differential pressure decreases to maintain a constant flow.

■ How to control flow



- Below the control range
  Because the disc is completely open by the spring, the opening area of the orifice reaches the maximum. When the valve is operated, the orifice area begins to decrease in proportion to the differential pressure, and thus the flow is controlled. (Case ①)
- Within the control range
  The opening area of the orifice is automatically adjusted according to changes in differential pressure between the front and rear of the disc. The valve precisely controls and maintains the flow within ±5% of the designed flow. (Case ②)
- Over the control range
  If the differential pressure between the front and rear of the disc increases, resulting in excess of the control range, the spring is compressed as much as possible, resulting in the opening area of the orifice reaching its minimum. The flow thus remains at a fixed position in proportion to the differential pressure. (Case ③)

Type YFC-2F, 20F Automatic Flow Control Valve

This product is suitable for places that require appropriate flow distribution, based on restriction on the maximum flow, and that require automatic flow restriction during constant flow rate operation of the instrument.

■ Features

- As a perfect balance type, it features outstanding control of the set flow in response to pressure fluctuations.
- Can be changed and adjusted on the field, and control range is wide.
- As a diaphragm type product, the range of applicable differential pressure is wide and superb in its ability to respond to rapid load fluctuations.
- The structure as a top-bottom separable type is simple and ensures easy handling, pipeline installation.

■ Specifications

Type		YFC-2F	YFC-20F
Size		65~200A	65~200A
Automatic differential pressure range		0.3~3kgf/cm²	0.5~5kgf/cm²
Flow control range		5% of rated flow	
Applicable fluid		Cold/hot water, liquid	
Fluid temperature		150° C or below	
Flow variation		±5% of set flow	
Materials	Body	GC200	SCPH2
	Disc, seat	STS	
	Diaphragm	EPDM	
End connection		KS 10K RF FLANGE	KS 20K RF FLANGE
Hydraulic test pressure		1.5 time of applicable flange rating	

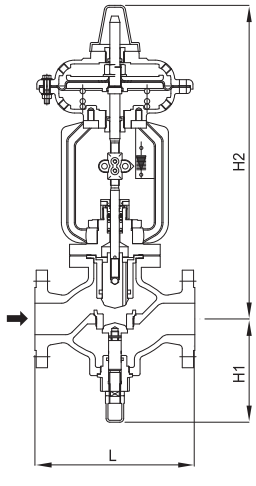
▶ Made-to-orders are available for valves with a size of 250 or larger.

■ Dimensions

(mm)

Type / Size	YFC-2F				YFC-20F			
	L	H1	H2	Weight(kg)	L	H1	H2	Weight(kg)
65(2½")	276	185	548	50	292	140	720	55
80(3")	298	190	560	55	318	158	720	61
100(4")	352	200	567	69	368	160	735	78
125(5")	400	225	590	126	400	225	590	145
150(6")	451	263	625	158	473	263	625	197
200(8")	543	357	658	202	568	263	635	251

■ Dimensional drawing



Type YBC-2F, 20F Manual Balancing Valve

This product is suitable for places that manually restrict flow during constant flow rate operation of the instrument and that need to appropriately distribute flow based on restriction on the maximum flow.

Type YBC-2F

■ Specifications

Type		YBC-2F	YBC-20F
Applicable fluid		Cold/hot water	
Applicable temperature		220°C or below	
Applicable pressure		Maximum 10 kgf/cm²g	Maximum 20 kgf/cm²g
End connection		KS PT 10K RF FLANGE	KS PT 20K RF FLANGE
Materials	Body	GC200	SCPH2
	Disc, seat	STS	
Hydraulic test pressure		15 kgf/cm²g	30 kgf/cm²g

■ Dimensions

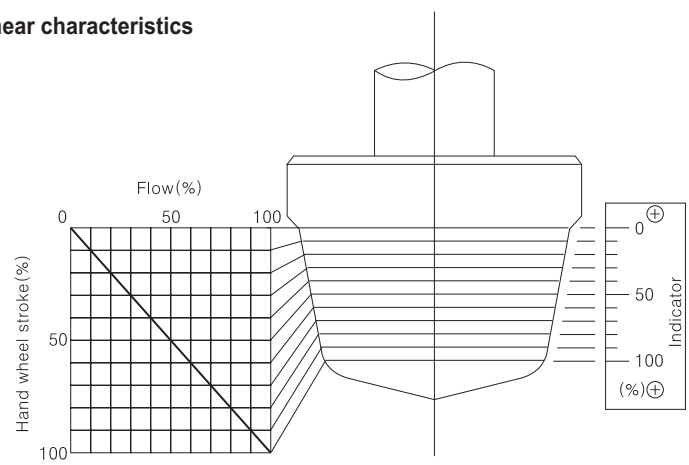
(mm)

Size	L	H1	H2	Cv	Weight(kg)
50(2")	254 (267)	95	355	43	31
65(2½")	276 (276)	115	380	58	39
80(3")	294 (294)	120	400	85.5	47
100(4")	352 (352)	130	420	128	61
125(5")	400 (410)	150	562	222	118
150(6")	451 (473)	180	592	324	150
200(8")	543 (568)	255	632	555	191

▶ The length values in parenthesis are for the type YBC-20F.

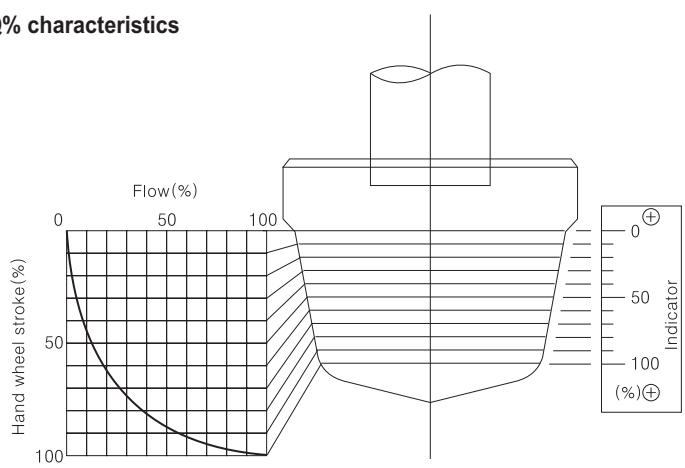
■ Flow characteristics curve

● Linear characteristics



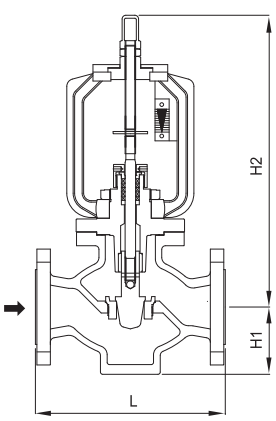
▶ If the valve stroke ratio is 50%, changes in the rated flow ratio are made as per the plug stroke ratio.

● EQ% characteristics



▶ Proximity to the close state entails precise throttling, while proximity to the open state entails a rapid flow increase. As such, it is also used for cases where it is forecasted that there will be substantial fluctuations in terms of pressure drop.

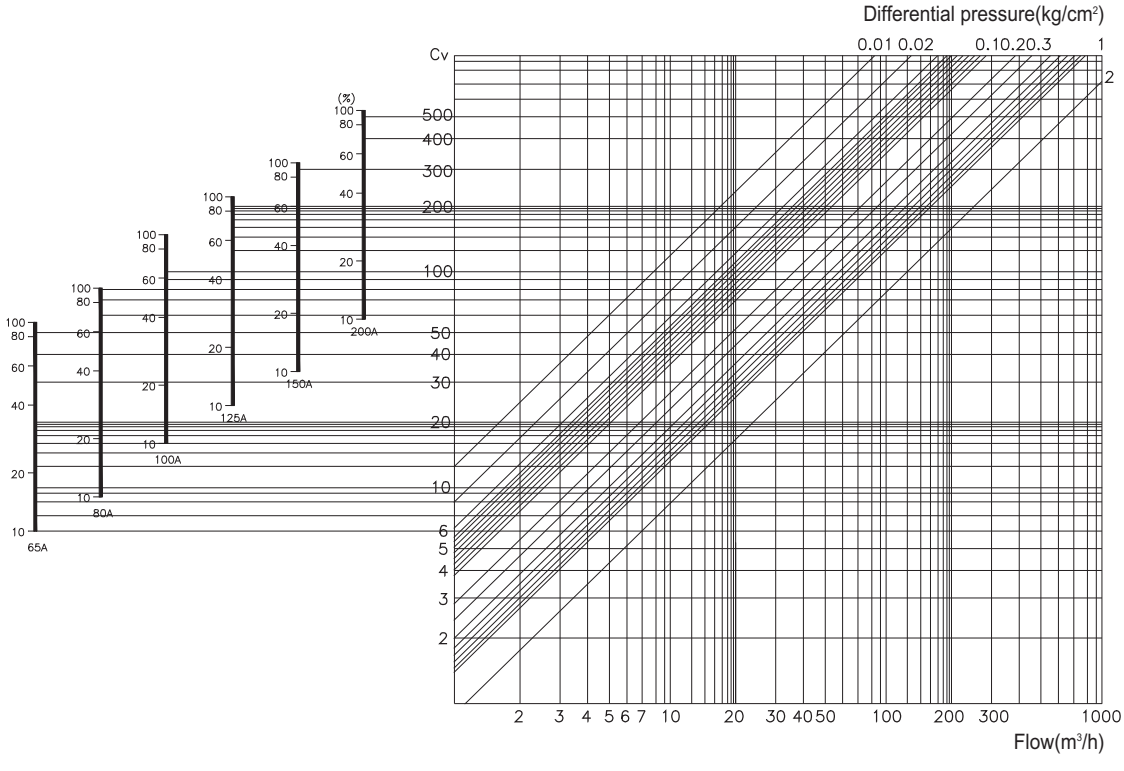
■ Dimensional drawing



Type YBC-2F

Type YBC-2F, 20F Manual Balancing Valve

■ Chart on selecting a flow and size



■ How to select by using a calculation formula

$W = 0.8569 \times Cv\ max \times k \times \sqrt{\Delta P}$

W = Flow (m^3/h)

Cv max = Maximum Cv value of balancing valve

K = Set graduation of indicator (%)

ΔP = Differential pressure between the valve's inlet and outlet (kgf/cm^2)

(Example) Standard = 150A, Maximum Cv value = 324

$W = 0.8569 \times 324 \times 0.4 \times \sqrt{0.03} = 19.2\ m^3/h$

How to set the flow using the chart

The maximum Cv value is 324 when the standard is 150A, which means that the Cv value becomes 129.6 when the indicator's adjustment is 40%. "A" is the point of intersection between this point and the line of the measured differential pressure between the valve's inlet and outlet (0.03). The flow at this point is 19.2 (m^3/h).

Type YTF-20, YFC-20, YTC-20 Constant Flow Temperature Control Valve

The constant flow temperature control valve is installed in a pipeline in the vicinity of a pan coil unit and hot water distributor within a household of a central and district heating system. It enhances energy efficiency by maintaining a selected temperature and controlling the flow.

YTF-20
(Thermal type)

YTF-20
(Electronic type)

Type YFC-20

YTC-20
(Thermal type)

YTC-20
(Electronic type)

■ Features

- Flexibly control a heat supply including a variable flow control function according to each household's need. (YTF-20, YFC-20)
- A diaphragm operation method ensures a less set flow variation from pressure fluctuations and prevents noise or vibration from the flow of fluid. (YTF-20, YFC-20)
- The attachment of a thermal actuator prevents vibration, noise during operation and can be used at a high differential pressure level. (YTF-20, YTC-20)
- Having a strainer attached, remove possibilities that leads to defects from foreign substances and ensures easy cleaning without tools. (YTF-20, YTC-20)
- A thermometer can be attached to allow for easy checking of the temperature of heat source water supplied to households. (YTF-20, YFC-20)
- The attachment of a stop valve saves construction costs and installation space. (YFC-20)

■ Specifications

Type		YTF-20	YFC-20	YTC-20
Applicable fluid		Cold/hot water		
Operating differential pressure range		0.3~0.8kgf/cm²		
Applicable fluid temperature		5~120° C		
Flow control range		15A, 20A : 1.5~10LPM		15A
		25A : 1.5~14LPM		
End connection	Inlet	KS PT SCREW		
	Outlet	KS PT UNION		
Materials		Body : BsC3 / Diaphragm : EPDM / Body : C3771		
Hydraulic test pressure		15 kgf/cm²		

■ Dimensions

(mm)

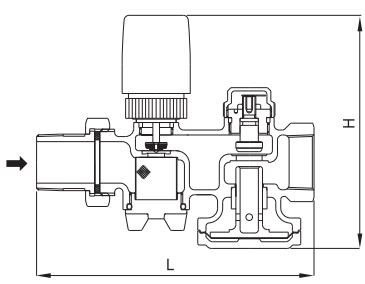
Type	Size	L	H	Weight (kg)
YTF-20	15(½")	148	128	1.2
	20(¾")	148	128	1.3
	25(1")	159	134	2.0
YFC-20	15(½")	97	125	0.4
	20(¾")	97	125	0.4
	25(1")	110	130	0.6
YTC-20	15(½")	92	85	0.4
	20(¾")	92	100	0.4

▶ Strainer (over 40 Mesh) installation is required to ahead inlet when valve installing.

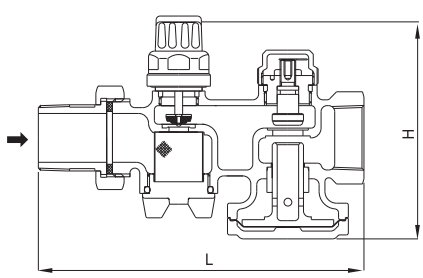
■ Actuator specifications

	Thermal type	Electronic type
Form of operation	Normal Closed	Normal Closed
Rated voltage	AC 220V, 60Hz	AC 220V, 60Hz
Permissible differential pressure	4.5kgf/cm²	3.5kgf/cm²
Power consumption	3W	5W

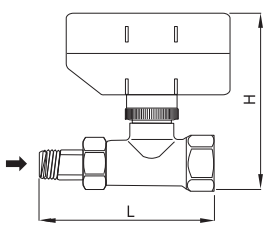
■ Dimensional drawing



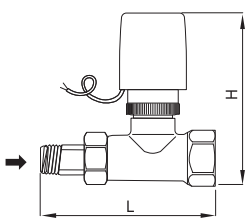
Type YFT-20



Type YFC-20



YTC-20 (Electronic type)



YTC-20 (Thermal type)

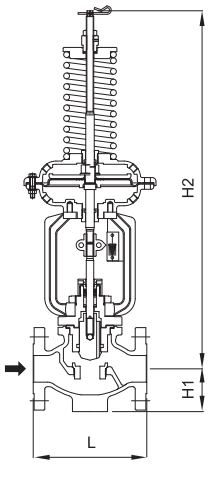
Type YDF-2F, 20F Differential Pressure Flow Control Valve

This valve performs the two control functions of restricting flow and maintaining a differential pressure of supply and return lines. It can be installed in a supply line or return line according to its purpose of use.

Type YDF-2F

Type YDF-20F

■ Dimensional drawing



■ Features

- High-performing differential pressure flow control valve that is installed in a supply or return line of a load device to control the differential pressure and flow comprehensively.
- In addition to differential pressure control, it offers a wide flow control range, from small to large flows, thanks to an embedded equal % cone for flow control.
- The diaphragm is separated from the body and thus is not affected by temperature. Since it is a perfect balance type, the set differential pressure does not change due to pressure fluctuations.
- Has a solid structure, and thus offers an outstanding level of durability.
- A diaphragm method enables to be installed horizontally or vertically.
- The opening percentage of the valve can be easily checked, thanks to the attached indicator.
- Leakage from packings can be visually checked, enabling easy identification of the appropriate time for repair.

■ Specifications

Type		YDF-2F	YDF-20F
Applicable pressure		Maximum 10 kgf/cm²g	Maximum 20 kgf/cm²g
Applicable fluid		Cold/hot water	
Fluid temperature		Maximum 170° C	
Structure		DIAPHRAGM	
Differential pressure control range		0.1~0.7, 0.15~1.5, 1.5~5kgf/cm²	
Flow control range		0.5~100% of the constant flow rate	
End connection		KS 10K RF FLANGE	KS 20K RF FLANGE
Materials	Body	GC200	SCPH2
	Disc, seat	BC6	STS
	Diaphragm	EPDM	
Hydraulic test pressure		15 kgf/cm²	30 kgf/cm²

▶ The basic pressure regulating range is 0.15~1.5 kgf/cm²

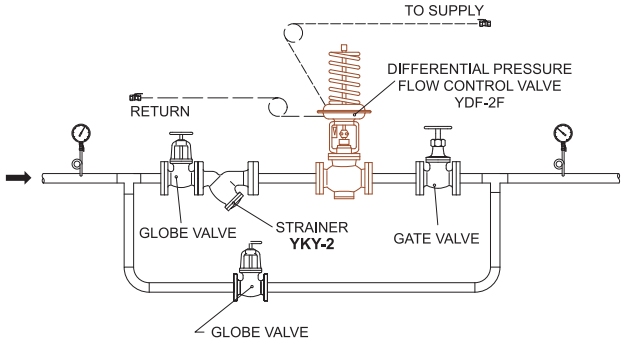
■ Dimensions

(mm)

Type / Size	YDF-2F				YDF-20F				Cv
	L	H1	H2	Weight (kg)	L	H1	H2	Weight (kg)	
25(1")	184	62.5	640	20	197	62.5	640	21	8
32(1¼")	180	70	650	26	180	70	650	26	12.5
40(1½")	222	80	658	28	235	80	658	30	18
50(2")	254	95	670	41	267	95	670	43	43
65(2½")	276	115	720	48	292	115	720	54	64
80(3")	294	120	720	56	318	120	720	65	84
100(4")	352	130	735	72	368	130	735	83	150
125(5")	400	150	775	130	400	150	775	152	200
150(6")	451	180	800	162	473	180	800	203	288

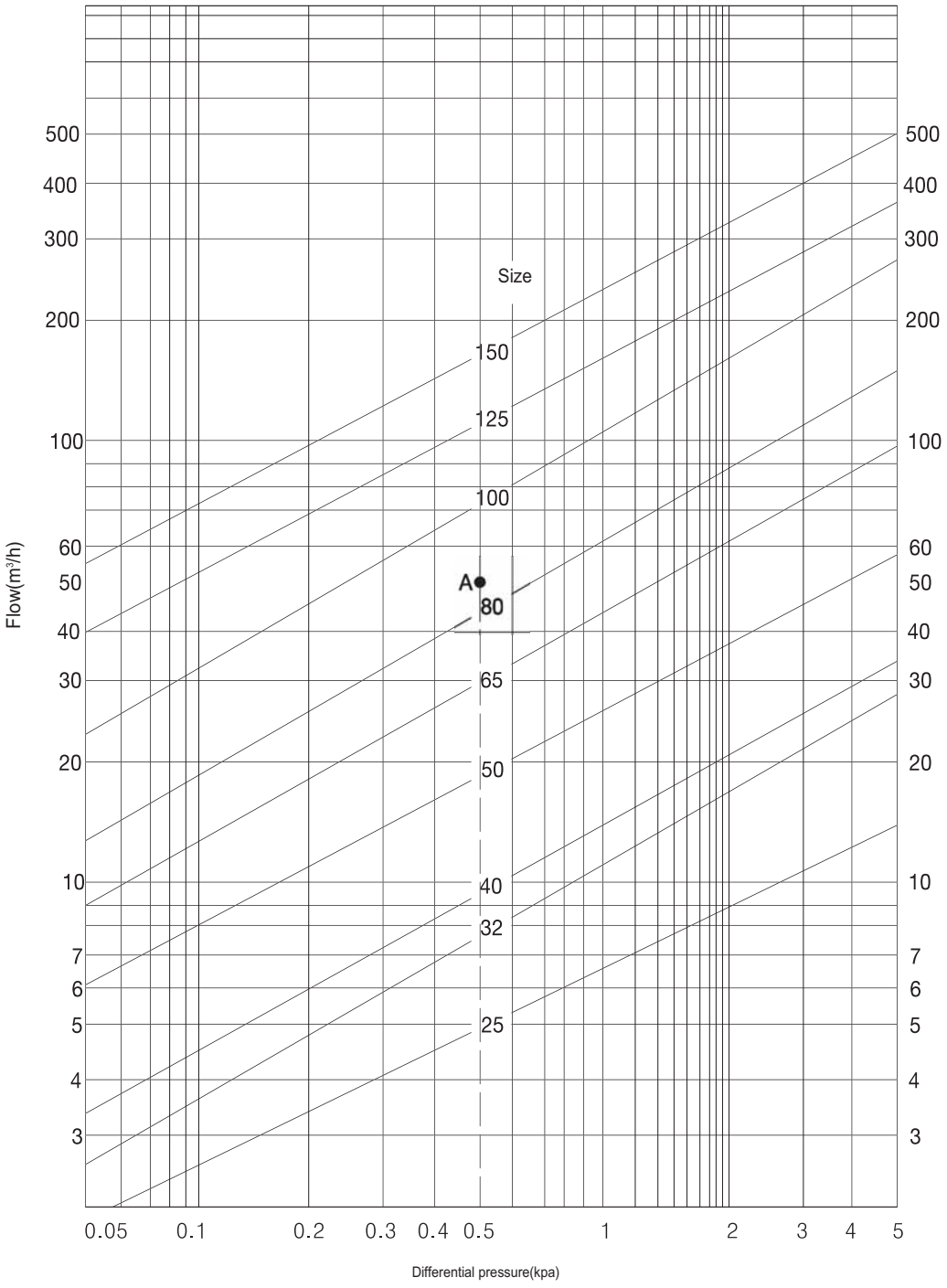
▶ Made-to-orders are available for valves with a size of 200 or larger.

■ Application Diagram (Example)



Type YDF-2F, 20F Differential Pressure Flow Control Valve

■ Selection of a size



$$Cv = \frac{1.167 \times Q \times \sqrt{r}}{\sqrt{\Delta P}}$$

Here, Cv: Valve flow coefficient
Q : Flow (m^3/h)
r : Density (Water =1)
ΔP : Pressure difference between the valve's inlet and outlet (kgf/cm^2)

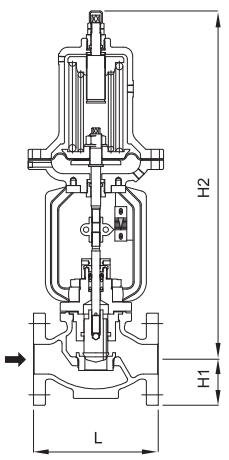
Type YDP-1F, 20F Differential Pressure Control Valve

This maintains the differential pressure of supply and return lines or the differential pressure of the inlet and outlet side of an instrument in a closed circuit.

Type YDP-1F

Type YDP-20F

■ Dimensional drawing



■ Features

- As an air-to-close differential pressure valve, it has a structure where the valve opens when the primary pressure goes up. It is installed in between the supply header and return header to control the differential pressure.
- As a self-control type, it does not require auxiliary power supply.
- As a complete balancing type, almost no changes in the set differential pressure resulting from pressure fluctuations.
- Structure is relatively simple, and offers superb durability.
- Convenient piping and handling.
- Separated diaphragm from the main body, not affected by temperature, resulting in outstanding durability.

■ Specifications

Type		YDP-1F	YDP-20F
Applicable pressure		Maximum 10 kgf/cm^{2}g	Maximum 20 kgf/cm^{2}g
Applicable fluid		Cold/hot water	
Fluid temperature		170° C below	
Differential pressure control range		0.05~1.0, 0.5~2.0 / 1.0~3.0, 3.0~5.0	0.5~3.0, 3.0~5.0
Leakage allowance		0.05% less of rated flow	
Direction of installation		Horizontally or vertically	
End connection		KS 10K RF FLANGE	KS 20K RF FLANGE
Materials	Body	GC200	SCPH2
	Disc, Seat	BC6	STS
	Diaphragm	EPDM	
Hydraulic test pressure		15 kgf/cm^{2}g	30 kgf/cm^{2}g

▶ Made-to-orders are available for valves with a differential pressure control range of 5 kg/cm^2 or higher.
▶ The basic pressure regulating range is 0.5~2.0 kgf/cm^2.

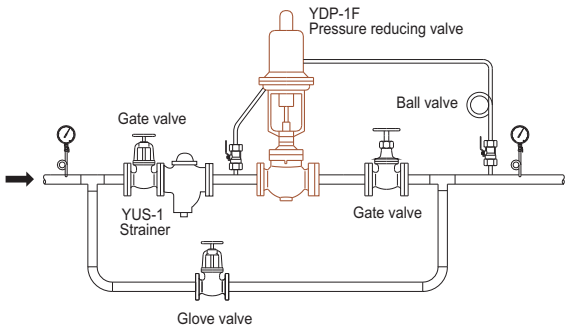
■ Dimensions

(mm)

Size	L	H1	H2	Cv	Weight(kg)
25(1")	184 (197)	62.5	559	8	24
32(1¼")	180	70	565	12.5	31
40(1½")	222 (235)	80	565	18	33
50(2")	254 (267)	95	586	43	47
65(2½")	276 (292)	115	610	64	51
80(3")	294 (318)	120	630	84	63
100(4")	352 (368)	130	650	152	77
125(5")	400	150	685	200	139
150(6")	451 (473)	180	715	288	168
200(8")	543 (568)	225	755	320	216

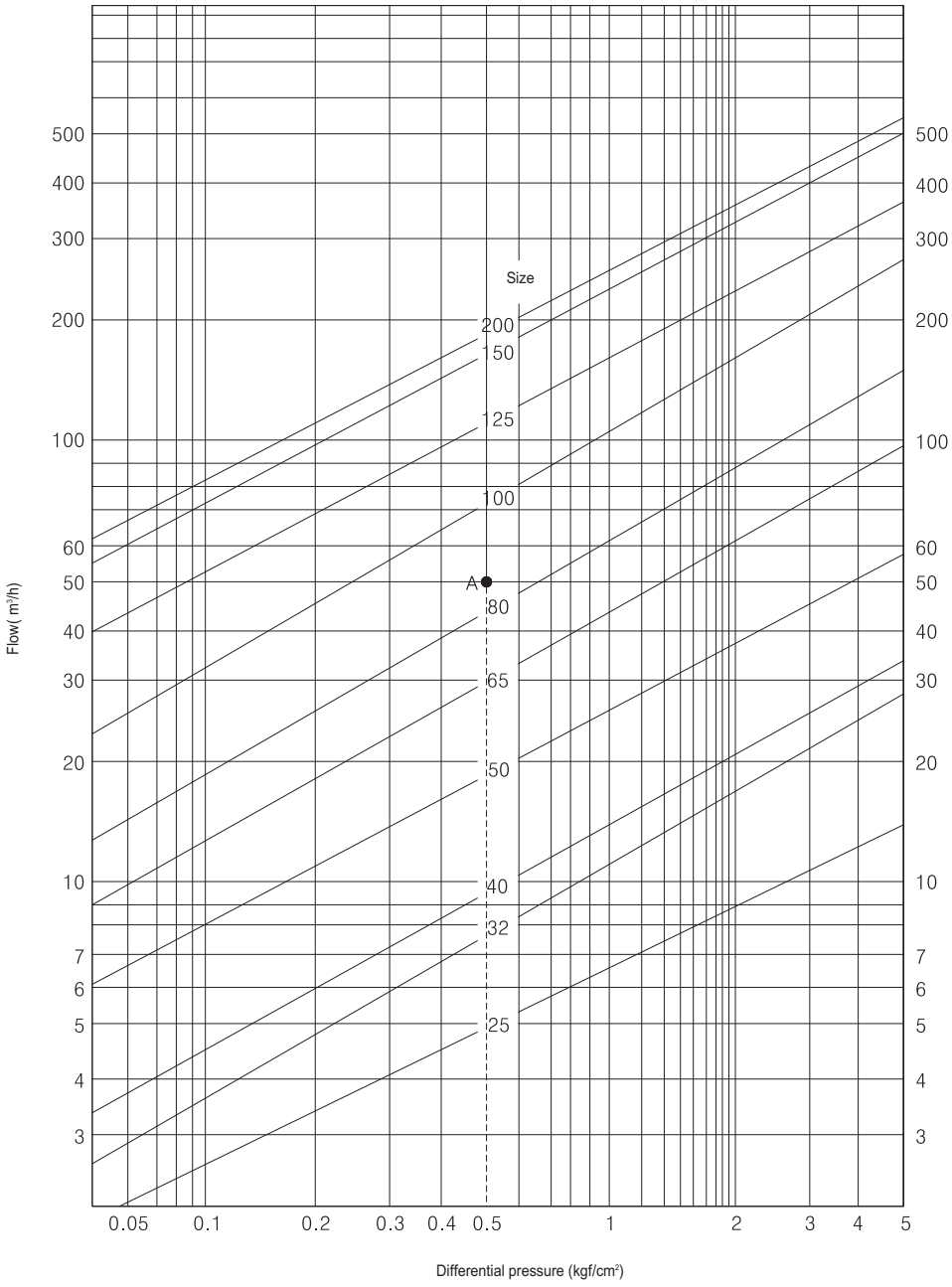
▶ The length values in parenthesis are for the type YDP-20F.

■ Application Diagram (Example)



Type YDP-1F, 20F Differential Pressure Control Valve

■ Chart on selecting a size



How to select the size of a valve by the chart

Example) If the supply side pressure is 4 kgf/cm²g, return side pressure is 3.5 kgf/cm²g, and maximum capacity is 50 m³/h,

1) The differential pressure (⊿P) between the supply side (Ps) and return side (Pr) is 0.5 kgf/cm²g (⊿P=Ps-Pr).
2) Go up vertically from the differential pressure point (0.5 kgf/cm²) to make intersection “A” with the flow (50 m³/h).
3) Now that "A" is in between 80 and 100, 100 should be selected.

■ Types and characteristics of flow control valves

1) Balancing valve

The valve's opening percentage is controlled manually, based on which the flow is controlled. As such, there needs to be a graduation to confirm the opening percentage and an embedded linear port for an accurate flow as per the graduation. There also needs to be a locking device that can be used after adjustment.

2) Automatic constant flow control valve

Because the valve has an embedded orifice or piston-type linear port, the spring absorbs the differential pressure between the inlet and outlet of the valve, and the opening area of the orifice changes according to the spring's movements. When the differential pressure goes up and thus the flow velocity increases, the valve narrows the opening area. When the differential pressure goes down, it automatically widens the opening area, thereby ensuring that a constant flow is maintained at all times. Because there is no function to readjust the flow, the flow needs to be precisely calculated according to the circuit. If there is a need to change the flow, an internal part (orifice or spring) needs to be replaced.

3) Automatic flow control valve

Samyang's automatic flow control valves are diaphragm type valves. They detect load fluctuations that occur in the circuit and ensure that the adjusted flow remains constant at all times. Compared to automatic constant flow control valves, they feature a higher level of precision, more stable control, and a wider applicable differential pressure range. This is why they can be widely used for flow control in apartment buildings and industrial equipment. They also have an embedded linear port, which allows readjustment of the set flow, thereby enabling readjustments on the field. Since they have a cut-off valve function as needed, there is no need for a globe valve on the inlet side of the valve.

4) Differential pressure control valve

This type of valve is mostly used for one of two purposes. Installed between the supply header and return header, this valve maintains the system's pressure balance and guarantees the designed operation point of a pump even in case of load changes, thereby ensuring optimal energy distribution efficiency and a certain system life span. The other usage is as a valve for flow control (differential pressure control valve). Installed in the return line of a load device, it maintains a constant flow by maintaining an appropriate differential pressure level of the load device.

■ How to order a valve

The following information should be described when consulting or placing an order for a valve.

Model number (type) and standard	
Type of fluid	
Set flow or set flow range (LPM, GPM, m^3/h)	
Temperature of used fluid (Maximum °C)	
Operating differential pressure range (kgh/cm^2 PSI)	
Differential pressure control range (kgh/cm^2 PSI)	

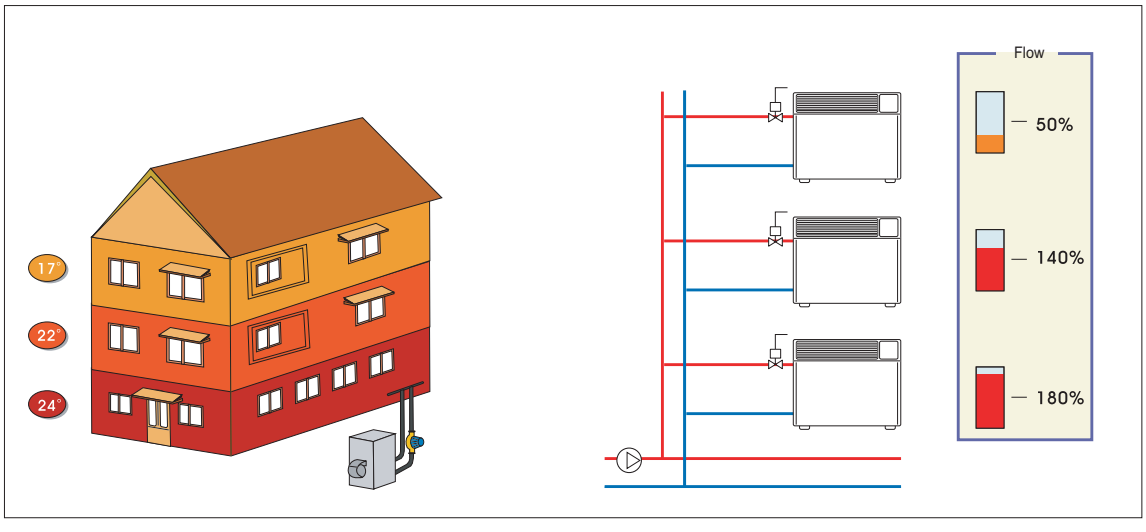
▶ For selection of valve, select it to have 30-70% of rated valve capacity.

4

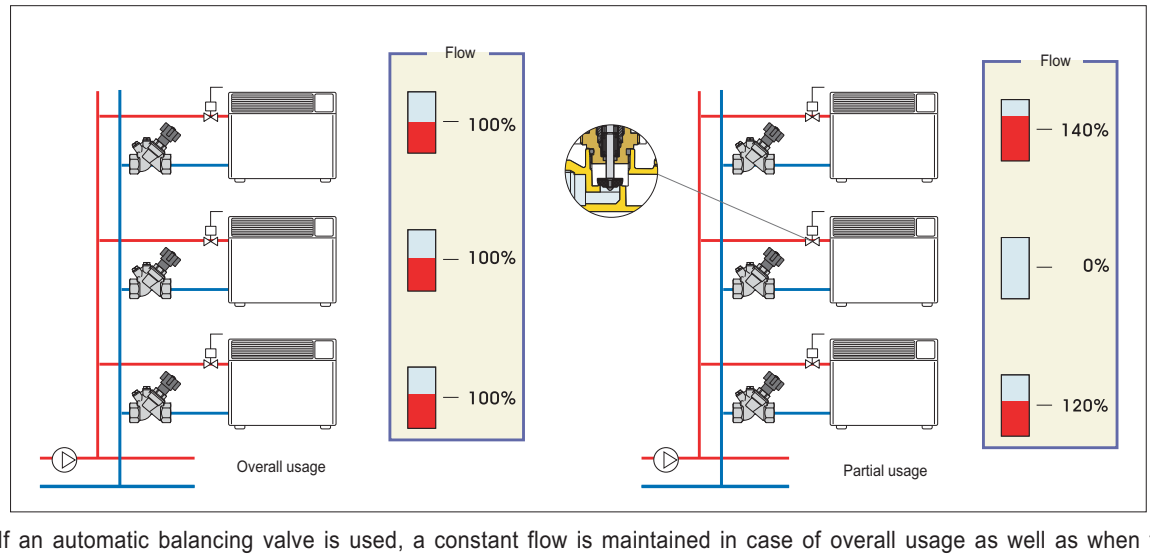
◎ YFC-2N, 1F, 1S, YTF-20

■ Balacing circuit

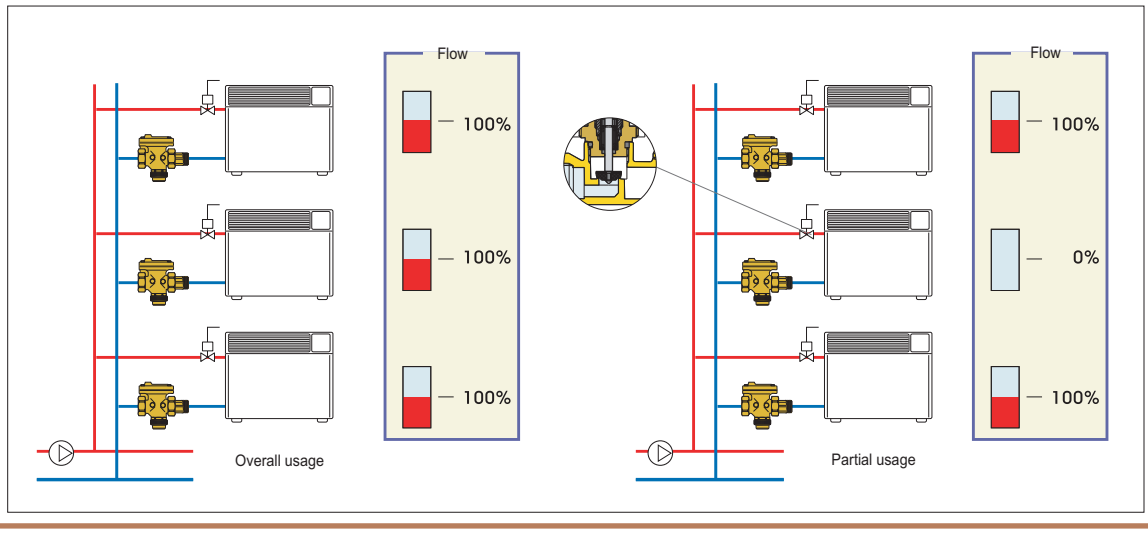
• If a balancing valve is not used : As seen below, there is a flow imbalance among households.



• If a manual balancing valve is used : As seen below, balance is maintained in case of overall usage, but there is an imbalance between the high and low floors when there are load changes.

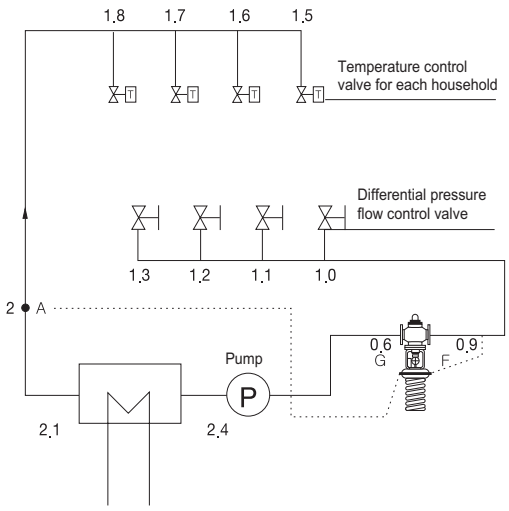


• If an automatic balancing valve is used, a constant flow is maintained in case of overall usage as well as when there are load fluctuations.

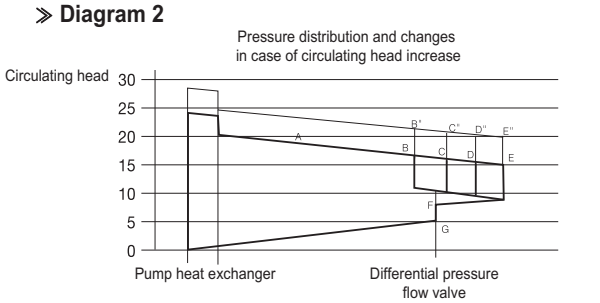


■ Flow balancing technology for apartments

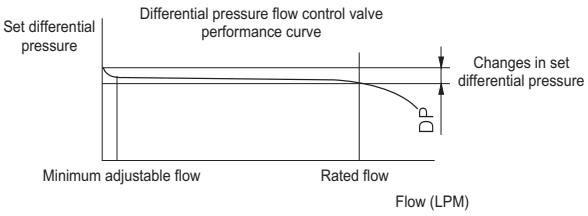
≫ Diagram 1



≫ Diagram 2



≫ Diagram 3



1. A system that has a differential pressure flow control valve installed

1. A system that has a differential pressure flow control valve installed
   The pump lift is 24 m,
   Flow is 400 LPM,
   Pressure loss of heat exchanger is 0.3 bar,
   Pressure loss of the differential pressure flow control valve is 0.3 bar, and

The set differential pressure is operating as the differential pressure between points A and F (2-0.9=1.1 bar);
This is a case where a flow of 100 LPM has been distributed to each standing line. If the flow is cut off due to the operation of temperature control valves installed at points B, C, D, and E according to changes in outside temperature, the lift of point A rises, resulting in higher pressure. The differential pressure flow control valve detects the increased lift of point A and increases point F to the same level, thereby maintaining a differential pressure of 1.1 bar between points A and F. The pressure gradient of the entire pipeline becomes constant (refer to Diagram 2), resulting in optimal flow balancing effects despite the variable flow.

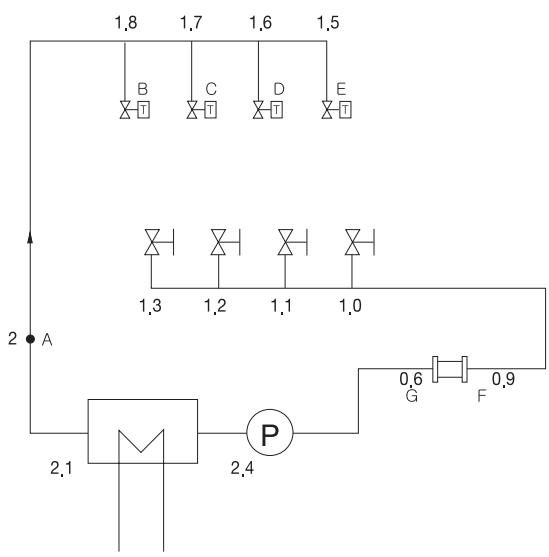
Also, a constant differential pressure is maintained at all times even in cases where only one or two apartment units require heating, thereby preventing the breakdown of the temperature control valve for each household and completely resolving noise-related problems within households.

2. A system that has a constant flow control valve (automatic balancing valve) installed

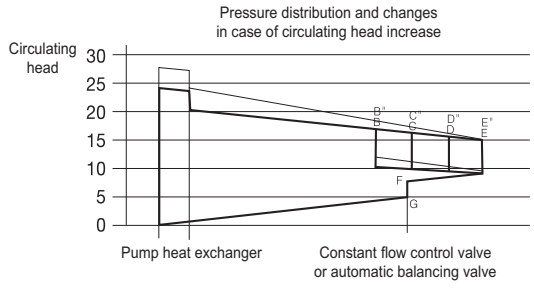
In Diagrams 4 and 5, a constant flow control valve (automatic balancing valve) is installed in the same location. If the flow becomes smaller after operation of temperature control valves at points B, C, D, and E, the constant flow control valve will operate below the control range since the flow will be smaller than the original flow of 400 LPM. As such, the pressure gradient within the pipeline will change, leading to a flow imbalance.

There will be excessive flow in certain sections. This is why some adopt the solution of installing a constant flow control valve for each standing line, but this leads to the issue of imbalance among households within each standing line. This is why it is recommended that a constant flow control valve should be installed for each household. However, in case of continuous heating, where the pump needs to be operated even when the level of used flow is extremely low, the lift of the circulation pump rapidly increases. As such, there is noise since the differential pressure goes up when the constant flow control valve is operated. Moreover, rapid fluctuations in differential pressure lead to decreased control performance of each household's temperature control valve and even cause breakdown. This is why there is a need to install a differential pressure valve or differential pressure flow control valve and appropriately maintain a differential pressure of the supply and return to ensure definite balancing effects.

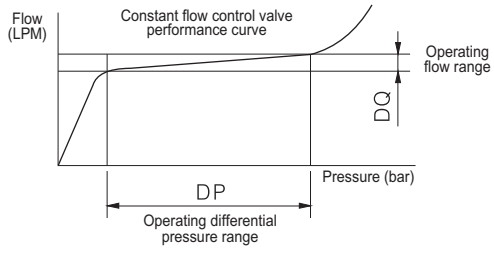
≫ Diagram 4



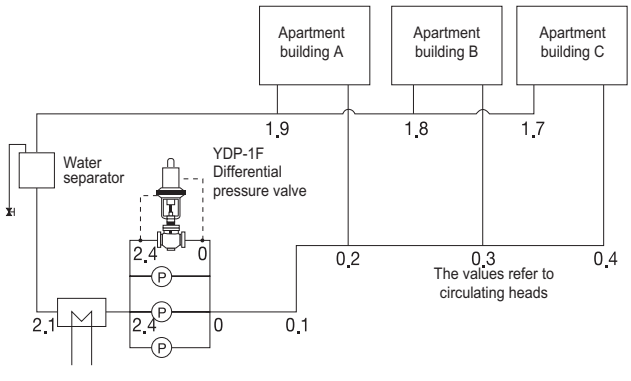
≫ Diagram 5



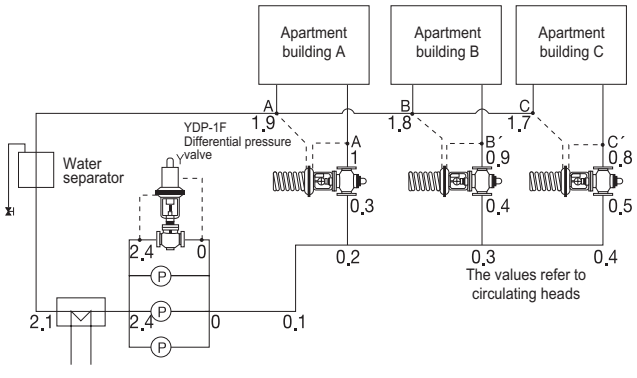
≫ Diagram 6



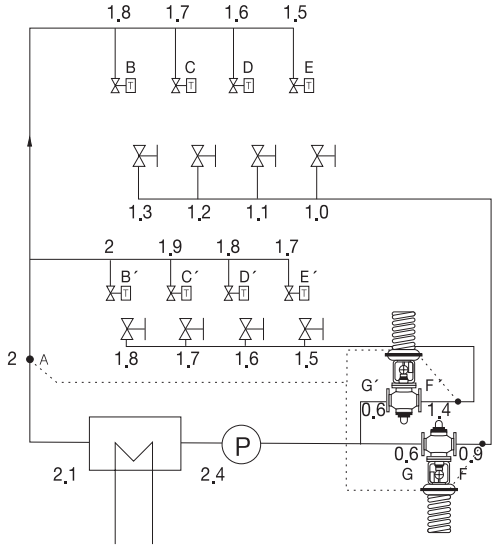
≫ Diagram 7



≫ Diagram 8



≫ Diagram 9



3. System flow control using differential pressure valve

As shown in Diagram 7, the method of balancing the flow with only a differential pressure valve of the machinery room is adopted for small systems, and is mostly used for single pump systems that do not have a high circulating head. The capacity is 80% or more of the pump flow. The set differential pressure is the same as the pump lift, or as the pressure loss value of the overall circulation pipelines if there is an overall pressure loss value.

4. Systems using a differential pressure valve and a differential pressure flow control valve

A system that uses only a differential pressure valve is difficult to apply when several pumps are operated or load fluctuations are substantial. In this case, there is a need to install a differential pressure valve for pump relief purposes and set up a differential pressure flow control valve for each apartment building. This would enable to establish balance among apartment buildings as well as among different zones within an apartment building through a differential pressure flow control valve.

<Valve selection>

(1) Differential pressure valve

As a relief purpose, it determines the relief flow which is over 25 % of a pump flow since it could be selected within the scope where the pump would not get excessive loads. The set differential pressure would be the same as the pump lift or the pressure loss value of the overall circulation pipelines.

e.g.) Pump flow Qp=75ton/h
Pump lift H=24m=2.4bar
Relief flow (usually, 30~35% of pump flow) Qr=22.5T/H

$$Cv = \frac{1.167 \times Qr}{\sqrt{\Delta P}} = \frac{1.167 \times 22.5}{\sqrt{2.4}} = 16.95$$

Select the valve Cv value as YDF-1F 40A(Cv=18) which is over 16.95

(2) Differential pressure flow control valve

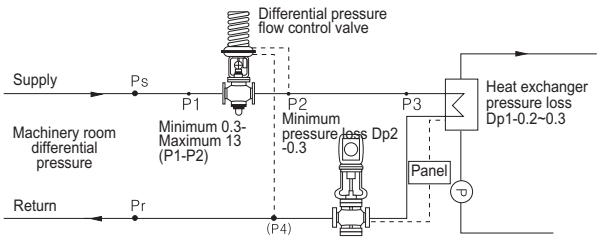
Since the valve controls the flow changes occurring due to the temperature control valve operation within an apartment, if the flow of each apartment would be 25ton/h,
Q = 25ton/h(417LPM)

$$Cv = \frac{1.167 \times Qr}{\sqrt{\Delta P}} = \frac{1.167 \times 25}{\sqrt{0.3}} = 53.26$$

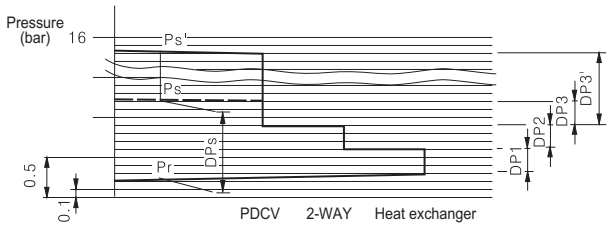
(ΔP : Here, 0.3. It is the maximum pressure loss of the valve itself and constant)

Select the valve Cv value as YDF-2F 65A(Cv=58) which is larger than 53.2. At this time, the controlling differential pressure DPs such as the points A-A', B-B', and C-C' which the differential pressure flow control valve should control are irrelevant to the valve size selection and are different a bit according to working places. When the required flow for each apartment is very huge, the differential pressure flow control valve should be enlarged. So, if the range ability would be 1/40, 1/40 of the maximum flow could not be controlled, in this case, it would be appropriate to install the differential pressure flow control valve for each zone like Picture 7.

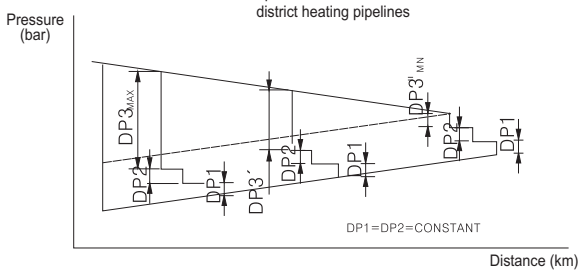
Schematic diagram of the intermediary machinery room of a district heating system's primary pipeline



Machinery room pressure drop curve



Overall pressure distribution chart for district heating pipelines



he ⊿P

■ Valve selection for an intermediate machinery room for district heating

<Terminologies>

Ps : Pressure of high-temperature water that is supplied to the machinery room (different for each district)

Pr : Pressure returning to the power plant (from the machinery room)

P_4 = Pr, Ps = P_1

DP_1 : Pressure drop in heat exchanger

DP_2 : Pressure drop in 2-way valve

DP_3 : Pressure drop in differential pressure flow control valve (Minimum 0.3 ~ Maximum 13 bar)

The pressure distribution in Diagram 12 indicates that DP_1 and DP_2 are constant. This is why DP_3 the pressure drop in the differential pressure flow control valve is extremely high at the maximum level (approximately 13 bar) in the case of a machinery room located near the power plant. The Ps' in Diagram 11 changes in-between Ps and Ps' according to outdoor air temperature, and the maximum pressure loss (minimum differential pressure) of the differential pressure flow control valve is 0.3. As such, the pressure drop in the machinery room located the farthest away is approximately DP1+DP2+DP3min+line loss=1 bar. (Diagram 12)

1) 2-way valve selection

The 2-way valve always operates within a ⊿P that is between 0.3 and 0.8 bar based on the differential pressure flow control valve, but its control performance is affected by the differential pressure flow control valve performance. The ⊿P maintaining capability of the differential pressure flow control valve is determined by set differential pressure changes (DP) from the minimum controllable flow to the maximum flow. Higher performance differential pressure flow control valves have lower DPs, which means better control performance of the 2-way valve. If -2F, 20F, etc. are installed on PDCV Y, there is no operational problem even if the maximum allowable differential pressure of the 2-way valve is at least 1 bar. (3.5 bar is the practical standard of the Korea District Heating Corp.)

Calculation example>

Ps=P_1 : 15bar

Pr=P_4 : 4bar

Q=20ton/h(Flow calculated based on the connected thermal load)

The following is a calculation of the required Cv value,

$$Cv = \frac{1.167 \times Q}{\sqrt{DP_3}} = \frac{1.167 \times 20}{\sqrt{0.7}} = 27.89$$

(DP_2=2-way valve pressure loss)

A valve whose Cv is bigger than 27.89 needs to be chosen. A safety coefficient of 0.7 is usually applied as a divider.

2) Differential pressure flow control valve selection

The differential pressure flow control valve performs the role of maintaining the pressure between P_2 and P_4 within 0.6 to 0.8 bar, and thus the set differential pressure is adjusted to 0.6 to 0.8 bar. However, the valve capacity should be chosen based on 0.7 bar pursuant to the usage facility standards of the Korea District Heating Corp. However, the P_3 - pressure drop in the differential pressure flow control valve - in machinery rooms varies from 0.3 to 13 bar. This is why the valve size becomes different for the same thermal load. However, the pressure drop in the differential pressure flow control valve frequently changes according to fluctuations in outdoor air temperature, making it difficult to obtain the exact value even for a specific machinery room. This is why DP3=0.7 bar is used for calculation. Based on the example above:

$$Cv = \frac{1.167 \times Q}{\sqrt{DP_3}} = \frac{1.167 \times 20}{\sqrt{0.7}} = 27.89$$

A selection should be made on a valve whose Cv value is bigger than 27.89. A safety coefficient of 0.7 is sometimes applied as a divider in consideration of control valve characteristics, depending on the load type of the system.

Data / Reference

■ Terminology

- Set pressure (Set differential pressure): Pressure on the inlet side (pressure difference between the valve's inlet and outlet) when the fluid begins to flow, resulting from operation of the primary pressure control valve and differential pressure control valve.
- Static pressure (Static differential pressure): Pressure on the inlet side (pressure difference between the valve's inlet and outlet) when the fluid's flow comes to a stop, resulting from closing of the primary pressure control valve and differential pressure control valve.
- Differential pressure: Pressure of difference between the set pressure (set differential pressure) and static pressure (static differential pressure)
- Accumulation: Indicating, in percentage or unit pressure, the level of pressure that is above the set pressure (set differential pressure) so as to calculate the discharge requirement
- Capacity-determining pressure (Capacity-determining differential pressure): As a base pressure that determines the rated capacity, this is the pressure at the inlet side when the flow continues after the pressure reaches the nominal pressure level that equals or is above the set pressure (set differential pressure)
- Rated discharge capacity: Maximum capacity that can be guaranteed in terms of the capacity-determining pressure (capacity-determining differential pressure)

※ Notes : Information in the parenthesis applies to the differential pressure control valve.

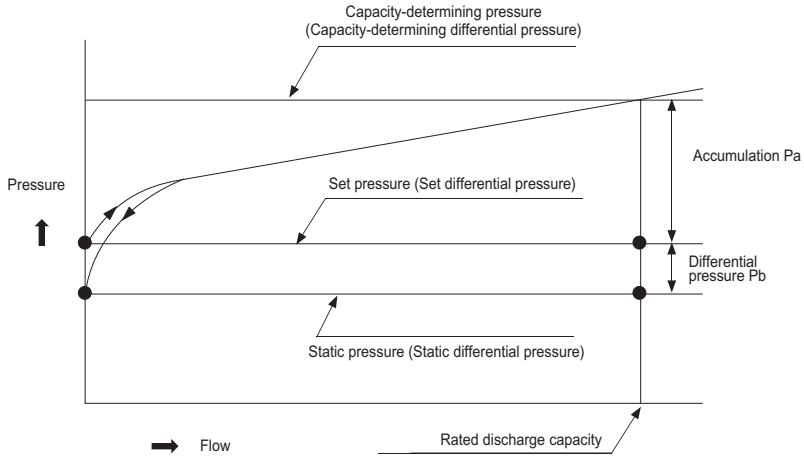
■ Selecting a size of a primary pressure control valve

① The size selection chart should be used to select a size.

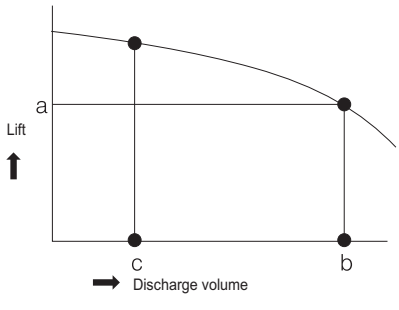
② If the primary pressure and back pressure are not constant and used within a certain range, select a size based on the back pressure or primary pressure when the difference is at its lowest level.

③ If used as a pump relief valve, the discharge capacity of the primary pressure control valve is determined as follows: In case of a complete cut-off state on the pump's discharge side, determine discharge volume "b" of lift "a" that is equivalent to the control pressure, based on the pump characteristics curve. The "b" becomes the discharge capacity of the primary pressure control valve. If it is not a complete cut-off state on the discharge side, and assuming that the minimum flow used at all times is "c," then b-c becomes the discharge capacity of the primary pressure control valve.

■ Pressure and flow characteristics curve



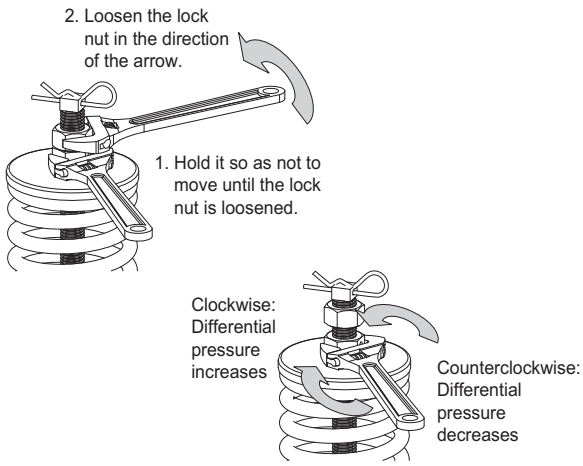
■ Pump characteristics curve



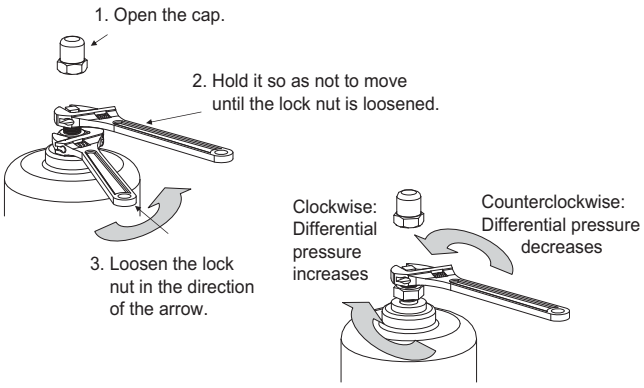
■ Characteristics

Type	Accumulation Pa	Differential pressure Pb
Primary pressure control valve	Within maximum value of the regulating spring range X 15%. Within 20% in case of a 5 kgf/cm²g spring with a size of at least 100.	Within set pressure X 10% (minimum value of 0.2 (kgf/cm²)
Differential pressure control valve		Within set differential pressure X 10% (minimum value of 0.2 (kgf/cm²)

■ How to adjust the differential pressure flow



■ How to adjust the differential pressure



※ If not requested otherwise, the differential pressure is set to 0.7 kgf/cm^2 prior to product delivery.

● Cautions when handling the product

The following should be noted when handling the product so that it can be operated at maximum performance.

1. Do not cause impact on the product.
2. Avoid storage in humid and dusty places.
3. Pay special attention to prevent entry of foreign substances into the product.
4. When installing the product in a pipeline, completely remove scales, sand, dregs, etc. and clean the area that comes into contact with the gasket.
5. If possible, install the product where easy repair and inspections can take place.

※ The product's structure, dimensions, materials, etc. are subject to change without notice to improve its performance.

● Maintenance

≫ Leakage at the packing of stuffing nut boxes

1. Close after checking the gate valve. -Close the main valve.
2. Close the ball valve of the pressure-inducing pipeline.
3. Slowly loosen after checking the set spring height.
4. Detach the pressure-inducing pipeline.
5. Loosen after checking the set height of the stem screw of the indicator.
6. Slowly loosen the stuffing nut box. - Stop disassembling if water continuously flows out.
7. Check and change the packing, and assemble in reverse order.

≫ O-ring leakage

1. Close after checking the gate valve.
2. Close the ball valve of the pressure-inducing pipeline.
3. Slowly loosen after checking the set spring height.
4. Detach the pressure-inducing pipeline.
5. Loosen after checking the set height of the stem screw of the indicator.
6. Disassemble the actuator.
7. Polish the stem with soft sandpaper if extremely rusty.
8. Replace the o-ring, and assemble.

※ Checking for diaphragm function :
The spindle is regarded as being damaged if it does not operate when draining water with a supply air pin in a state where the supply's ball valve is closed and the return's ball valve is open.

MEMO

Level Control Valve

5

Level Control Valve

Developed based on extensive experience, the water level control valves ensure easy maintenance, offer good durability, and prevent water hammers. They feature an outstanding performance and a wide array of functions that satisfy user needs.

Level control valve

Type	Size	Applicable pressure (kgf/cm²g)	Materials		End connection	Page
			Body	Disc, seat		
YAW-3S	32(1¼")~40(1½")	Max. 10	GC200	NBR, BC	KS PT SCREW	104
YAW-3F	50(2")~150(6")				KS 10K RF FLANGE	
YAWEL-1	100(4")~350(14")					107

Type YAW-3S, 3F Level Control Valve

The type YAW-3S and 3F water level control valves were developed for the exclusive purpose of controlling the water level of a wide array of water tanks. They are optimal water level control valves that have a simple structure and are small sized and lightweight, thereby ensuring easy handling and installation.

Type YAW-3S

Type YAW-3F

■ Features

- Embedded strainer prevents various foreign substances into the pipeline.
- No external pipeline, kept warm easily & no concerns of freezing damage.
- Large capacity make suitable for apartment water & elevated tanks.
- EM mark acquired.

■ Specifications

Type		YAW-3S	YAW-3F
Size		32A~40A	50A~150A
Applicable pressure		Maximum 10 kgf/cm²g	
Minimum differential pressure in the inlet and outlet side of the valve		0.35kgf/cm²	
Fluid temperature		5~80° C	
Function		On and off operation by a pilot solenoid valve	
Solenoid valve		AC 220V, 60Hz	
Applicable fluid		Drinking water, fresh water, industrial water, agricultural water	
End connection		KS PT SCREW	KS 10K RF FLANGE
Materials	Body	GC200	
	Disc, seat	NBR, BC	
Hydraulic test pressure		15 kgf/cm²g	

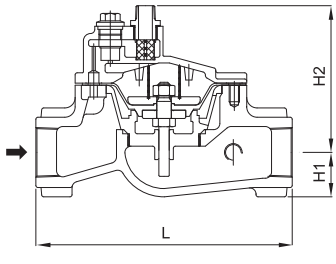
■ Dimensions

(mm)

Size	L	H1	H2	Cv	Weight(kg)	Notes
32A(1¼")	248	43	135	30	14	Screwed type
40A(1½")	248	43	135	35	15	
50A(2")	248	77.5	135	40	17	Flanged type
65A(2½")	270	87.5	138	62	22	
80A(3")	270	92.5	138	90	22	
100A(4")	288	105	148	140	27	
125A(5")	400	125	225	220	60	
150A(6")	400	140	225	315	69	

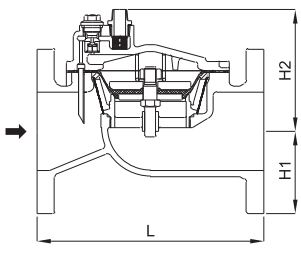
■ Dimensional drawing

32~40A



Type YAW-3S

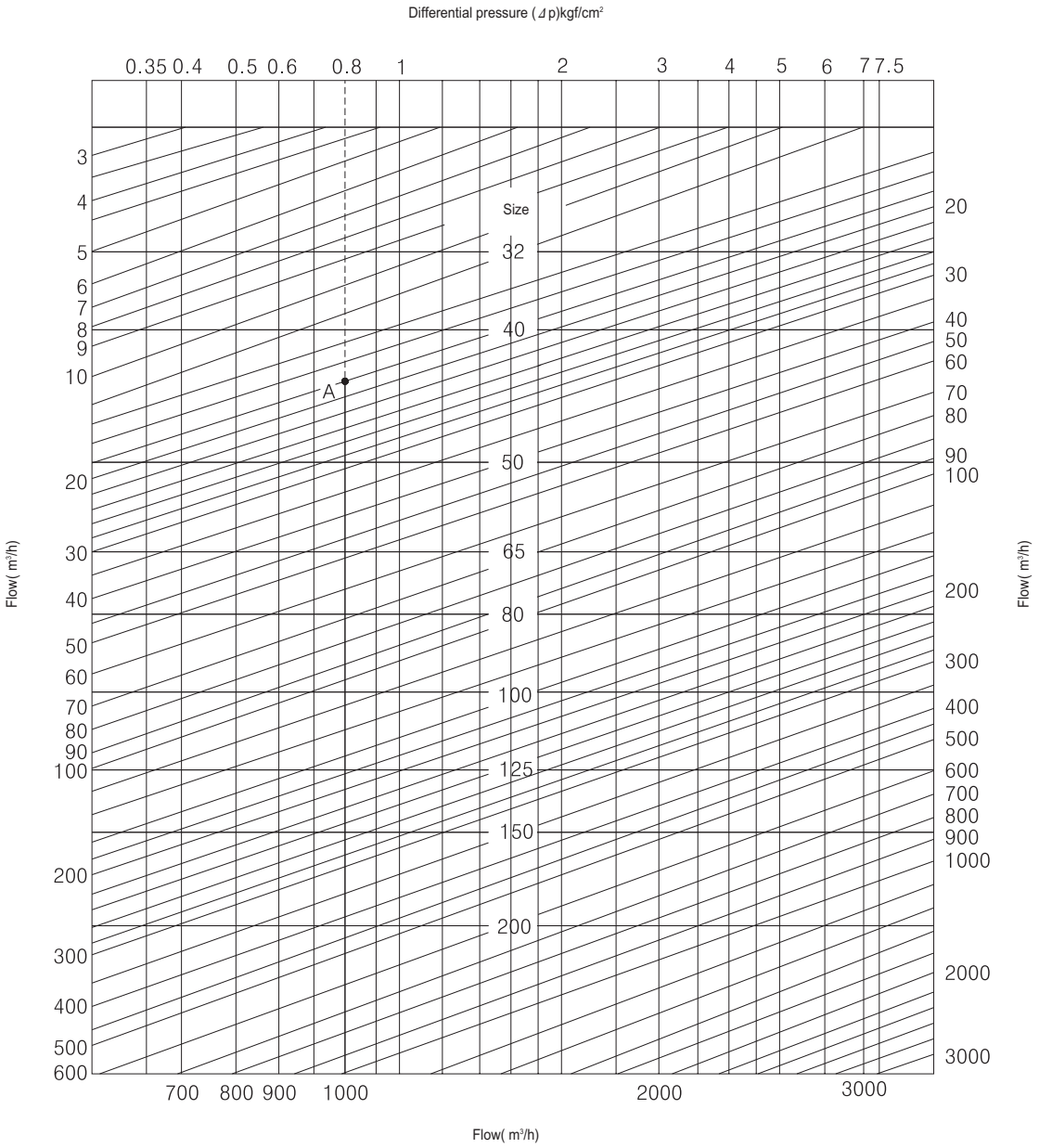
50~150A



Type YAW-3F

Type YAW-3S, 3F Level Control Valve

■ Chart on selecting a size



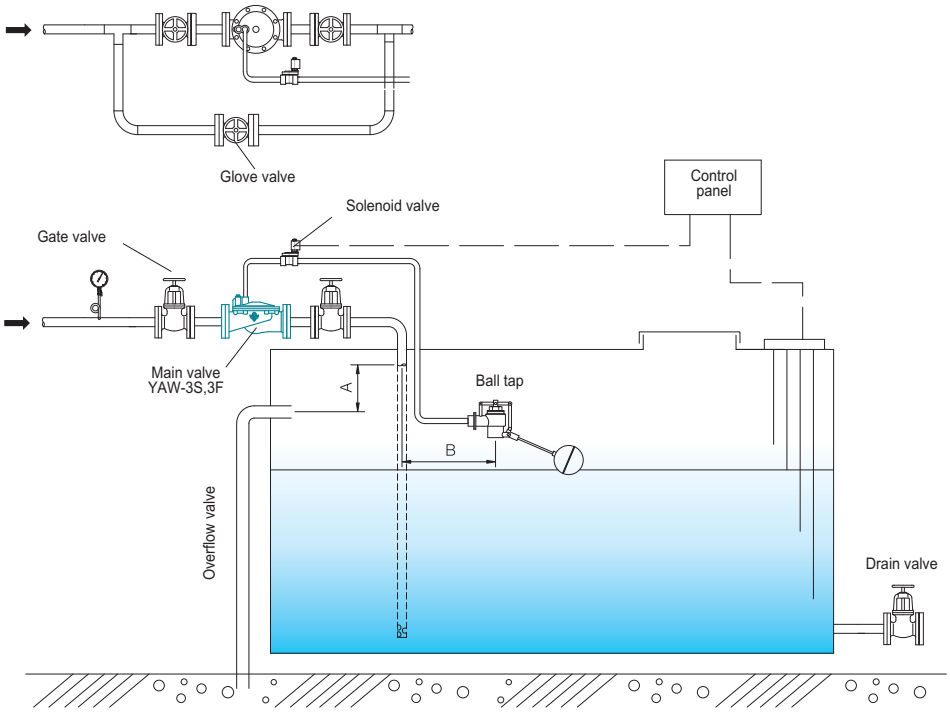
How to select the size of a valve by the chart

Example) If the supply pressure is 3 kg/cm²g,
Back pressure is 2.2 kgf/cm²g,
Flow is 18 m³/h,
Then the differential pressure is 0.8 kgf/cm²g. Since ⊿P is at the point of intersection between the line of 0.8 kgf/cm²g and a flow of 18 m³/h, the valve's size should be selected as 50 in order to avoid harmful stress on the pipeline.

Type YAW-3S, 3F Level Control Valve

◎ Standard Pipeline Installation of the Types YAW-3S and 3F Level Control Valves

■ Application Diagram (Example)



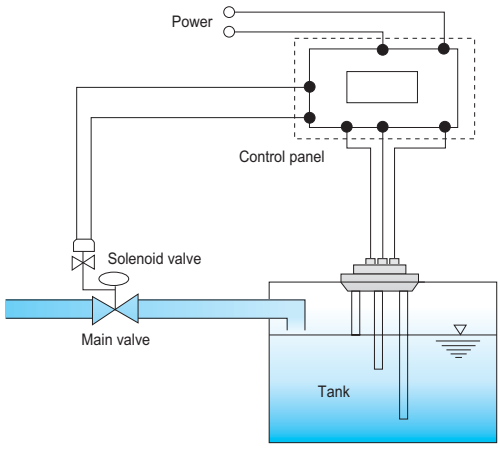
■ Cautions for pipeline installation

1. A bypass pipeline must be installed.
2. In case of installation in an underground water tank, install a pump or sufficiently pump out water to prevent damages caused by water overflow.
3. The distance of “A” should be at least 1.5 times (minimum 50 mm) the pipe diameter.
4. In case of installation of a ball tap, make the distance of “B” as long as possible (minimum 1 m) to prevent damage to the ball tap resulting from irregular water waves. The ball tap should be installed in close proximity to a manhole for easy repair and inspections.
5. The overflow pipeline should be connected to an underground drainage system. (Prevents damage caused by overflow.)
6. In terms of the end connection between the valve’s body and ball tap, a union should be used to ensure easy disassembly and inspection.

■ Cautions for operation

1. Between installation and operation, completely remove foreign substances within the pipeline by blowing them out through the bypass pipeline.
2. If the main valve is not operating due to a power failure or breakdown of the ball tap, use the valve by opening the ball valve and consult Samyang technicians for further instructions. (The ball valve should be closed unless there is an emergency situation.)

≫ Diagram 2. Solenoid valve connecting circuit



Type YAWEL-1 Level Control Valve

The type YAWEL-1 is a large-capacity level control valve that supplies water by opening when the water level inside a water tank goes down to the level at which water supply is commenced. The valve closes when the water level rises to the level at which water supply is stopped. The valve thus features an outstanding performance in controlling the water level.

■ Features

- Automatically opened & closed, without external power supply even large-diameter.
- No leakage with special rubber diaphragm & disc.
- Attached speed control valve (needle valve) can adjust main valve's opening & closing speed.
- Ensure easy repair & inspections structure.

■ Specifications

Applicable fluid		Fresh water, industrial water, agricultural water
Function		On and off operation by a pilot solenoid valve
Applicable pressure		Maximum 10 kgf/cm²g
Minimum differential pressure in the inlet and outlet side of the valve		0.5kgf/cm²
Fluid temperature		5~80° C
Solenoid valve	**Standard**	50~150A : ½", 200~350A : 1"
	Power	AC200V, 60Hz
End connection		KS 10K RF FLANGE
Materials	**Body**	GC200
	Disc, seat	NBR, BC
	Diaphragm	NBR
Hydraulic test pressure		15 kgf/cm²g

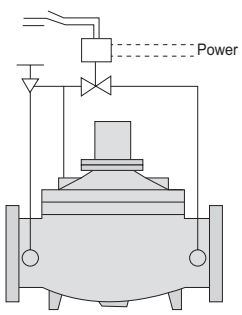
■ Dimensions

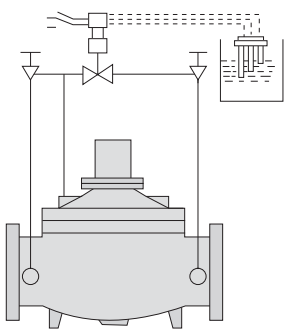
(mm)

Size	L	H1	H2	Cv	Weight(kg)
100(4")	400	120	209	160	67.5
150(6")	520	170	237	360	123
200(8")	640	210	390	640	205
250(10")	740	250	481	1000	440
300(12")	900	290	557	1440	516

▶ Made-to-orders are available for valves with a size of 350 or larger.

■ Example of application

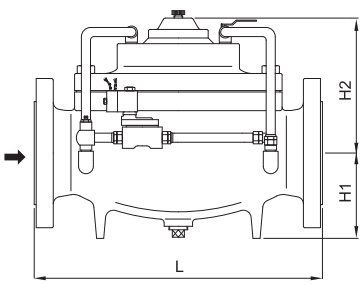




1) Automatic control and remote operation
Because it has adopted a balance structure, even a large-diameter valve can be opened and closed with simple power switching operation. It can also offer a remote control function if applied with appropriate wiring.

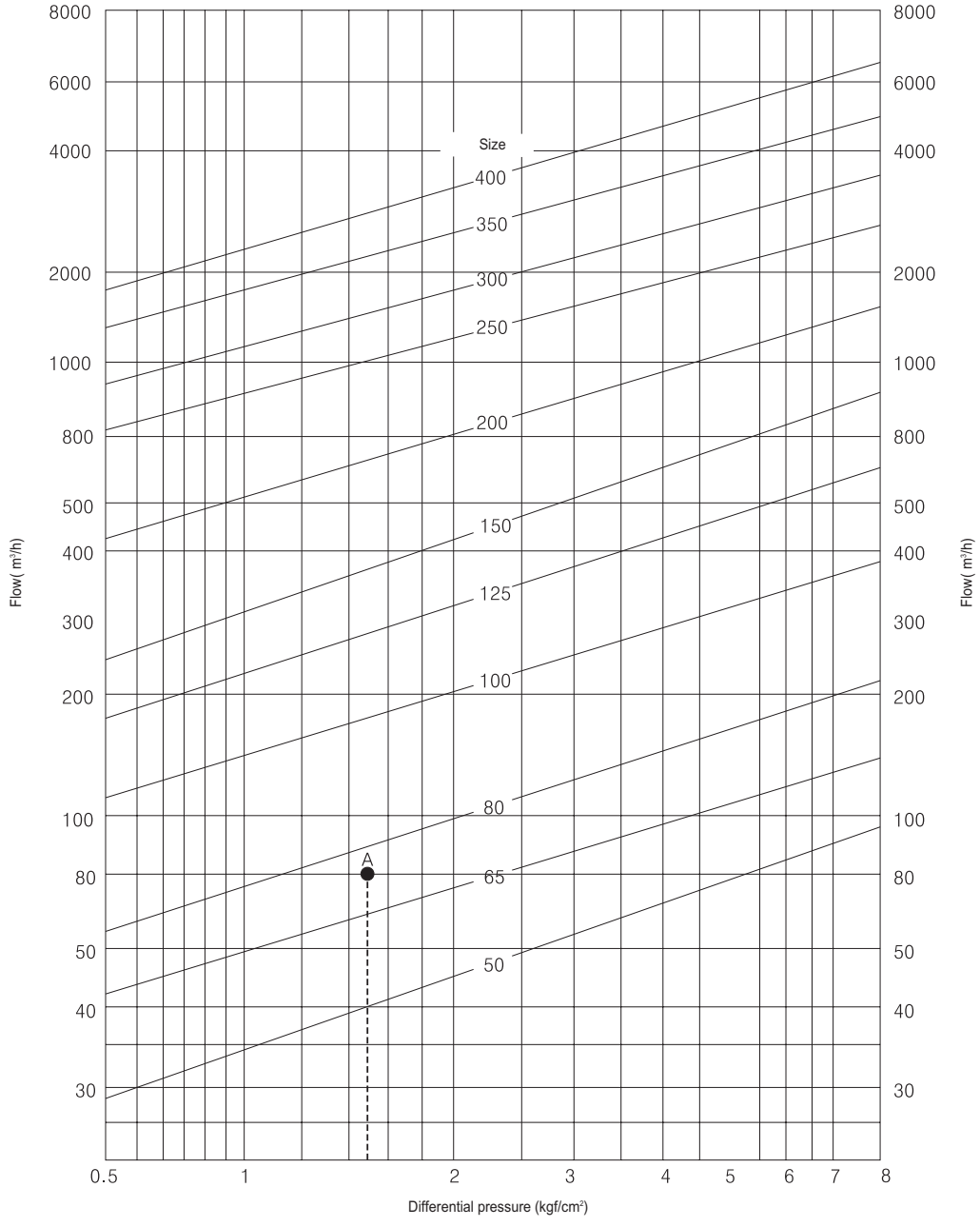
2) Level control function
The valve can be used to maintain a constant water level for water tanks, settling tanks, pressure control tanks, and swimming pools.

■ Dimensional drawing



Type YAWEL-1 Level Control Valve

■ Chart on selecting a size

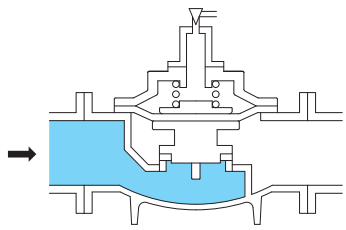


How to select the size of a valve by the chart

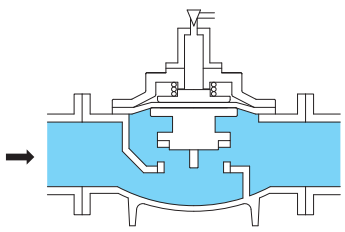
Example) If the primary pressure is 1.5 kg/cm²g, secondary pressure is 0 kg/cm²g, and flow is 80 m³/h, the differential pressure ⊿P is 1.5-0=1.5 (kg/cm²g) since the primary pressure is 1.5 kg/cm²g and secondary pressure is 0 kg/cm²g. Determine "A," the point of intersection between the differential pressure (1.5 kg/cm²g) and flow (80 m³/h). Now that point A is in between a size of 65 and 80, a diameter of 80 should be selected in order to avoid harmful stress on the pipeline.

Type YAWEL-1 Level Control Valve

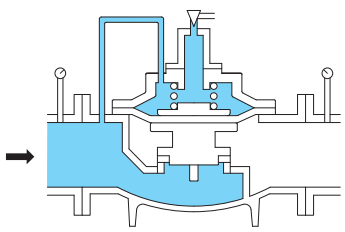
■ How the valve works



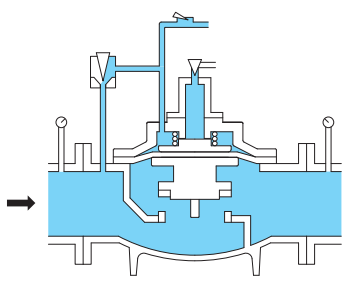
1. At first, the valve is ···
The level control valve consists of a main valve and an auxiliary valve. As shown in the diagram, the valve remains closed, by the main valve`s weight and the spring`s force, when the fluid is not flowing.



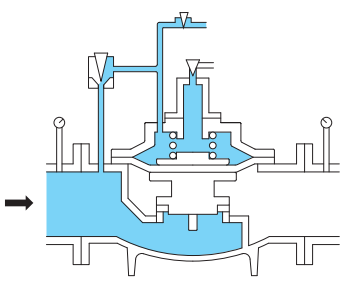
2. When the fluid flows ···
When the level control valve receives pressure, the main valve disc, which was closed, is slightly raised, resulting in the fluid passing through the inside of the valve. In other words, the pressure of the discharged fluid operates in the lower part of the diaphragm and completely opens the main valve.



3. When pressure is applied to the upper part of the diaphragm ···
Once the fluid enters the upper part of the diaphragm through the copper tube that connects the inlet of the level control valve with the upper part of the diaphragm, the pressure level of the upper part and lower part of the diaphragm becomes the same. The main valve begins to close as balance is reached between the main valve`s weight and the spring`s force. In other words, the valve closes when pressure reaches the upper part of the diaphragm, and opens as the pressure disappears.



4. When the valve begins to open ···
Install a speed control valve in the middle of the copper tube so that one side of the copper tube is installed to two directions. If the speed control valve is adjusted so that the volume of fluid discharged from the discharge valve is larger than the volume of fluid that passed through the speed control valve, the discharge valve remains open. Then the pressure of the upper part of diaphragm goes down and the main valve opens.

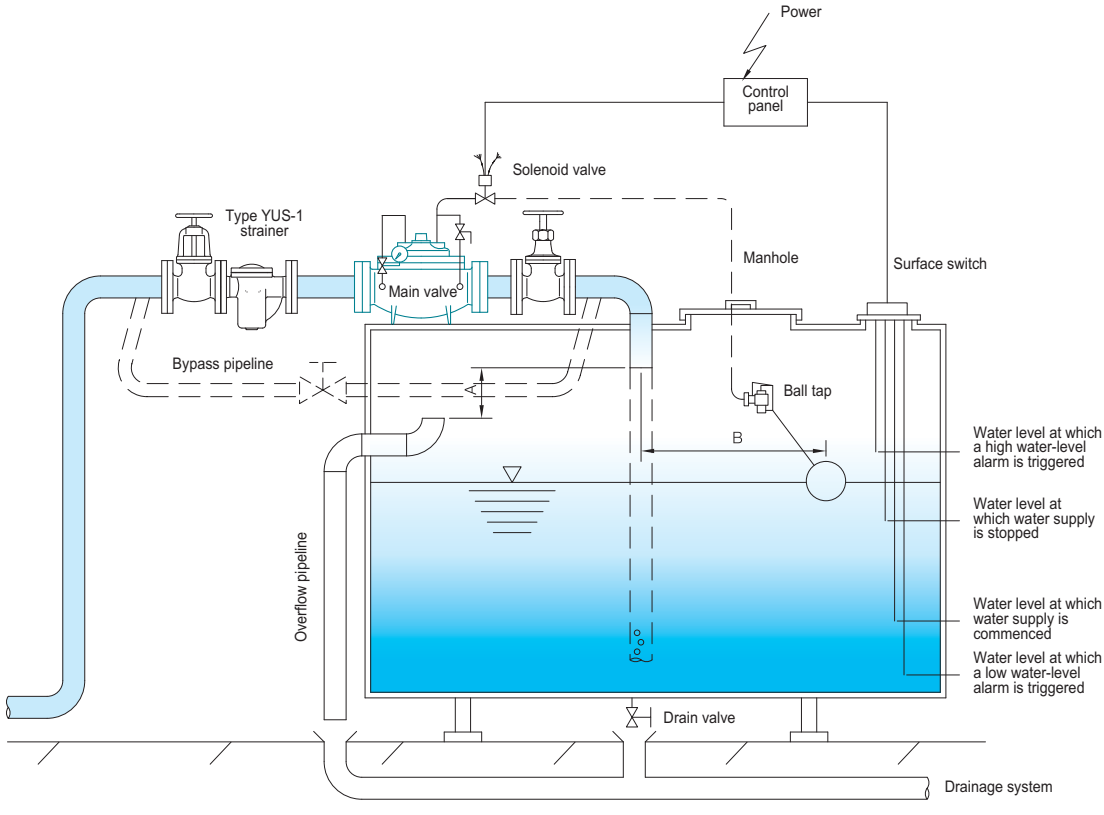


5. Whether it can be automatically opened and closed ···
Once the discharge valve is closed, pressure accumulates in the upper part of the diaphragm and the main valve closes. When the discharge valve is opened by adjusting it slightly, the force applied to the top and the bottom of the diaphragm reach a balance, and the opening of the main valve is automatically controlled.

Type YAWEL-1 Level Control Valve

◎ Standard Pipeline Installation of the Type YAWEL-1 Level Control Valve

■ Application Diagram (Example)



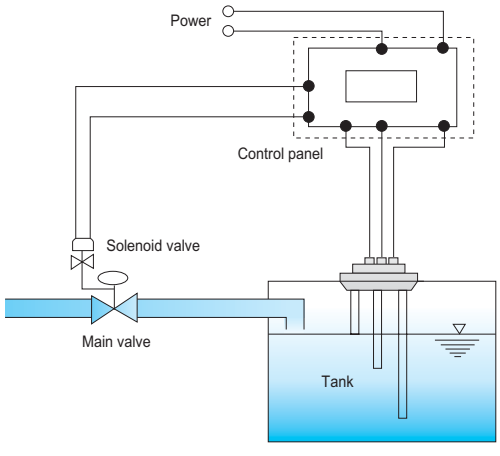
■ Cautions for pipeline installation

1. A bypass pipeline must be installed.
2. A strainer should be installed on the inlet side of the main valve to prevent the breakdown of the valve resulting from foreign substances.
3. The distance of “A” should be at least 1.5 times (minimum 50 mm) the pipe diameter.
4. In case of installation of a ball tap, make the distance of “B” as long as possible (minimum 1 m) to prevent damage to the ball tap resulting from irregular water waves. The ball tap should be installed in close proximity to a manhole for easy repair and inspections.
5. The overflow pipeline should be connected to an underground drainage system. (Prevents damage caused by overflow.)
6. In terms of the end connection between the valve’s body and ball tap, a union should be used to ensure easy disassembly and inspection.
7. The ball tap should be installed at a level lower than the overflow pipeline and higher than the water level at which the high water-level alarm is triggered.
8. Consult with Samyang if there is a need to install the level control valve below the water level within the tank.

■ Cautions for operation

1. Between installation and operation, completely remove foreign substances within the pipeline by blowing them out through the bypass pipeline.
2. Since the needle valve ② was attached to adjust the opening and closing speed of the main valve, use it to adjust the opening and closing speed when there is a water hammer or pipeline vibration during operation.
3. If the main valve is not operating due to a power failure or breakdown of the ball tap, open and use the ball valve ① and consult Samyang technicians for further instructions. (The ball valve ① should be closed unless there is an emergency situation.)

≫ Diagram 2. Solenoid valve connecting circuit



Strainer / Water Separator

6

Strainers

Type	Size	Applicable pressure(kgf/cm²g)	Body materials	End connection	Page
YKY-1	15(½")~50(2")	Maximum 10	GC200	KS PT SCREW	112
YKY-2	15(½")~50(2")			KS 10K FF FLANGE	
YKY-11	15(½")~50(2")		GC	KS PT SCREW	113
YKY-12	65(2½")~200(8")			KS 10K FF FLANGE	
YKY-3	15(½")~500(20")	Maximum 20	GCD450, SCPH2	KS 20K RF FLANGE	114
YKY-5B	32(½")~50(2")	Maximum 10	BC6	KS PT SCREW	115
YKY-6	15(½")~25(1")	Maximum 10	BsC1		
YBS-6	20(¾")~25(1")	Maximum 10			
YUS-1	20(¾")~300(12")		GC200	KS 10K RF FLANGE	116
ⓘ - Strainer	50(2")~300(12")				117

Separators

Type	Size	Applicable pressure(kgf/cm²g)	Body materials	End connection	Page
YSS-100	15(½")~50(2")	Maximum 20	SPPS	KS PT SCREW	118
	15(½")~250(10")			KS 20K RF FLANGE	
YSS-511S	20(¾")~25(1")	Maximum 10	Brass	KS PT SCREW	119
YSS-511F	50(2")~150(6")		Epoxy-coated steel	KS 10K RF FLANGE	

Type YKY-1, 2 Strainer

These are Y-type strainers of cast iron screw and flange type. They are compact and have a large filtering area, and thus are optimal strainers for an automatic valve line.

Type YKY-1

Type YKY-2

■ Specifications

Type		YKY-1	YKY-2
Applicable fluid		Steam, liquid, vapor	
Applicable pressure		Maximum 10 kgf/cm²g	
Fluid temperature		220° C below	
End connection		KS PT SCREW	KS 10K FF FLANGE
Materials	Body	GC200	
	Cover	C3771	GC200
	Screen	STS	
Hydraulic test pressure		20 kgf/cm²g	

- As wire screen, product which would embed max. 200MESH could be produced upon request.
- In terms of flanges, the designated diameter of 20-50A are using RF Type, of 65~200A are using FF Type, and of over 250A are using RF type.

■ Dimensions

≫ Type YKY-1

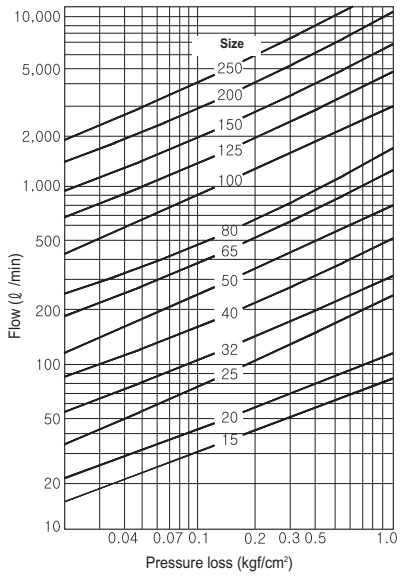
(mm)

Size	L	H	Weight(kg)
15(½")	80	60	0.5
20(¾")	95	69	0.7
25(1")	110	84	1.2
32(1¼")	135	105	2.0
40(1½")	160	123	3.4
50(2")	185	134	5.0

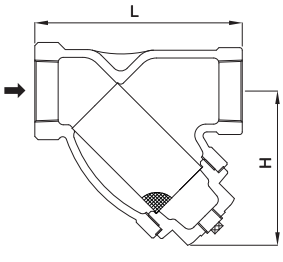
≫ Type YKY-2

Size	L	H	d	Weight(kg)
20(¾")	132	69	-	0.6
25(1")	153	84	⅜"	1.3
32(1¼")	182	105	⅜"	2.1
40(1½")	207	123	⅜"	7.3
50(2")	230	142	⅜"	8.9
65(2½")	285	163	½"	12.2
80(3")	305	195	½"	17.1
100(4")	355	265	½"	24.2
125(5")	405	308	¾"	36.2
150(6")	464	368	¾"	53.2
200(8")	550	484	1"	81.6
250(10")	684	560	1"	165.2
300(12")	848	792	1"	288.2
350(14")	1040	848	1"	488.2
400(16")	1040	890	1"	500.2
450(18")	1082	960	1"	800.2

■ Pressure loss curve



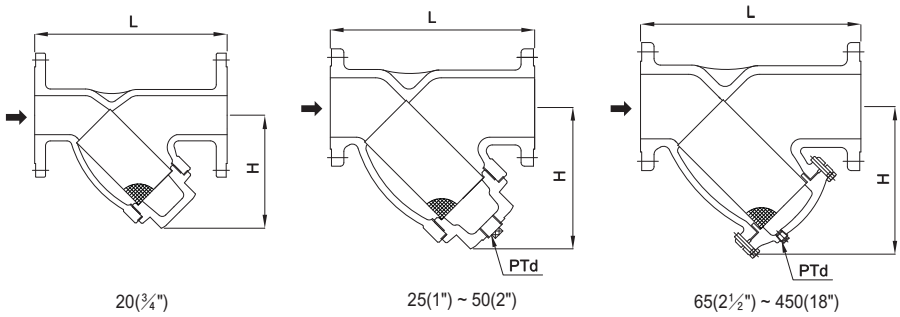
■ Dimensional drawing



25(1") ~ 50(2")

Type YKY-1

■ Dimensional drawing



20(¾") 25(1") ~ 50(2") 65(2½") ~ 450(18")

Type YKY-2

Type YKY-11, 12 Strainer

Type YKY-11

Type YKY-12

■ Features

- Approved by the Korean Industrial Standard (KS B1538).
- Extremely fine meshes screen can filter all foreign substances.
- Designed to ensure easy disassembly & assembly, and has a drain plug installed.

■ Specifications

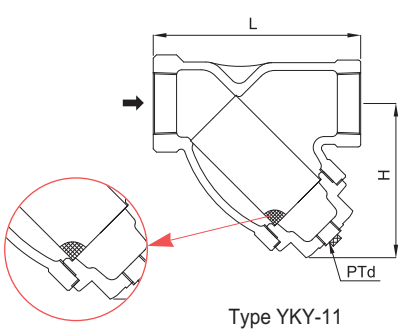
Type		YKY-11	YKY-12
Applicable fluid		Steam	
Applicable pressure		Maximum 10 kgf/cm²g	
Fluid temperature		220° C below	
End connection		KS PT SCREW	KS 10K FF FLANGE
Materials	Body	GC	
	Screen	STS Wire net	
Hydraulic test pressure		20 kgf/cm²g	

■ Dimensions

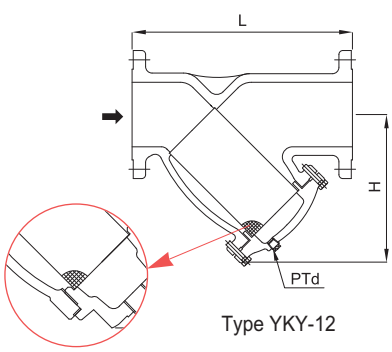
(mm)

Category	Size	L	H	d
YKY-11	15(½")	80	60	-
	20(¾")	95	69	-
	25(1")	110	84	⅜"
	32(1¼")	135	105	⅜"
	40(1½")	160	123	⅜"
	50(2")	185	134	⅜"
YKY-12	65(2½")	285	163	½"
	80(3")	305	195	½"
	100(4")	355	265	½"
	125(5")	405	308	¾"
	150(6")	464	368	¾"
	200(8")	550	484	1"

■ Dimensional drawing



Type YKY-11



Type YKY-12

Type YKY-3 Strainer

This is a Y-type strainer for high pressure. It is compact and has a large filtering area, and thus is an optimal strainer for an automatic valve line.

■ Specifications

Type		YKY-3	YKY-30
Applicable fluid		Steam, liquid, vapor	
Applicable pressure		Maximum 20 kgf/cm²g	Maximum 30 kgf/cm²g
Fluid temperature		250° C below	
End connection		KS 20K RF FLANGE	KS 30K RF FLANGE
Materials	Body	GCD450	SCPH2
	Cover	GCD	
	Screen	STS	
Hydraulic test pressure		40 kgf/cm²g	

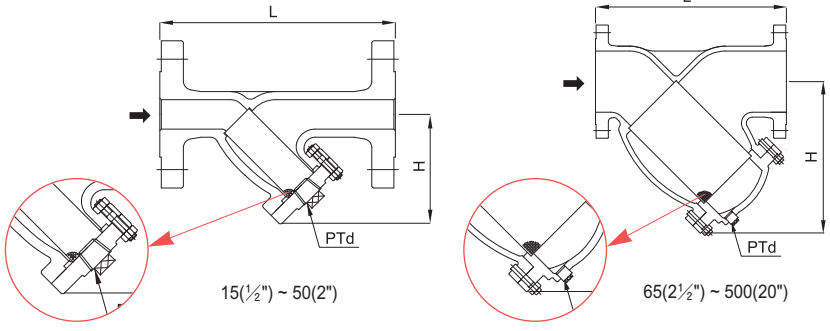
▶ Made-to-orders are available for 30kgf/cm²g.

■ Dimensions

(mm)

Size	L	H	d	Weight(kg)
15(½")	160	74	⅜"	1.1
20(¾")	160	75	⅜"	1.1
25(1")	190	97	⅜"	2.2
32(1¼")	220	110	⅜"	3.6
40(1½")	235	117	⅜"	12.4
50(2")	250	140	⅜"	15.1
65(2½")	256	180	⅜"	23.8
80(3")	300	210	⅜"	25.5
100(4")	390	270	½"	42.5
125(5")	440	310	½"	64.6
150(6")	520	370	¾"	92.3
200(8")	600	490	1"	155
250(10")	750	565	1"	260
300(12")	892	792	1"	480
350(14")	1052	848	1"	750
400(16")	1044	890	1"	700
450(18")	1087	960	1"	1360
500(20")	1252	965	1"	1450

■ Dimensional drawing



Type YKY-5B, 6, YBS-6 Strainer

These are Y and U-type strainers of bronze screw type. They are compact and have a large filtering area, and thus are optimal strainers for an automatic valve line.

Type YKY-5B

Type YKY-6

Type YBS-6

■ Specifications

Type		YKY-5B	YKY-6	YBS-6(Stop compound valve)
Applicable fluid		Liquid		
Applicable pressure		Maximum 10 kgf/cm²g		
Fluid temperature		220° C below		
End connection		KS PT SCREW		
Materials	Body	BC6	BsC1	BsC1
	Cover	C3771	C3771	C3771
	Screen	STS		
Hydraulic test pressure		20 kgf/cm²g		

■ Dimensions

≫ Type YKY-5B

(mm)

Size	L	H	D	Weight(kg)
32(1¼")	124	75	1½"	1.9
40(1½")	138	90	1½"	2.3
50(2")	145	110	2"	3.3

≫ Type YKY-6

(mm)

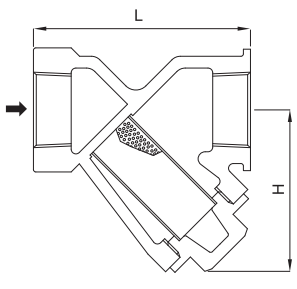
Size	L	H	D
15(½")	58	50	½"
20(¾")	72	60	¾"
25(1")	90	73	1"

≫ Type YBS-6

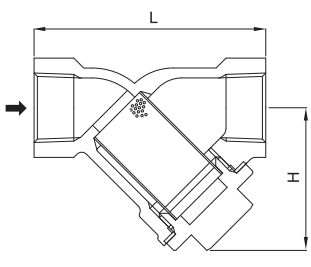
(mm)

Size	L	H	D
15(½")	72	98	½"
20(¾")	90	125	¾"
25(1")	115	153	1"

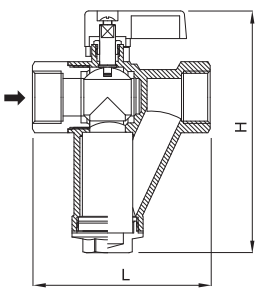
■ Dimensional drawing



Type YKY-5B



Type YKY-6



Type YBS-6

Type YUS-1 Strainer

This is a U-type strainer that is optimal mainly for automatic valves for liquid.

■ Features

- Easier disassemble screen structure from the top.
- Internal screen ensuring little input loss with sufficient opening area.

■ Specifications

Applicable fluid		Water, oil, air, steam
Applicable pressure		Maximum 10 kgf/cm²g
Fluid temperature		220° C below
End connection		KS 10K RF FLANGE
Materials	Body	GC200
	Screen	STS
Hydraulic test pressure		20 kgf/cm²g

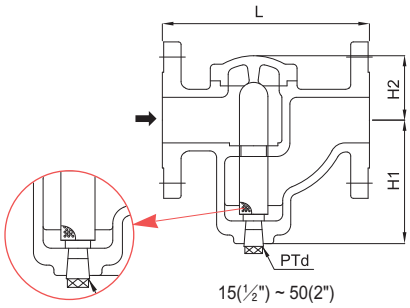
▶ Made-to-orders are available for strainers with embedded dual screens for up to 200 meshes.
▶ Made-to-orders are available for 20 kgf/cm²g.

■ Dimensions

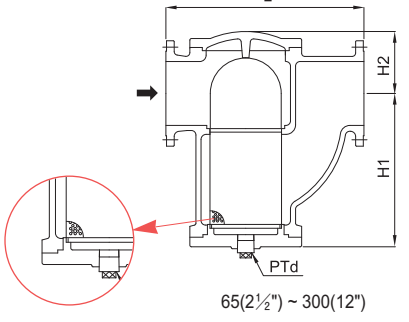
(mm)

Size	L	H1	H2	d	Weight(kg)
20(¾")	185	98	48	½"	8
25(1")	185	98	48	½"	8.2
32(1¼")	207	122	61	½"	9.4
40(1½")	207	122	61	½"	10.2
50(2")	230	135	78	½"	11.3
65(2½")	270	155	89	1"	18.5
80(3")	305	185	100	1"	21.8
100(4")	385	240	115	1"	48.5
125(5")	424	288	148	1½"	74
150(6")	526	360	165	1½"	95
200(8")	620	487	195	2"	290.8

■ Dimensional drawing

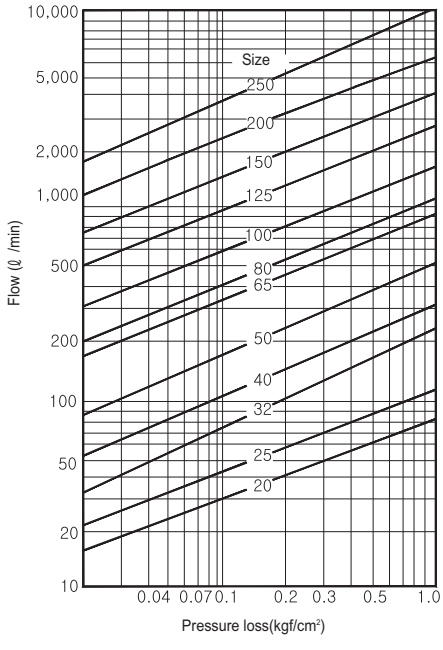


15(½") ~ 50(2")



65(2½") ~ 300(12")

■ Pressure loss curve



Type ⓘ - Strainer

This product features an automatic contamination detection function, minimizes pressure loss, and ensures perfect screen cleaning.

■ Features

- It ensures easy screen cleaning.
- It has a compact design, and ensures easy installation and handling.
- It minimizes pressure loss.
- It offers a wide range of selection.

■ Specifications

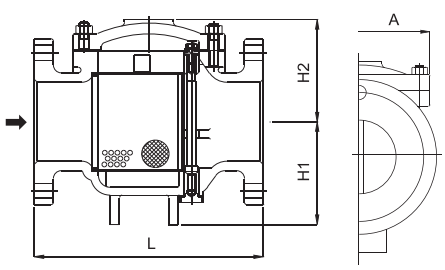
Category		For general use
Type		ⓘ - Strainer
Designated diameter		50~300A
Applicable fluid		Steam, vapor, liquid
Maximum running temperature		220° C
Applicable pressure		Maximum 10 kgf/cm²g
End connection		KS 10K RF / FF FLANGE
Materials	**Body**	GC200
	Screen	STS
Screen		60 mesh standard
Hydraulic test pressure		15 kgf/cm²g

▶ Notes 1: Strainers with a screen of 40, 80, and 100 meshes or with a punch hole only (perforation, 3 X pitch 4) are also available.
Notes 2: Main bodies with GCD material (applicable pressure of 1.6 MPa or below) are also available.
Notes 3: The internal inspection window, differential pressure gauge, and magnetic absorption screen are optional.

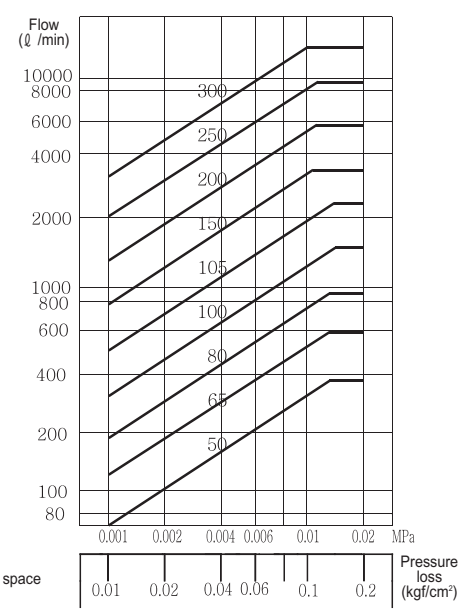
■ Dimensions

Size	L	H1	H2	A	Weight(kg)
50(2")	210	166	-	112	10.8
65(2½")	250	191	-	160	16.2
80(3")	275	105	-	172	20.4
100(4")	300	131	132	204	30.6
125(5")	360	158	144	256	44.8
150(6")	400	174	170	286	66.2
200(8")	480	225	208	372	109
250(10")	600	280	250	436	194
300(12")	720	328	290	488	303

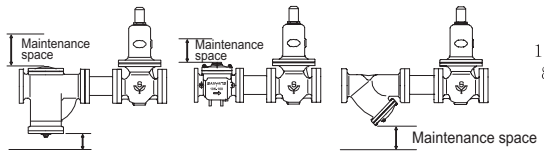
■ Dimensional drawing



■ Pressure loss curve



■ Spatial comparison



Type YSS-100 Steam Separator

This product ensures that there is no pressure loss within the pipeline, and is designed in a way that allows an effective water separation function even when there are flow velocity changes. It can thus be used for steam pipelines as well as compressed air pipelines.

■ Features

- Protects process facilities & extends life span by preventing damage caused by Water Hammer in steam system.
- Shield board designed condensate which is separated steam's flow efficiently gathered at discharge point.
- Almost no pressure loss within pipeline, efficiently separates condensate even in extensive flow velocity changes.

■ Specifications

Applicable fluid	Steam	
Applicable pressure	Maximum 20 kgf/cm²g	
Fluid temperature	214° C below	
End connection	KS PT SCREW	KS 20K RF FLANGE
Materials	SPPS	
Hydraulic test pressure	35 kgf/cm²g	

▶ In terms of the end connection, the PT, NPT, KS, and ANSI standards can be applied.

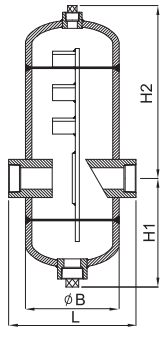
■ Dimensions

(mm)

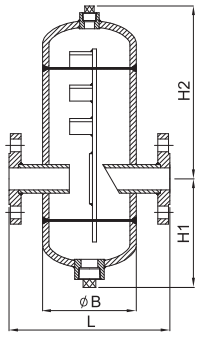
Size	L	H1	H2	ØB	Weight(kg)
15(½")	160(120)	125	175	76	4.1
20(¾")	200(136)	124	200	89	5.9
25(1")	220(162)	131	223	114	8.9
32(1¼")	240(190)	162	258	139	14.1
40(1½")	280(220)	175	320	165	18.7
50(2")	290(220)	209	352	165	21.8
65(2½")	350	246	409	216	37
80(3")	410	305	437	267	60
100(4")	468	367	463	318	85
125(5")	556	350	532	355	136
150(6")	656	375	575	406	195
200(8")	898	421	667	508	313

▶ Made-to-orders are available for water separators with a size of 250 or larger.
▶ Dimensions in parentheses are for the screwed type.

■ Dimensional drawing

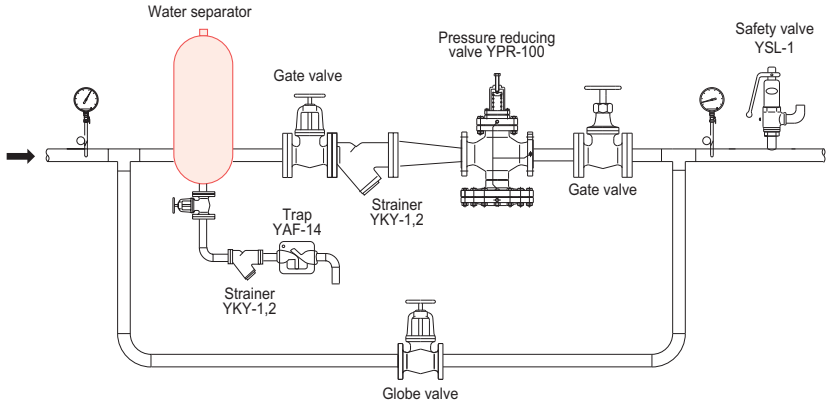


Screwed type



Flanged type

■ Application Diagram (Example)



■ Installation and application in a steam pipeline

- The diameter of the water separator should be the same as the pipeline diameter. The separator should be installed in a horizontal pipeline.
- The condensate gathered at the discharge point of the separator should be immediately discharged. This is why there is a need to install a float steam trap on the lower part.

Bellows Type Expansion Pipe Joint / Flexible Tube

7

Bellows Type Expansion Pipe Joint / Flexible Tube

Bellows type expansion pipe joint

Type	Size	Applicable pressure (kgf/cm²g)	Category	Expansion/contraction length (mm) Expansion length + Contraction length -	End connection	Page
YBJ-1S	25(1")~300(12")	Maximum 10	Single-type steel pipe	+10 -25	KS 10K RF FLANGE	122
YBJ-1W			Double-type steel pipe	+20 -50		
YBJ-2S		Maximum 20	Single-type steel pipe	+10 -25	KS 20K RF FLANGE	123
YBJ-2W			Double-type steel pipe	+20 -50		
YBJ-3S	25(1")~100(4")	Maximum 10	Single-type steel pipe	+10 -25	KS standard socket welding	124
YBJ-3W			Double-type steel pipe	+20 -50		
YBJ-4S			Single-type steel pipe	+10 -25		125
YBJ-4W			Double-type steel pipe	+20 -50		

Flexible tube

Type	Size	Applicable pressure(kgf/cm²g)	Category	End connection	Page
JSY-9B	25(1")~300(12")	Maximum 10, 20	Flexible tube	KS 10, 20K RF FLANGE	126
JSY-9C	25(1")~400(15")		Metal connector		

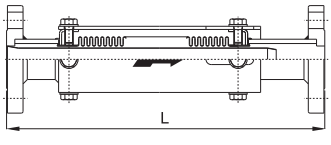
Type YBJ-1S, 1W Bellows Type Expansion Pipe Joint

The KS B 1536 bellows type expansion pipe joint is mainly used for cooling, heating, air-conditioning, and sanitary pipelines. It is an expansion pipe joint that absorbs the axial-direction expansion and contraction of a pipeline that occurs according to temperature changes.

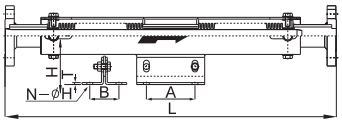
Type YBJ-1S

Type YBJ-1W

■ Dimensional drawing



Type YBJ-1S



Type YBJ-1W

Mark inscription allowed product/ Korea register of ahipping model approval

■ Features

- Standards of the Korean Industrial Standard (KS B 1536), the Association of the United States Army, and the Korean Register of Shipping (KR).
- Offer strong & outstanding level of corrosion resistance & durability : Parts material come into contact with fluid are made of stainless steel and have been molded.
- Outer tube has been used to prevent damage to bellows from outside impact.
- Inner tube adoption ensures little pressure loss of fluid smooth flow & long life span.

■ Specifications

Type		YBJ-1S	YBJ-1W
Structure		Single type	Double type
Applicable fluid		Steam, Cold/hot water, Air, Gas, Oil	
Applicable pressure		Maximum 10kgf/cm²g	
Fluid temperature		220° C below	
Expansion/contraction length		35mm	70mm
End connection		KS 10K RF FLANGE	
Materials	Bellows, Inner tube	STS	
	Outer tube	SGP	
	Flange	25~150A(SS), 200~250A(GC), 300A(SS)	
Hydraulic test pressure		15kgf/cm²g	

▶ Do not couple this product with a copper pipeline.
▶ 300A or larger are available by made-to-orders.
▶ Those used for ANSI #125, #150, and steel flanges are available by made-to-orders.
▶ The fixing bolt should be loosened after the hydro-pressure test.

■ Dimensions

≫ Type YBJ-1S

(mm)

Size	L	Expansion/contraction length		Weight(kg)
		Expansion length	Contraction length	
25(1")	365	10	25	06.4
32(1¼")	365	10	25	06.9
40(1½")	365	10	25	08.3
50(2")	365	10	25	10.9
65(2½")	415	10	25	13.4
80(3")	415	10	25	15.5
100(4")	415	10	25	21.2
125(5")	440	10	25	30.4
150(6")	440	10	25	41.4
200(8")	440	10	25	52.3
250(10")	465	10	25	60.2
300(12")	465	10	25	68.1

≫ Type YBJ-1W

(mm)

Size	L	Expansion/contraction length		H	A	B	T	N-øH	Weight(kg)
		Expansion length	Contraction length						
25(1")	680	20	50	100	100	060	2.5	4-12	11.0
32(1¼")	680	20	50	120	100	070	2.5	4-12	13.0
40(1½")	680	20	50	106	106	070	2.5	4-12	15.0
50(2")	680	20	50	130	100	080	2.5	4-15	19.0
65(2½")	780	20	50	140	120	100	3.0	4-15	21.0
80(3")	780	20	50	150	120	110	3.0	4-15	29.5
100(4")	880	20	50	170	120	130	4.0	4-19	43.0
125(5")	880	20	50	200	120	150	5.0	4-19	62.5
150(6")	930	20	50	220	160	180	5.0	4-23	70.0
200(8")	930	20	50	250	220	160	14.0	4-25	135.0
250(10")	980	20	50	300	280	180	14.0	4-27	166.0
300(12")	980	20	50	350	300	200	18.0	4-27	190.0

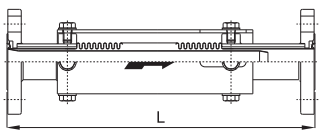
Type YBJ-2S, 2W Bellows Type Expansion Pipe Joint

The KS B 1536 bellows type expansion pipe joint is mainly used for cooling, heating, air-conditioning, and sanitary pipelines. It is an expansion pipe joint that absorbs the axial-direction expansion and contraction of a pipe that occurs according to temperature changes.

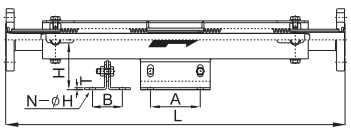
Type YBJ-2S

Type YBJ-2W

■ Dimensional drawing



Type YBJ-2S



Type YBJ-2W

Ⓚ Mark inscription allowed product/ Korea register of ahipping model approval

■ Features

- Standards of the Korean Industrial Standard (KS B 1536), the Association of the United States Army, and the Korean Register of Shipping (KR).
- Offer strong & outstanding level of corrosion resistance & durability : Parts material come into contact with fluid are made of stainless steel and have been molded.
- Outer tube has been used to prevent damage to bellows from outside impact.
- Inner tube adoption ensures little pressure loss of fluid, smooth flow & long life span.

■ Specifications

Type		YBJ-2S	YBJ-2W
Structure		Single type	Double type
Applicable fluid		Steam, Cold/hot water, Air, Gas, Oil	
Applicable pressure		Maximum 20kgf/cm²g	
Fluid temperature		220° C below	
Expansion/contraction length		35mm	70mm
End connection		KS 20K RF FLANGE	
Materials	Bellows, Inner tube	STS	
	Outer tube	SPP	
	Flange	SS	
Hydraulic test pressure		30kgf/cm²g	

▶ Do not couple this product with a copper pipeline.
▶ 350A or larger are available by made-to-orders.
▶ Those used for ANSI #125, #150, #300, and steel flanges are available by made-to-orders.
▶ The fixing bolt should be loosened after the hydro-pressure test.

■ Dimensions

≫ Type YBJ-2S

(mm)

Size	L	Expansion/contraction length		Weight(kg)
		Expansion length	Contraction length	
25(1")	365	10	25	06.4
32(1¼")	365	10	25	06.9
40(1½")	365	10	25	08.3
50(2")	365	10	25	10.9
65(2½")	415	10	25	13.4
80(3")	415	10	25	15.5
100(4")	415	10	25	21.2
125(5")	440	10	25	30.4
150(6")	440	10	25	41.4
200(8")	440	10	25	52.3
250(10")	465	10	25	60.2
300(12")	465	10	25	68.1

≫ Type YBJ-2W

(mm)

Size	L	Expansion/contraction length		H	A	B	T	N-ØH	Weight(kg)
		Expansion length	Contraction length						
25(1")	680	20	50	100	100	60	2.5	4-12	11
32(1¼")	680	20	50	120	100	70	2.5	4-12	13
40(1½")	680	20	50	106	106	70	2.5	4-12	15
50(2")	680	20	50	130	100	80	2.5	4-15	19
65(2½")	780	20	50	140	120	100	3	4-15	21
80(3")	780	20	50	150	120	110	3	4-15	29.5
100(4")	880	20	50	170	120	130	4	4-19	43
125(5")	880	20	50	200	120	150	5	4-19	62.5
150(6")	930	20	50	220	160	180	5	4-23	70
200(8")	930	20	50	250	220	160	14	4-25	135
250(10")	980	20	50	300	280	180	14	4-27	166
300(12")	980	20	50	350	300	200	18	4-27	190

Type YBJ-3S, 3W Bellows Type Expansion Pipe Joint (for Copper Pipe)

This is an expansion pipe joint used for cold water, hot water, or other copper pipelines.

Type YBJ-3S

Type YBJ-3W

Ⓚ Mark inscription allowed product/ Korea register of ahipping model approval

■ Features

- Absorb the expansion & contraction of pipelines by temperature changes.
- Stainless steel ensuring high level of corrosion resistance leads little fluid pressure loss : Inner tube materials which come into contact with fluid are made of stainless steel.
- Outer tube has been used to prevent damage to bellows from impact.
- Internal pressure type product prevents noise.

■ Specifications

Type		YBJ-3S	YBJ-3W
Structure		Single type	Double type
Applicable fluid		Cold/hot water, Oil, Air	
Applicable pressure		Maximum 10kgf/cm^{2}g	
Fluid temperature		220° C below	
Expansion/contraction length		35mm	70mm
End connection		KS D 5578 Dimensions-based socket-welded type	
Materials	Bellows, Inner tube	STS	
	Outer tube	SGP	
	Socket	CuT	
Hydraulic test pressure		15kgf/cm^{2}g	

▶ The fixing bolt should be loosened after the hydro-pressure test.

■ Dimensions

≫ Type YBJ-3S

(mm)

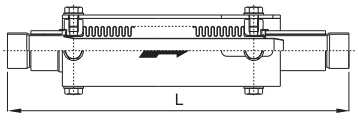
Size	L	Expansion/contraction length		Weight(kg)
		Expansion length	Contraction length	
25(1")	365	10	25	04.1
32(1¼")	365	10	25	04.1
40(1½")	365	10	25	05.2
50(2")	365	10	25	07.1
65(2½")	415	10	25	08.2
80(3")	415	10	25	10.3
100(4")	415	10	25	15.7

≫ Type YBJ-3W

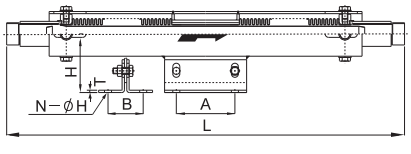
(mm)

Size	L	Expansion/contraction length		H	A	B	T	N-øH	Weight(kg)
		Expansion length	Contraction length						
25(1")	680	20	50	100	100	060	2.5	4-12	08.7
32(1¼")	680	20	50	120	100	070	2.5	4-12	10.0
40(1½")	680	20	50	106	100	070	2.5	4-12	11.9
50(2")	680	20	50	130	100	080	2.5	4-15	15.2
65(2½")	780	20	50	140	120	100	3.0	4-15	15.8
80(3")	780	20	50	150	120	110	3.0	4-15	24.3
100(4")	880	20	50	170	120	130	4.0	4-19	37.5

■ Dimensional drawing



Type YBJ-3S



Type YBJ-3W

Type YBJ-4S, 4W Bellows Type Expansion Pipe Joint (for Steel Pipe)

This is used to absorb the axial-direction expansion and contraction of a pipeline that occurs according to temperature changes. Since it is an internal pressure type, it is buckling-free and ensures smooth expansion/contraction.

Type YBJ-4S

Type YBJ-4W

㉮ Mark inscription allowed product/ Korea register of ahipping model approval

■ Features

- Absorb the expansion & contraction of pipelines by temperature changes.
- Outstanding level of corrosion resistance : Parts materials come into contact with fluid are made of stainless steel.
- Outer tube has been used to prevent damage to the bellows from impact.

■ Specifications

Type		YBJ-4S	YBJ-4W
Structure		Single type	Double type
Applicable fluid		Cold/hot water, Oil, Air, Steam	
Applicable pressure		Maximum 10kgf/cm^{2}g	
Fluid temperature		220° C below	
Expansion/contraction length		35mm	70mm
End connection		KS D 3507 dimensions-based welded type	
Materials	Bellows	STS	
	Outer tube	SGP	
	Pipe	SPP	
Hydraulic test pressure		15kgf/cm^{2}g	

▶ The fixing bolt should be loosened after the hydro-pressure test.

■ Dimensions

≫ Type YBJ-4S

(mm)

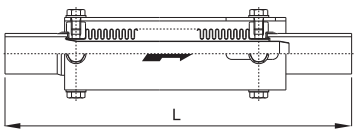
Size	L	Expansion/contraction length		Weight(kg)
		Expansion length	Contraction length	
25(1")	365	10	25	04.1
32(1¼")	365	10	25	04.1
40(1½")	365	10	25	05.2
50(2")	365	10	25	07.1
65(2½")	415	10	25	08.2
80(3")	415	10	25	10.3
100(4")	415	10	25	15.7

≫ Type YBJ-4W

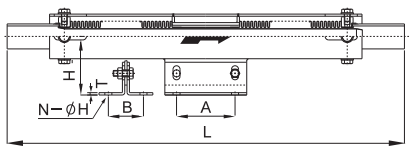
(mm)

Size	L	Expansion/contraction length		H	A	B	T	N-øH	Weight(kg)
		Expansion length	Contraction length						
25(1")	680	20	50	100	100	060	2.5	4-12	08.7
32(1¼")	680	20	50	120	100	070	2.5	4-12	10.0
40(1½")	680	20	50	106	100	070	2.5	4-12	11.9
50(2")	680	20	50	130	100	080	2.5	4-15	15.2
65(2½")	780	20	50	140	120	100	3.0	4-15	15.8
80(3")	780	20	50	150	120	110	3.0	4-15	24.3
100(4")	880	20	50	170	120	130	4.0	4-19	37.5

■ Dimensional drawing

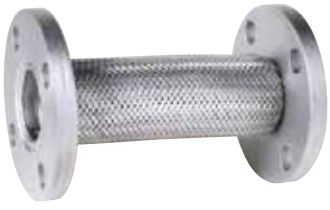


Type YBJ-4S



Type YBJ-4W

Type JSY-9B Flexible Tube



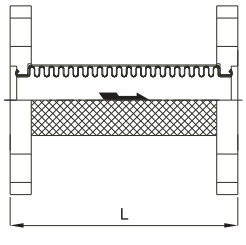
■ Features

This product has a short distance among the surfaces and has a structure that allows it to absorb an extensive expansion/contraction length, making it especially ideal for pump connectors.

■ Specifications

Applicable fluid		Cold/hot water, Oil, Air, Steam	
Maximum running pressure		Maximum 10kgf/cm²g	Maximum 20kgf/cm²g
Maximum applicable temperature		220° C below	250° C below
End connection		KS 10K FF FLANGE	KS 20K FF FLANGE
Materials	Bellows	STS	
	Flange	SS	
Hydraulic test pressure		15kgf/cm²g	30kgf/cm²g

■ Dimensional drawing



■ Dimensions

(mm)

Size	25(1")	32(1¼")	40(1½")	50(2")	65(2½")	80(3")
L	200.0	200.0	230.0	230.0	230.0	230.0
Weight(kg)	2.5	3.5	3.9	4.2	5.9	6.5

Size	100(4")	125(5")	150(6")	200(8")	250(10")	300(12")
L	230.0	280.0	280.0	300.0	300.0	300.0
Weight(kg)	7.2	10.5	14	17.1	26	40

Type JSY-9C Flexible Tube (Tie-Rod Type)

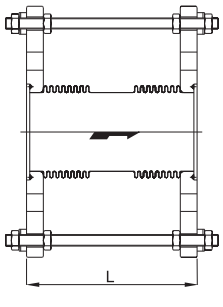
■ Features

This product has a simple structure, a short pipeline length, and absorbs a large amount of expansion/contraction and vibration, making it ideal for classic pipelines, tank pipelines, and pump connectors.

■ Specifications

Applicable fluid		Cold/hot water, Oil, Air, Steam	
Maximum running pressure		Maximum 10kgf/cm²g	Maximum 20kgf/cm²g
Applicable temperature		220° C below	250° C below
End connection		KS 10K FF FLANGE	KS 20K FF FLANGE
Materials	Bellows	STS316	
	Flange	SS41	
Hydraulic test pressure		15kgf/cm²g	30kgf/cm²g

■ Dimensional drawing



■ Dimensions

(mm)

Size	25(1")	32(1¼")	40(1½")	50(2")	65(2½")	80(3")	100(4")
L	90	90	90	130(140)	130(140)	130(140)	130(140)

Size	125(5")	150(6")	200(8")	250(10")	300(12")	350(14")	400(16")
L	150(180)	150(180)	150(180)	210(180)	210(240)	210(240)	210(240)

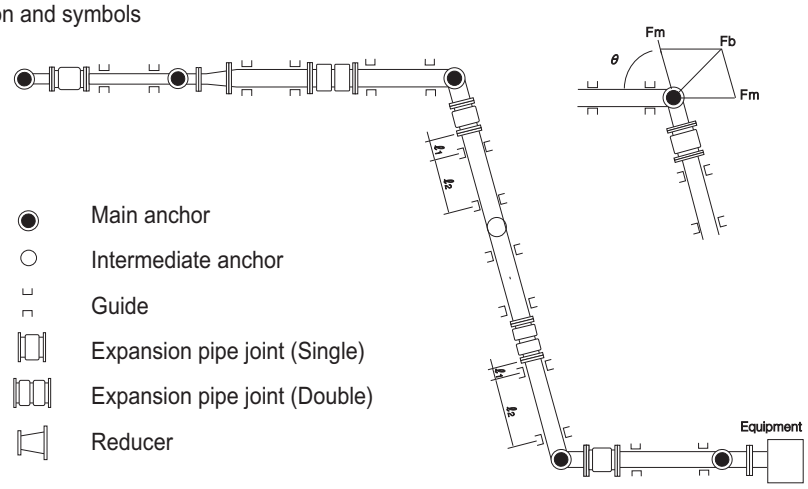
▶ The length values in parentheses are for 20kgf/cm²g

■ How to select a bellows type expansion pipe joint

● **Sequence of selecting an expansion pipe joint**

1) Categorize the two ends of a straight pipeline, a branch pipeline, a reducer-using part, a valve installation point, and a curved section of the pipeline as main anchors.
2) Identify the pipeline length among the main anchors.
3) Calculate the expansion/contraction length for each main anchor section, based on the difference of maximum temperature of applicable fluid, air temperature during installation, and minimum ambient temperature.
4) Determine how many joints need to be installed by dividing the expansion/contraction length of each section by the allowed expansion/contraction length of the expansion pipe joint.
5) If there is a need to install two or more expansion pipe joints, first select a double type and then a single type.
6) Decide on intermediate anchors and guides so that the expansion pipe joint can smoothly engage in axial-direction expansion/contraction operation.

● Example of pipeline installation and symbols



ℓ_1 : Distance of guide no. 1
ℓ_2 : Distance of guide no. 2

● **Pipe's expansion/contraction length (based on calculation)**

Basic formula $\Delta\ell = \alpha \times \Delta t \times L$
Maximum expansion length calculation formula $\Delta\ell = \alpha \times (T - t_1) \times L$
Maximum contraction length calculation formula $\Delta\ell = \alpha \times (t_1 - t_2) \times L$

$\Delta\ell$: Expansion/contraction length of pipe(mm)
α : Pipe's expansion coefficient
Steel pipe : 12.2×10^{-3}mm/m℃
Copper pipe : 17.7×10^{-3}mm/m℃
Stainless pipe : 18.4×10^{-3}mm/m℃
Δt : Temperature difference(°C)
L : Pipeline length(m)
T : Maximum applicable temperature (°C)
t_1 : Temperature during installation(°C)
t_2 : Minimum ambient temperature(°C)

※ The expansion/contraction of a pipe is heavily dependent on the temperature of the applied fluid. The pipe expands or contracts according to changes in the maximum running temperature, minimum ambient temperature, etc. based on the temperature at the point of installation.

● **Deciding on the number of joints**

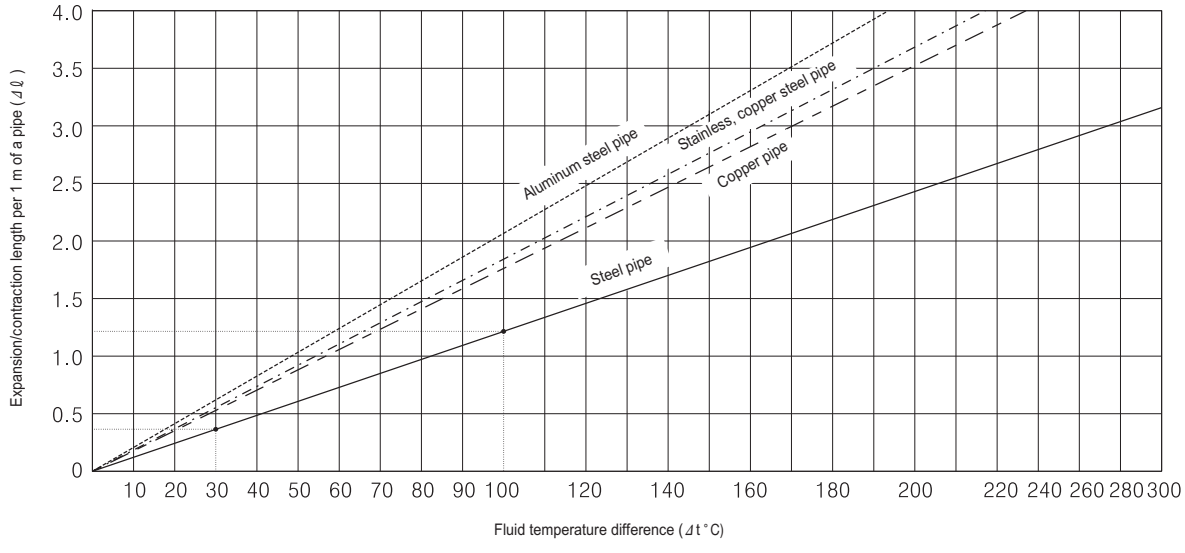
$$N = \frac{\Delta\ell}{\delta}$$

N : Number installed
$\Delta\ell$: Pipe's expansion or contraction length
δ : Maximum expansion/contraction length

Data / Bellows Type Expansion Pipe Joint

■ Pipe' s expansion/contraction length according to temperature changes

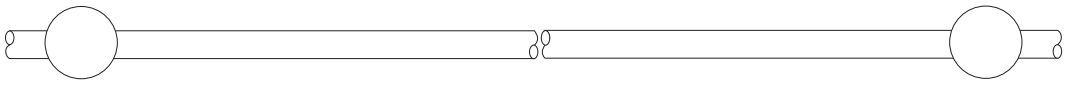
≫ Diagram 1 Expansion/contraction length of a pipe (Expansion/contraction length per 1 m of a pipe)



≫ Table 1 Expansion/contraction length of a pipeline (Expansion/contraction length corresponding to different pipeline lengths)

Pipe type	Pipe length	Fluid temperature difference ⊿t°C																						Pipe length
		10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	
Steel pipe	1	0.122	0.244	0.366	0.488	0.61	0.732	0.854	0.976	1.1	1.22	1.34	1.46	1.59	1.71	1.83	1.95	2.07	2.2	2.32	2.44	2.56	2.68	1
	5	0.61	1.22	1.83	2.44	3.05	3.66	4.27	4.88	5.49	6.1	6.71	7.32	7.63	8.54	9.15	9.76	10.4	11.0	11.6	12.2	12.8	13.4	5
	10	1.22	2.44	3.66	4.88	6.1	7.32	8.54	9.76	11.0	12.2	13.4	14.6	15.9	17.1	18.3	19.5	20.7	22.0	23.2	24.4	25.6	26.8	10
	15	1.83	3.66	5.49	7.32	9.15	11.0	12.8	14.6	16.5	18.3	20.1	22.0	23.8	25.6	2735	29.3	31.1	32.9	34.8	36.6	38.4	40.3	15
	20	2.44	4.88	7.32	9.76	12.2	14.6	17.1	19.5	22.0	24.4	26.8	29.3	31.7	34.2	36.6	39.0	41.5	43.9	46.4	48.8	51.2	53.7	20
	25	3.05	6.1	9.15	12.2	15.3	18.3	21.4	24.4	27.5	30.5	33.6	39.7	42.7	45.8	48.8	51.9	54.9	58.0	61.0	61.0	64.1	67.1	25
	30	3.66	7.32	11.0	14.6	18.3	2200	25.6	29.3	32.9	36.6	40.3	43.9	47.6	51.2	54.9	58.6	62.2	65.9	69.5	73.2	76.9	80.5	30
	35	4.27	8.54	12.8	17.1	21.4	25.6	29.9	34.2	38.4	42.7	47.0	51.2	55.5	59.8	64.1	68.3	72.6	76.9	81.1	85.4	89.7	93.9	35
	40	4.88	9.76	14.6	19.5	24.4	29.3	34.2	39.0	43.9	48.8	53.7	58.6	63.4	68.3	73.2	78.1	83.0	87.8	92.7	97.6	102.5	107.4	40
Copper pipe	1	0.177	0.354	0.531	0.708	0.885	1.06	1.24	1.42	1.59	1.77	1.95	2.12	2.30	2.48	2.66	2.83	3.01	3.19	3.36	3.54	3.72	3.89	1
	5	0.885	1.77	2.66	3.54	4.43	5.31	6.2	7.1	7.97	8.85	9.74	10.6	11.5	12.4	13.3	14.2	15.1	15.9	16.8	11.7	18.6	19.5	5
	10	1.77	3.54	5.31	7.1	8.85	10.6	12.4	15.9	17.7	19.5	21.2	23.0	24.8	26.6	28.3	30.1	31.9	33.6	35.4	37.2	3	38.9	10
	15	2.66	5.31	7.97	10.6	13.3	15.9	18.6	21.2	23.9	26.6	29.2	31.9	34.5	37.2	39.8	42.5	45.1	47.8	50.5	53.1	55.8	58.4	15
	20	3.54	7.1	10.6	14.2	17.7	21.2	24.8	28.3	31.9	35.4	38.9	42.5	46.0	49.6	53.1	56.6	50.2	63.7	67.3	70.8	74.3	77.9	20
	25	4.43	8.85	13.3	17.7	22.1	26.6	31.0	35.4	39.8	44.3	48.7	53.1	57.5	62.0	66.4	70.8	75.2	79.7	84.1	88.5	92.9	97.4	25
	30	5.31	10.6	15.9	21.2	26.6	31.9	37.2	42.5	47.8	53.1	58.4	63.7	69.0	74.3	79.7	85.0	90.3	65.6	100.9	6.2	111.5	116.8	30
	35	6.2	12.4	18.6	24.8	31.0	37.2	43.4	49.6	55.8	62.0	68.2	74.3	80.5	86.7	92.9	99.1	105.3	111.5	117.7	123.9	130.0	136.3	35
	40	7.1	14.2	21.2	28.3	35.4	42.5	49.6	56.6	63.7	70.8	77.9	85.0	92.0	99.1	106.2	113.3	120.4	127.4	135.5	141.6	148.7	155.8	40
Stainless steel pipe	1	0.184	0.368	0552	0.736	0.92	1.1	1.29	1.047	1.66	1.84	2.02	2.21	2.39	2.58	2.76	2.94	3.13	3.31	3.5	3.68	3.86	4.08	1
	5	0.92	1.84	2.76	3.68	4.6	5.52	6.44	7.36	8.28	9.2	10.1	11.0	12.0	12.9	13.8	14.7	15.6	16.6	17.5	18.4	19.3	20.2	5
	10	1.84	3.68	5.52	7.36	9.2	11.0	12.9	14.7	16.6	18.4	20.2	22.1	23.9	25.8	26.6	29.4	31.3	33.1	35.0	36.8	38.6	40.5	10
	15	2.76	5.52	8.28	11.0	13.8	16.6	19.3	22.1	24.8	27.6	30.4	33.1	35.9	38.6	41.4	44.2	46.9	49.7	52.4	55.2	58.0	60.7	15
	20	3.68	7.36	11.0	14.7	18.4	22.1	25.8	29.4	33.1	36.8	40.5	44.2	47.8	51.5	55.2	58.9	62.6	66.2	69.6	73.6	77.3	81.0	20
	25	4.6	9.2	13.8	18.4	23.0	27.6	32.2	36.8	41.4	46.0	50.6	55.2	59.8	64.4	69.0	73.6	78.2	82.8	87.4	92.0	96.6	101.2	25
	30	5.52	11.0	16.6	22.1	27.6	33.1	38.6	44.2	49.7	55.2	60.7	66.2	71.8	77.3	82.8	88.3	93.2	99.4	104.9	110.4	115.9	121.4	30
	35	6.44	12.9	19.3	25.8	32.2	38.6	45.1	51.5	58.0	64.4	70.8	77.3	83.7	90.2	96.6	103	109.5	115.9	122.4	128.8	135.2	141.7	35
	40	7.36	14.7	22.1	29.4	36.8	44.2	51.5	58.9	66.2	73.6	81.0	88.3	95.7	103	110.4	117.8	125.1	132.5	139.8	147.2	154.6	161.9	40

■ Example of selecting a bellows type expansion pipe joint



- Pipeline length(ℓ) = 30m
- Maximum applicable temperature(t_1) = 110°C
- Temperature during installation = -10°C
- If the ambient temperature (t_3) equals 20°C during installation

First : Calculate the pipe's expansion/contraction length.

The temperature difference of the pipe's expanding axis is $\Delta t_1 = t_1 - t_3 = 110 - 20 = 90°C$
The temperature difference of the pipe's contracting axis is $\Delta t_2 = t_3 - t_2 = 20 - (-10) = 30°C$.
While referring to the pipe's expansion/contraction length (Table 1), find the point where the pipe's length is 30 m when the fluid' s temperature difference is (Δt)90° C, and make a perpendicular connection. The length of pipe expansion ($\Delta \ell_1$) is 32.9 mm. Find the point where the pipe's length is 30 m when the fluid's temperature difference is (Δt)30° C, and make a perpendicular connection. The length of pipe contraction ($\Delta \ell_2$) is 11.00 mm.

Second : Once the expansion/contraction length is determined, decide on the type of the bellows type expansion pipe joint and the number of joints.

When selecting the type YBJ-1S (single), which is a product approved with a Korean Industrial Standard mark

In case of a single bellows type expansion pipe joint

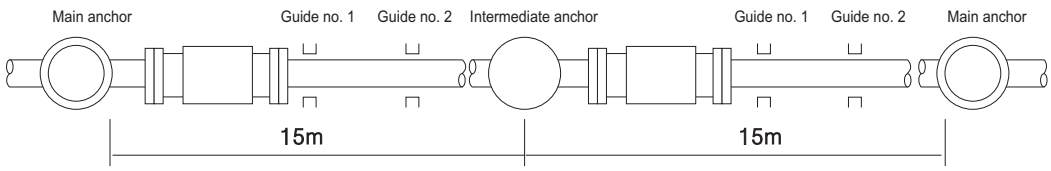
Pipe-expanding side (δ = 50mm)
Pipe-contracting side (δ = 20mm)

Therefore,

$$n = \frac{\Delta \ell_1}{\delta} = \frac{32.9}{25} = 1.32 \text{ joints}$$

$$n = \frac{\Delta \ell_2}{\delta} = \frac{11.0}{10} = 1.1 \text{ joints}$$

Since the number of joints of the side that is bigger between the pipe-expanding side and pipe-contracting side is adopted, the number of the single bellows type expansion pipe joint becomes two.



When selecting the type YBJ-2W (double), which is a product approved with a Korean Industrial Standard mark

In case of a double bellows type expansion pipe joint

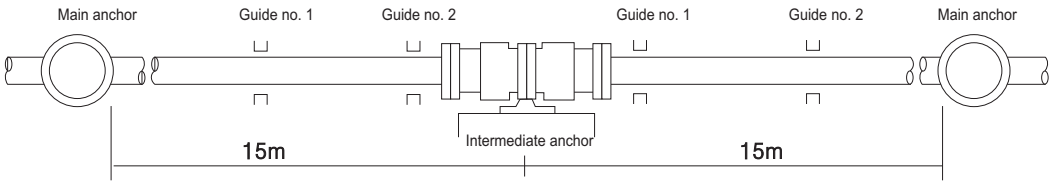
Pipe-expanding side (δ = 50mm)
Pipe-contracting side (δ = 20mm)

Therefore,

$$n = \frac{\Delta \ell_1}{\delta} = \frac{32.9}{50} = 0.61 \text{ joints}$$

$$n = \frac{\Delta \ell_2}{\delta} = \frac{11.0}{20} = 0.55 \text{ joints}$$

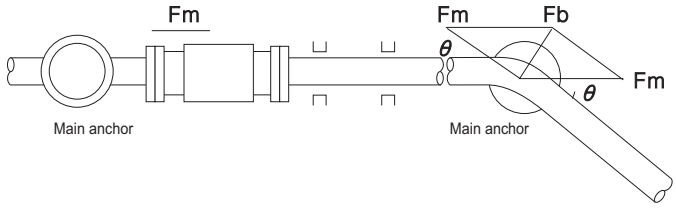
Since the number of joints of the side that is bigger between the pipe-expanding side and pipe-contracting side is adopted, the number of the double bellows type expansion pipe joint becomes one.



■ Deciding on where to install anchors and guides

● **Installation of main anchor**

○ Installation location
- Install at two ends of straight pipeline section
- Install in branch pipeline
- Reducer and valve installation points



1. Load on main anchor in straight pipeline

$Fm = (Ae \times P) + (K \times \delta)$

$Fm = Fp + Fs$

$Fp = Ae + p$

$Fs = K \times \delta$

Fm : Load on main anchor in straight pipeline section (kgf)
Fp : Thrust force caused by internal pressure (kgf)
Fs : Compressive load on expansion pipe joint (kgf)
Ae : Effective area of bellows (cm^2)
P : Fluid pressure (kgf/cm^2)
K : Spring constant of bellows (kgf/mm)
δ : Expansion/contraction length (mm)

2. Load on main anchor in curved pipeline

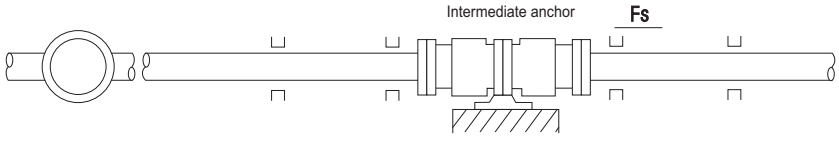
$$Fc = \frac{2A\rho V^2}{g} \times \sin\frac{\theta}{2}$$

$$Fb = 2Fm \cdot \sin\frac{\theta}{2} + Fc$$

Fb : Load on main anchor in curved pipeline section (kgf)
Fc : Load caused by centrifugal force of fluid (kgf)
θ : Angle of curved pipeline section
A : Cross section of pipe (cm^2)
ρ : Fluid density (kg/cm^2)
V : Fluid speed (cm/mm)
g : Gravity acceleration (cm/mm)

● Installation of intermediate anchor

○ Installation location
- If there are two or more expansion pipe joints between main anchors, install an intermediate anchor in the middle
- Fixing pole area of double expansion pipe joint



$Fi = Fs = K \times \delta$

Fi : Load on intermediate anchor (kgf)
Fs : Compressive load on expansion pipe joint (kgf)
K : Spring constant of bellows (kgf/mm)
δ : Expansion/contraction length (mm)

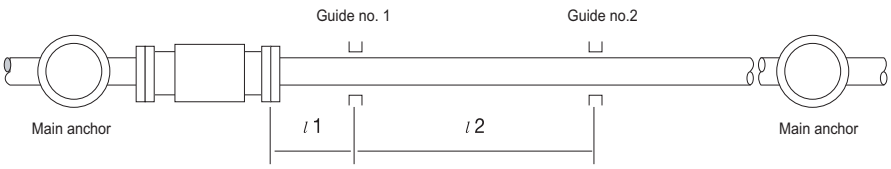
■ Deciding on where to install anchors and guides

● Installation of guide

Guide no. 1 and guide no. 2 are installed to prevent buckling from pipeline expansion and bending from the pipeline's own weight. Install guide no. 1 in close proximity to the expansion pipe joint. Refer to the following formula and chart for the installation interval of guide no. 2.

$$\ell_2 = \sqrt{\frac{\pi^2 E I}{F \cdot W}}$$

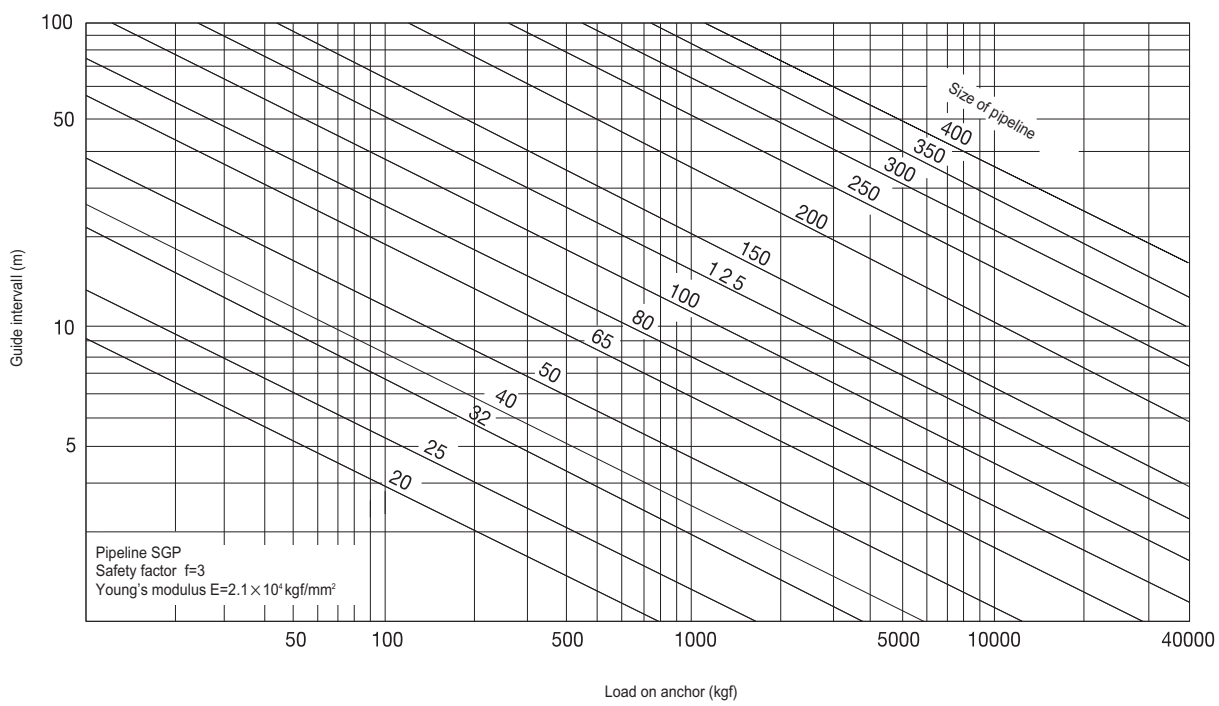
ℓ_2 : Guide no. 2 interval ..... (cm)
W : Buckling load ..... (kgf)
E : Young's modulus ..... (kgf/cm^2)
I : Moment of inertia ..... (cm^4)
f : Safety factor



≫ **Table 1 Expansion/contraction length of a pipeline (Expansion/contraction length corresponding to different pipeline lengths)**

Category / Size	~40	50	65	80	100	125	150	200	250
Guide no. 1 : ℓ_1(m)	0.15	0.2	0.25	0.3	0.4	0.5	0.6	0.8	1.0
Guide no. 2 : ℓ_2(m)	2.5	3.0	4.0	5.0	6.0	8.0	10	12	14

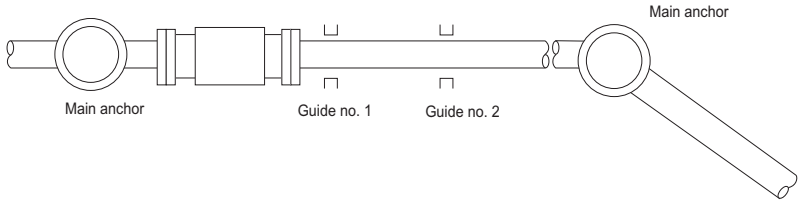
≫ **Chart 2. Guide interval to prevent buckling**



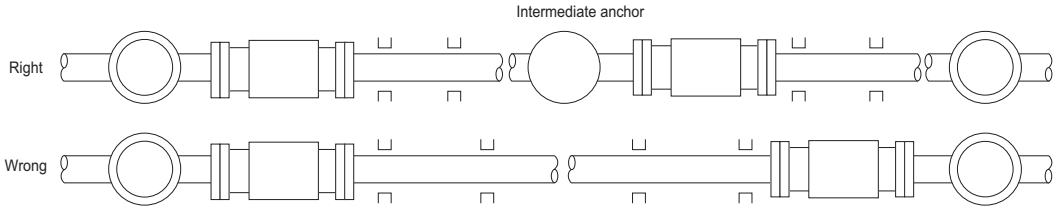
■ Cautions for installation

The following cautions need to be taken for installation to ensure maximum performance of the bellows type expansion pipe joint.

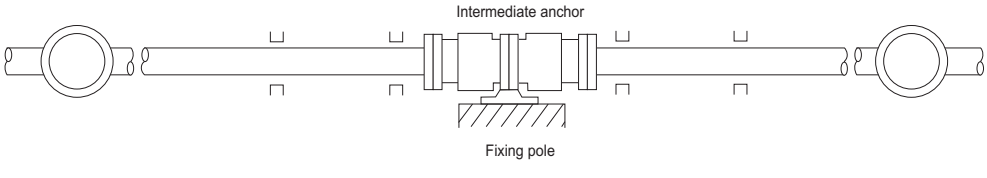
1. Fix the two ends of the straight pipeline and where the pipeline is curved.



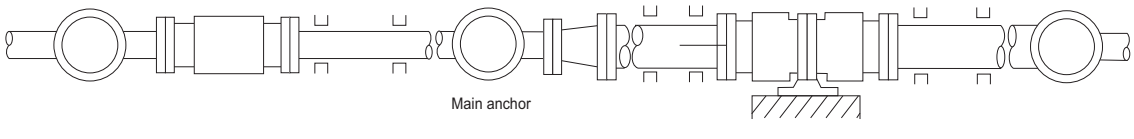
2. There are cases where several bellows type expansion pipe joints are installed consecutively when the length of the straight pipeline is long. In such cases, an intermediate anchor needs to be installed in the middle of each bellows type expansion pipe joint.



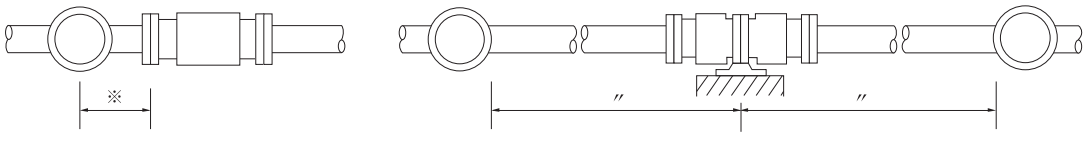
3. Points where main anchors and intermediate anchors are installed need to be sufficiently strong to withstand the loaded strength. Since the same level of load is applied to a double bellows type expansion pipe joint as an intermediate anchor, a fixing pole should be installed.



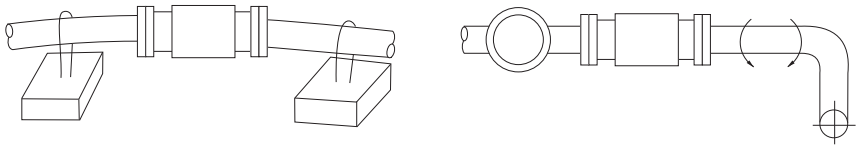
4. A main anchor should be installed when the size of a pipeline changes due to the use of an expansion pipe (reducer).



5. Install a single bellows type expansion pipe joint close to an anchor as much as possible. Install a double bellows type expansion pipe joint in the middle of two anchors.



6. The weight of the pipeline coupled with a bellows type expansion pipe joint and other weight should not directly apply to the bellows type expansion pipe joint. In addition, make sure that returning force is not applied.

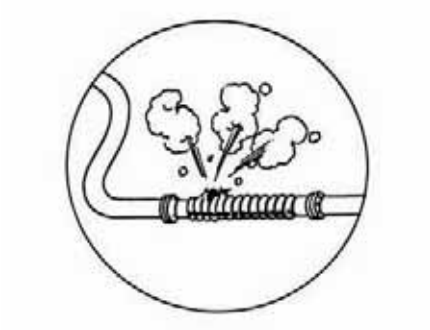


7. Remove bolts or nuts used for fixing surfaces after installation.
8. When applying thermal insulations to a bellows type expansion pipe joint, do not install a lagging material on the expansion/contraction operation part.

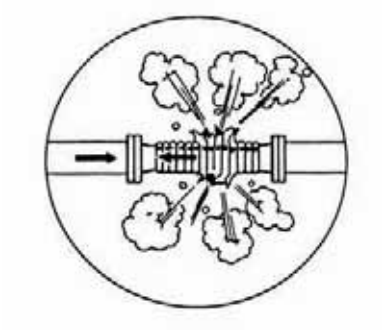
Data / Bellows Type Expansion Pipe Joint

■ Cautions for handling

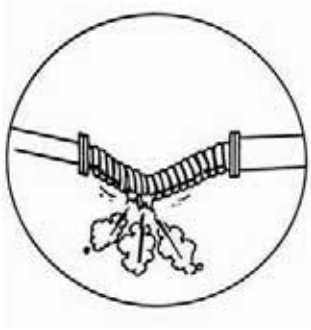
When using bellows, there is a need to install them after considering several matters from a professional point of view. There are simple precautionary measures that need to be taken when installing bellows in a pipeline. Serious accidents are caused by inattentiveness in handling bellows, rather than defects of the bellows.



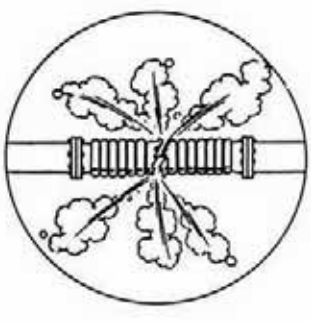
(1) Do not use the product for a long straight line (pipeline).



(2) Install the product so that the direction of the arrow indicated on the product is in line with the direction of the fluid' flow.



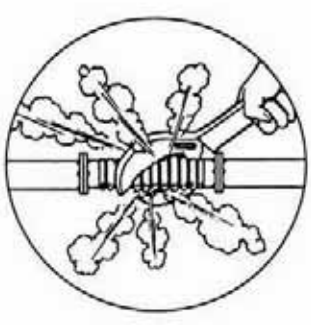
(3) Make sure that the pipeline diameter and weight, etc. is in compliance with the standard of the bellows coupling parts.



(4) Do not use out-of-spec bellows.

(5) When installing two or more bellows in a straight pipeline section, consider expansion/contraction capacity individually.

(6) Do not cause outside impact.



(7) Do not touch the bellows wrinkles without good reason.

MEMO

Ball / Slip / Multi Joint

8

Ball / slip / Multi joint

Type	Size	Applicable pressure (kgf/cm²g)	Materials (Body)	Applicable fluid	Page
BG/BI series	32(1¼")	10, 20, 30	GB, SUS, STPG, SCPH2, GCD	Sat. Steam, Superheat Steam, Oil, Water, Gas	136
SIS/SID series					137
SGS/SGD series					138
MJ-1/MJ-2 series					139
MJ-3 series	50(2")				140
BSI series	32(1¼")				141
UG-1 series					142

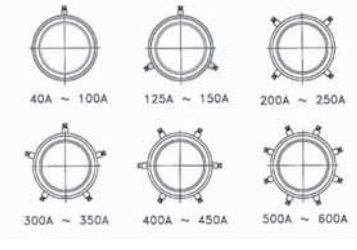
BG / BI Type Ball Joint

With the grand packing type, it is easy to install, and has a strong and simple internal structure.
It absorbs omni-directional displacements and is applied for thermal expansion, contraction, and ground subsidence. The injection packing type absorbs omni-directional displacements and allows maintenance during operation.

Grand Type

Injection Type

■ Dimensional drawing



Packing Cylinder Orientation

■ Features

- Grand & injection type packing ball joint.
- Absorbs omni-directional displacements & cover extremely high-temperature fluid.
- Absorb pipeline's expansion or contraction from thermal expansion outcome.
- Protect pipelines, buildings, facilities, etc. from ground damage.
- Absorb pipeline displacements which result from ground subsidence or transformation of large storage tanks.
- Absorb vibration, distortions, etc. generated from pumps & turbines.
- Maintenance is available even during operation with full of fluid in the pipeline.

■ Specifications

Type		BG series	BI series
Applicable fluid		Sat. Steam, Superheat Steam, Oil, Water, Gas	
Maximum running pressure		10, 20, 30kg/cm^{2}g	
Maximum applicable temperature		250° C	250° C (Special orders are available for 250° C)
Maximum displacement angle		15~30°	
Materials	Body	GB, STS, STPG, SCPH2, GCD	
	Ball	GB, SUS, SC49	
	Packing	Teflon+Grafoil (SG NO.100)	Grafoil (SI NO.700)

▶Clients can choose materials when placing an order.

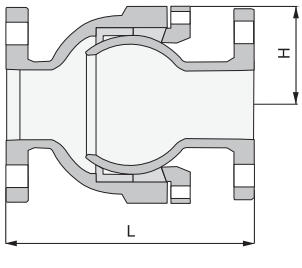
■ Dimensions

(mm)

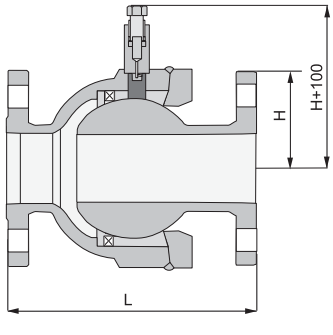
Size	L	H
32(1¼")	175	67.5
40(1½")	175	70
50(2")	190	77.5
65(2½")	190	87.5
80(3")	235	92.5
100(4")	250	105
125(5")	305	125
150(6")	355	140
200(8")	390	165
250(10")	420	200
300(12")	445	222.5
350(14")	505	245
400(16")	575	280
450(18")	615	620.0
500(20")	645	337.5
550(22")	685	372.5
600(24")	685	397.5

▶ Other pipe diameters are available by made-to-orders.

■ Dimensional drawing



Grand Type



Injection Type

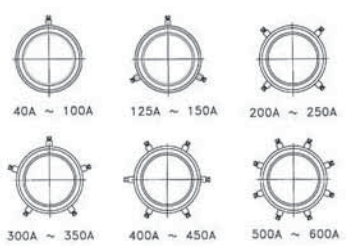
SI Type Slip Joint

As an injection packing type, it absorbs one-way (two-way) displacements and is applied for thermal expansion and contraction. Maintenance can be made during operation, thanks to injection packing.

SIS Single Type

SID Double Type

■ Dimensional drawing



Packing Cylinder Orientation

■ Features

- Injection packing type double slip joint.
- Absorb straight line direction displacements : It can be used for extremely high-temperature fluid.
- Internal & external guide structure : It has longer life span than other conventional slip joints.
- External guide with outstanding lubrication ensures smooth slip.
- Safe packing injection is available under internal pressure.

■ Specifications

Applicable fluid		Sat. Steam, Superheat Steam, Oil, Water, Gas
Maximum running pressure		10, 20, 30kg/cm^{2}g
Maximum applicable temperature		250° C (Special orders are available for 250° C)
Materials	**Body**	GB, SUS, STPG, SCPH2, GCD
	Sleeve	GB, SUS, SC49
	Packing	Grafoil (SI NO.800)

▶ The live loading method and dust-cover attachment are available by made-to-orders.

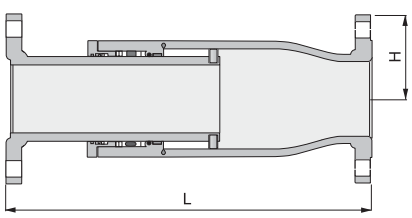
■ Dimensions

(mm)

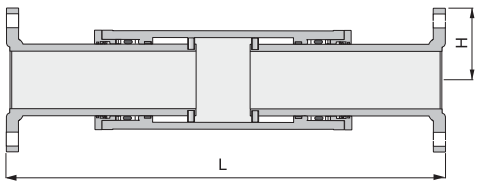
Size	L (Single)	L (Double)	H
32(1¼")	573	960	67.5
40(1½")	573	960	70
50(2")	573	960	77.5
65(2½")	592	978	87.5
80(3")	608	1,010	92.5
100(4")	639	1,023	105
125(5")	666	1,152	125
150(6")	705	1,153	140
200(8")	705	1,153	165
250(10")	771	1,234	200
300(12")	936	1,260	222.5
350(14")	954	1,296	245
400(16")	987	1,309	280
450(18")	1,159	1,349	620
500(20")	1,166	1,501	337.5
550(22")	1,219	1,519	327.5
600(24")	1,320	1,519	397.5

▶ The flanged type and the welding type have the same dimensions.
▶ The dimensions above are those for the full open state.
▶ These specifications are subject to change for product quality improvements.

■ Dimensional drawing



Single Type



Double Type

SG Type Slip Joint

As a grand packing type, this absorbs one-way direction (two-way direction) displacements, and is applied for thermal expansion and contraction.
Thanks to the adoption of the live loading method, simple maintenance is ensured.

SGS Single Type

SGD Double Type

■ Features

- Injection packing type single slip joint.
- Absorb displacements in a straight line direction.
- Internal & external guide structure has longer life span than other conventional slip joints.
- External guide with outstanding lubrication ensures smooth slip.
- Highly resistant to pipeline vibration & distortions by adopted live loading method.

■ Specifications

Applicable fluid		Sat. Steam, Superheat Steam, Oil, Water, Gas
Maximum running pressure		10, 20, 30kg/cm^{2}g
Maximum applicable temperature		250° C (Special orders are available for 250° C)
Materials	**Body**	GB, SUS, STPG, SCPH2, GCD
	Sleeve	GB, SUS, SC49
	Packing	Teflon+Grafoil (SI NO.800)

▶ The live loading method and dust-cover attachment are available by made-to-orders.

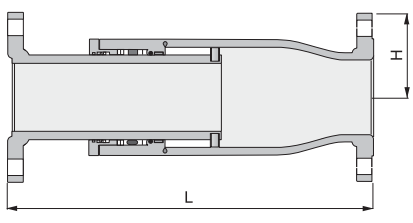
■ Dimensions

(mm)

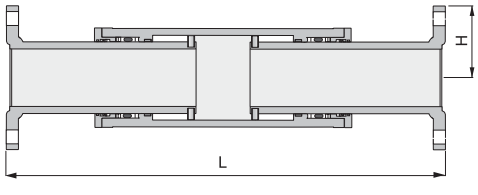
Standard	L (Single)	L (Double)	H
32(1¼")	573	960	67.5
40(1½")	573	960	70
50(2")	573	960	77.5
65(2½")	592	978	87.5
80(3")	608	1,010	92.5
100(4")	639	1,023	105
125(5")	666	1,152	125
150(6")	705	1,153	140
200(8")	705	1,153	165
250(10")	771	1,234	200
300(12")	936	1,260	222.5
350(14")	954	1,296	245
400(16")	987	1,309	280
450(18")	1,159	1,349	620
500(20")	1,166	1,501	337.5
550(22")	1,219	1,519	327.5
600(24")	1,320	1,519	397.5

▶ The flanged type and the welding type have the same dimensions.
▶ The dimensions above are those for the full open state.
▶ These specifications are subject to change for product quality improvements.

■ Dimensional drawing



SGS Single Type



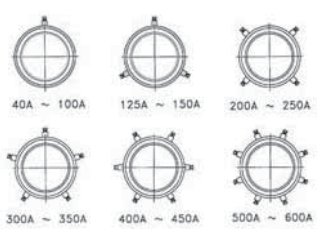
SGD Double Type

MJ Type Ball & Slip Joint

As an injection packing type, this product absorbs omni-directional displacements, and is applied for thermal expansion, contraction, and ground subsidence.
Maintenance can be made during operation, thanks to injection packing.

MJ-1 Single Type

MJ-2 Double Type



Packing Cylinder Orientation

■ Features

- Multi-joint type functions combined ball & slip joint.
- Absorb pipeline expansion and contraction results from thermal expansion.
- Protect pipelines, buildings, facilities, etc. from ground damage.
- Absorb pipeline displacements result from ground subsidence or transformation of large storage tanks.
- Used for hydraulic equipment, petrochemicals, mines, agricultural sites, cable facilities, and various plants.

■ Specifications

Applicable fluid		Sat. Steam, Superheat Steam, Oil, Water, Gas
Maximum running pressure		10, 20, 30kg/cm^{2}g
Maximum applicable temperature		250° C (Special orders are available for 250° C)
Materials	**Body**	GB, SUS, STPG, SCPH2, GCD
	Sleeve	GB, SUS, SC49
	Packing	Grafoil (SG NO.800)

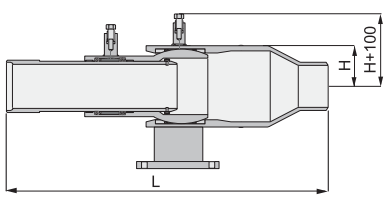
■ Dimensions

(mm)

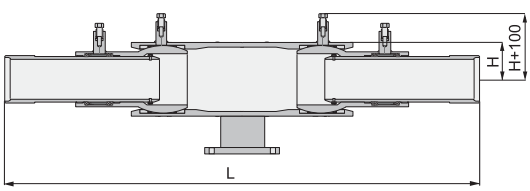
Size	L (Single)	L (Double)	H	θ°
32(1¼")	573	960	67.5	8
40(1½")	573	960	70	8
50(2")	573	960	77.5	4.3
65(2½")	592	978	87.5	4.3
80(3")	608	1,010	92.5	4.3
100(4")	639	1,023	105	4.3
125(5")	666	1,152	125	4.3
150(6")	705	1,153	140	4.3
200(8")	705	1,153	165	4.3
250(10")	771	1,234	200	4.3
300(12")	936	1,260	222.5	4.3

▶ The flanged type and the welding type have the same dimensions.
▶ The dimensions above are those for the full open state.
▶ These specifications are subject to change for product quality improvements.

■ Dimensional drawing



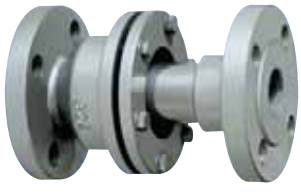
MJ-1 Single Type



MJ-2 Double Type

MJ-3 Multi Joint

As a grand packing type, this product absorbs omni-directional displacements, and is suitable for bending, expansion/contraction, rotational movements, and various fluid control facilities.
It enables effective measures against external stress, such as ground subsidence and earthquakes.



■ Features

- Reduce installation space as functions combined ball & slip joint.
- Absorb pipeline expansion & contraction results from thermal expansion.
- Protect pipelines, buildings, facilities, etc. from ground damage.
- Absorb pipeline displacements result from ground subsidence or transformation of large storage tanks.
- Used for hydraulic equipment, petrochemicals, mines, agricultural sites, cable facilities, and various plants.

■ Specifications

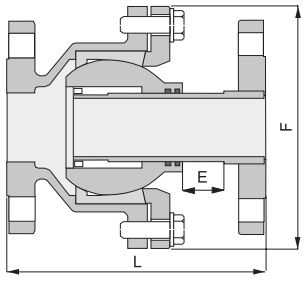
Applicable fluid		Sat. Steam, Superheat Steam, Oil, Water, Gas
Maximum running pressure		10, 20, 30kg/cm^{2}g
Maximum applicable temperature		250° C
Maximum displacement angle		15~30°
Materials	**Body**	GB, SUS, STPG, SCPH2, GCD
	Sleeve	GB, SUS, SC49
	Packing	Teflon+Grafoil (SG NO.100)

▶ The live loading method and dust-cover attachment are available by made-to-orders.
▶ The injection type is available by made-to-orders.

■ Dimensions

Size(mm)	Flanged type			Welding type			Torque
	L(mm)	F(mm)	E(mm)	L(mm)	(mm)	E (mm)	(kgf.m)
50(2")	210	121	40	210	121	40	25
65(2½")	230	141	40	230	141	40	35
80(3")	260	159	40	260	159	40	55
100(4")	280	195	40	280	195	40	80
125(5")	300	225	45	300	225	45	135
150(6")	310	255	50	310	255	50	190
200(8")	360	323	60	360	323	60	310

■ Dimensional drawing



Flanged Type

BSI Multi Joint

As an injection packing type, this product absorbs omni-directional displacements, and is applied for thermal expansion and contraction. Maintenance can be made during operation, thanks to injection packing.

■ Features

- Functions combined ball and slip joint, effectively uses both strengths.
- Absorb pipeline expansion & contraction which results from thermal expansion.
- Protect pipelines, buildings, facilities, etc. from ground damage.
- Used for hydraulic equipment, petrochemicals, mines, agricultural sites, cable facilities, and various plants.
- Absorb high-rise building' s sway & building shortening.

■ Specifications

Applicable fluid		Sat. Steam, Superheat Steam, Oil, Water, Gas
Maximum running pressure		10, 20, 30kg/cm^{2}g
Maximum applicable temperature		250° C (Special orders are available for 250° C or higher)
Materials	**Body**	GB, SUS, STPG, SCPH2, GCD
	Slip/Ball	GB, SUS, SC49
	Packing	Grafoil (Sl NO.800)

■ Dimensions (Tr+100 standard)

(mm)

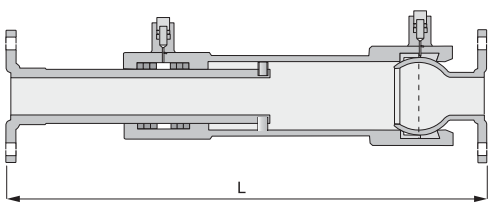
Size	L (TR100 standard)
32(1¼")	600
40(1½")	600
50(2")	615
65(2½")	625
80(3")	680

(mm)

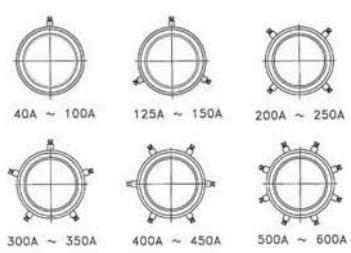
Size	L (TR100 standard)
100(4")	690
125(5")	770
150(6")	830
200(8")	850
250(10")	910

▶ These specifications are subject to change for product quality improvements.
▶ Other sizes are available by made-to-orders.

■ Dimensional drawing



SIngle Type



Packing Cylinder Orientation

UG-1 Underground Slip Joint

As an injection packing type, this product absorbs displacements and is applied for thermal expansion and contraction. Injection packing has been applied.

■ Features

- Injection packing type single slip joint.
- Absorb displacements in straight line direction : It can be used for extremely high-temperature fluid.
- Internal & external guide structure has longer life span than other conventional slip joints.
- External guide with outstanding lubrication ensures smooth slip.
- Safe packing injection is available with internal pressure.
- Double-structure product ensures thermal insulation (for underground use).

■ Specifications

Applicable fluid		Sat. Steam, Superheat Steam, Oil, Water, Gas
Maximum running pressure		10, 20, 30kg/cm^{2}g
Maximum applicable temperature		250° C (Special orders are available for 250° C)
Materials	**Body**	GB, SUS, STPG, SCPH2, GCD
	Sleeve	GB, SUS, SC49
	Packing	Grafoil (SG NO.800)

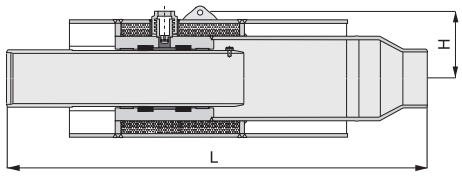
■ Dimension (Tr+100 standard)

(mm)

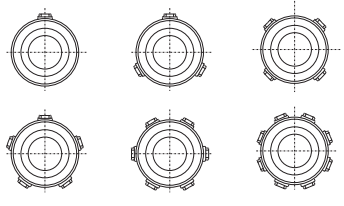
Size	L (Single)	L (Double)	H
32(1¼")	573	960	67.5 (Insulation thickness+60)
40(1½")	573	960	70 (Insulation thickness+60)
50(2")	573	960	77.5 (Insulation thickness+60)
65(2½")	592	978	87.5 (Insulation thickness+60)
80(3")	608	1,010	92.5 (Insulation thickness+60)
100(4")	639	1,023	105 (Insulation thickness+60)
125(5")	666	1,152	125 (Insulation thickness+60)
150(6")	705	1,153	140 (Insulation thickness+60)
200(8")	705	1,153	165 (Insulation thickness+60)
250(10")	771	1,234	200 (Insulation thickness+60)
300(12")	936	1,260	222.5 (Insulation thickness+60)
350(14")	954	1,296	245 (Insulation thickness+60)
400(16")	987	1,309	280 (Insulation thickness+60)
450(18")	1,159	1,349	620 (Insulation thickness+60)
500(20")	1,166	1,501	337.5 (Insulation thickness+60)
550(22")	1,219	1,519	327.5 (Insulation thickness+60)
600(24")	1,320	1,519	397.5 (Insulation thickness+60)

▶ The flanged type and the welding type have the same dimensions.
▶ The dimensions above are those for the full open state.
▶ These specifications are subject to change for product quality improvements.

■ Dimensional drawing



Flanged Type



Packing Cylinder Orientation

■ Standard type and pressure balance type

In case of the standard type, the sleeve operates when a thrust is applied, resulting from the application of internal pressure (P). This thrust force is

Effective area X pressure = $\frac{\pi}{4}D^2 \times P$

The frictional resistance and thrust that is caused by this internal pressure actuates on the pipeline's surrounding. This is why there is a need for a strong anchor that can withstand this frictional resistance. This is not the case for the pressure balance type. Assuming that the external diameter of sleeve ① is d1, and that of sleeve ② is d2,

Sleeve's left direction effort = $\frac{\pi}{4}d_1^2P$

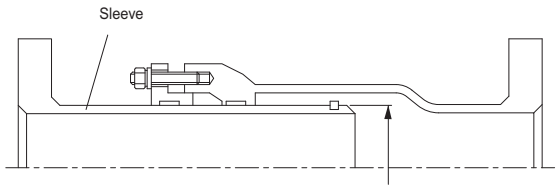
Sleeve's right direction effort = $\frac{\pi}{4}(d_2^2 - d_1^2)P$

which is, $\frac{\pi}{4}d_1^2P = \frac{\pi}{4}(d_2^2 - d_1^2)P$

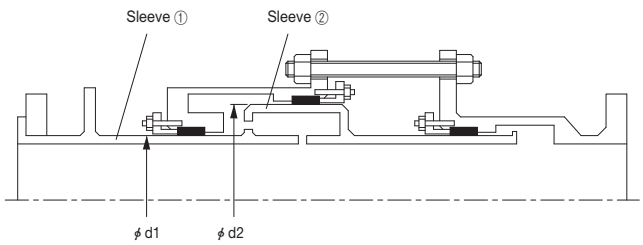
Or $\frac{\pi}{4}D^2 \times P$

meaning that there is no thrust caused by internal pressure.

≫ Standard type



≫ Pressure balance type



As seen above, the pressure balance type is free from a thrust. Therefore, the load on the anchor is only the frictional resistance of the sleeve.
As such, where a strong anchor cannot be installed due to a concentration of pipelines, a large diameter, or a high pressure level, the use of a pressure balance type would lead to economic advantages, resulting from a reduction in the construction period and anchor installations.

■ Calculation of a pipeline' s expansion/contraction length

$\triangle \int = \beta x \triangle t x \int$

$\triangle \int$ = Pipeline's expansion/contraction length(mm)
β = Pipeline's expansion coefficient
Steel pipe : 12.2 x 10-3mm/m/° C
Copper pipe : 17.7 x 10-3mm/m/° C
Stainless pipe : 18.4 x 10-3 mm/m/° C
$\triangle t$ = Temperature difference (° C)
$\int$ = Pipeline length (m)
Notes) The expansion/contraction length per 1 m of a pipeline can be calculated by Diagram 1 on page 126 as well.

■ Load on anchor

Load on main anchor in straight pipeline section Fm (N) = Ae x P + u
Load on intermediate anchor in straight pipeline section Fi (N) = u
In terms of the pressure balance type, however, Fm = Fi = u
Ae = Sleeve' s internal pressure area
P = Fluid pressure Mpa
u = Sleeve' s frictional resistance

■ Anchor installation

When using a slip joint, anchors of sufficient strength should be installed. The installation location and types of anchors are as follows:

① Main anchor (Main fixing point)
- The end part of a straight pipeline with a closing plate installed
- A curved pipeline section where the fluid's direction changes
- Where the pipeline changes with the use of a reducer and a slip joint
- Where two slip joints are installed in a pipeline
- Between a main pipeline and a branch pipeline, including a slip joint that is not fixed

② Intermediate anchor (Intermediate anchor)
- If two or more slip joints are used between two main anchors, install an intermediate anchor in the middle of each slip joint

■ Installation of a guide and a pipeline weight support

1. Guide

For proper expansion/contraction of a slip joint, there is a need for guides that would smoothly deliver to anchors the strength needed for axial movements and ensure alignment between the slip joint and the pipeline center. Each guide's installation location should be based on the following interval:

The tolerance with the pipeline center is within ±2mm in case of 125A or smaller, and is within, ±3mm in case of 150A or larger. The parallelism of the pipeline should be maintained within ±0.5°

L1 : Interval between slip joint and guide no. 1
L2 : Interval between guide no. 1 and guide no. 2
L3 : Interval between guide no. 2 and intermediate anchor

The maximum installation interval of each guide can be calculated using the following formula. The maximum value of L3 can be determined by Diagram 4.

$L1 \leqq 4D$
$L2 \leqq 14D$

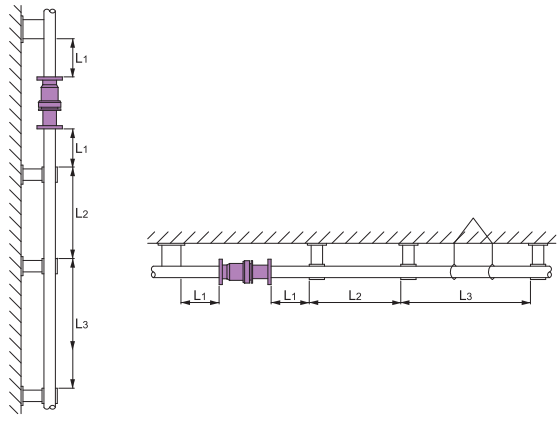
$$L3 \leqq \sqrt{\frac{\pi^2 EI}{fFm}} \qquad I = \frac{\pi}{64}(D^4 - d^4)$$

L1, L2, L3 : Guide interval (maximum) (mm)
D : External diameter of pipeline (mm)
d : Inside diameter of pipeline (mm)
E : Young's modulus of the designed temperature of pipeline (N/mm^2)
Steel pipe 200°C 191 x $103N/mm^2$
Stainless pipe 200°C 183 x $103N/mm^2$
I : Pipeline section 2nd moment (mm^4)
f : Safety factor (3 or more)
Fm : Load on main anchor (N)

2. Pipeline weight support

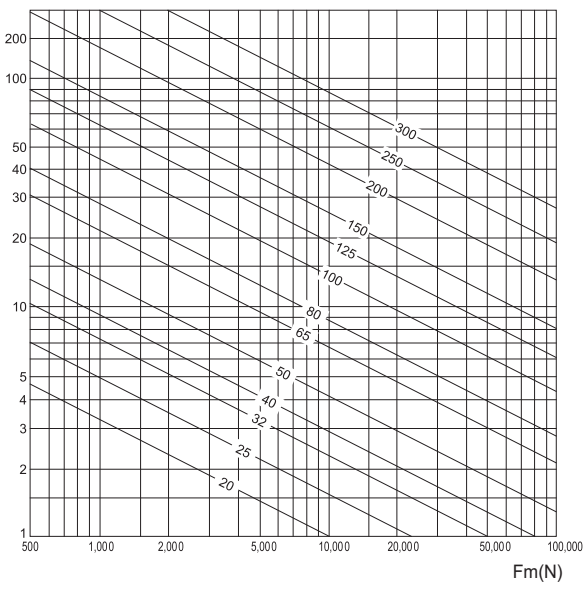
There is a need for a roller support or a roller hanger guide to prevent the bending of a pipeline that results from the pipeline's weight or fluid mass.

≫ Vertical pipeline

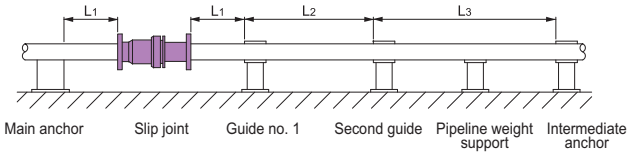


≫ Maximum interval of intermediate guide(10^3 mm)

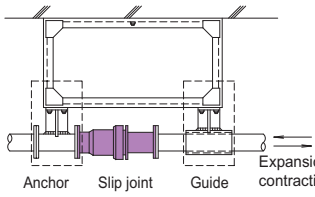
ks=spps(ks D)



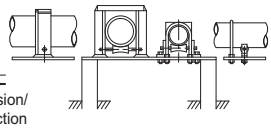
≫ Installation interval of guide



≫ Anchor, guide (example)

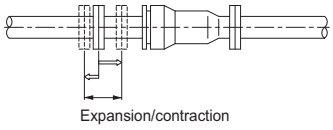


≫ Buckling prevention guide (example)

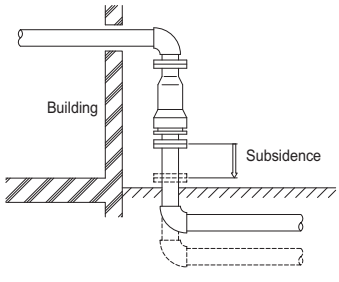


■ Example of use of slip joint

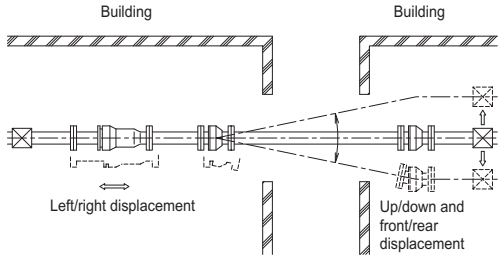
≫ Absorption of thermal expansion



≫ Measure against ground subsidence



≫ Measure against ground subsidence and earthquakes between buildings



Data / Ball Joint for Seismic Isolation

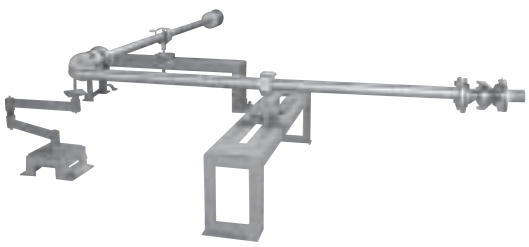
■ Ball joint equipment for seismic isolation (Single)

This is a seismic isolation piping system that has set up equipment for pipelines, slide guides, and supports between ball joints.

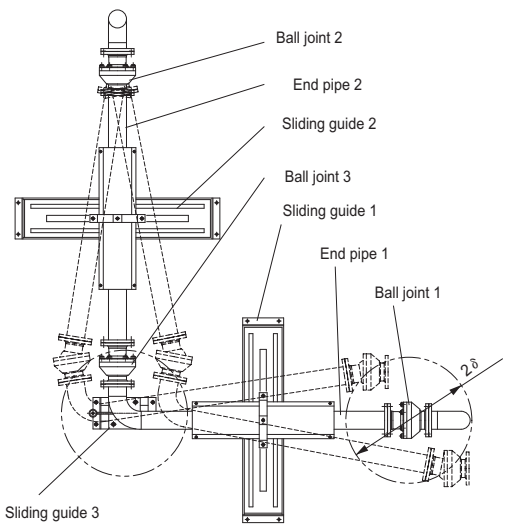
● Features

- The use of a ball joint for seismic isolation allows a small device installation space.
- By equipping the pipelines surrounding a ball joint, the construction period and costs are reduced.

≫ Equipping example



≫ Dimensional drawing



● Specifications

Standard	40 ~ 250
Applicable fluid	Cold/hot water, steam, air, gas, oil
Maximum running pressure	10K, 20K
Maximum displacement (δ)	400, 500, 600, 700mm

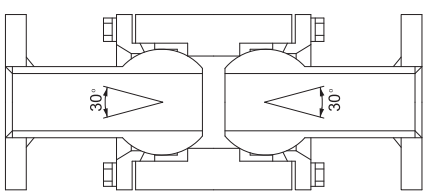
■ Ball joint equipment for seismic isolation (Double)

This is a double type ball joint that has two ball parts on its body.

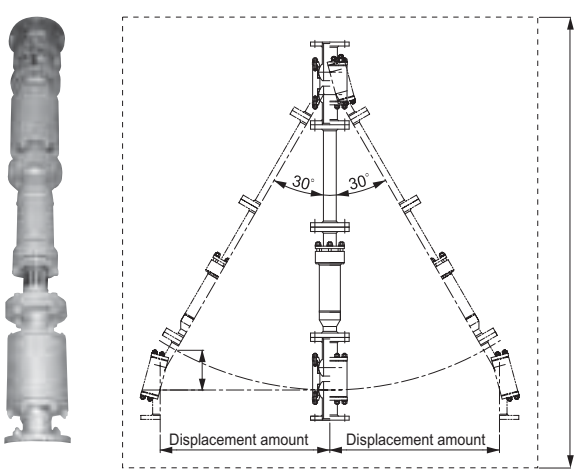
● Features

- Thanks to its large displacement absorption capacity, the distance between ball joints can be reduced. In addition, only a small installation space is required.
- A seismic isolation equipment combined with a slip joint can be installed horizontally in a pipeline. It can be installed vertically and horizontally in a pipeline, even in limited space.

≫ Dimensional drawing



≫ Ball joint equipment for seismic isolation (Double)
This is a seismic isolation equipment that has been combined with a slip joint.



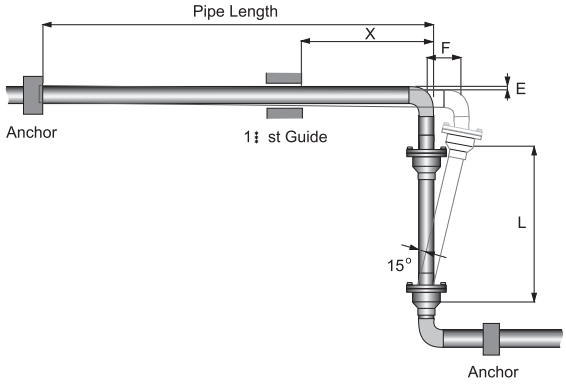
● Specifications

Standard	40 ~ 150
Applicable fluid	Cold/hot water, steam, air, gas, oil
Maximum running pressure	10K
Fluid temperature	220°C or below
Maximum displacement	60°
Hydro-pressure test	15K (Water pressure)
End connection	KS 10K FF (Frange)

Data / Ball Joint Installation Location

A ball joint can be installed in all places where the extraction/contraction of a pipeline can be absorbed. In case of absorption of axial displacement, installation of a ball joint in a bent area of a pipeline or vertically ascending/descending areas is easy even with limited space.

■ When two ball joints are used



What is the most important here is the location of the first guide and the distance between ball joints.

1. Pipeline deflection level (E)

Because a ball joint rotates, once it begins to move as a result of expansion/contraction, a pipeline deflects in the direction of the ball joint installation point.
The deflection level is determined by the expansion/contraction length, and plays an important role in deciding the installation distance of the first guide. In general, a pipeline's deflection level (E) is calculated as follows:

$$E=L-\sqrt{L^2-(\frac{F}{2})^2}$$

Here,
E : Pipeline deflection level (mm)
L : Distance between ball joints (mm)
F : Pipeline's expansion/contraction length (mm)

2. Determining the distance between ball joints

Ball joints should be installed based on at least a minimum distance required to absorb the expansion/contraction of a pipeline. The distance between ball joints (L) is calculated as follows:

$$L \geq \frac{Fx1.5}{\sin\theta} = 6\times F$$

Here,
L : Distance between ball joints
F : Pipeline's expansion/contraction length
θ : Ball joint operation angle
1.5 : Safety factor

3. Distance to guide no. 1 (X)

Because a ball joint rotates, once it begins to move as a result of expansion/contraction, a pipeline deflects in the direction of the ball joint installation point.
The deflection level is determined by the expansion/contraction length, and the distance to guide no. 1 can be calculated based on the following formula:

$$X=\sqrt{\frac{3\times Y\times E\times F}{2\times\delta}}$$

Here,
X : Distance to guide no. 1 (mm)
Y : Young' Midulus (mm)
E : Pipeline deflection level (mm)
F : Pipeline expansion/contraction length (mm)
δ : Allowable stress of pipeline (kgf/mm^2)

■ When three ball joints are used

Using a combination of three ball joints is more effective than using two ball joints.
It is an extremely suitable installation method in case there is insufficient installation space or it is difficult to maintain the distance to guide no. 1 because the pipeline deflection level is substantial.

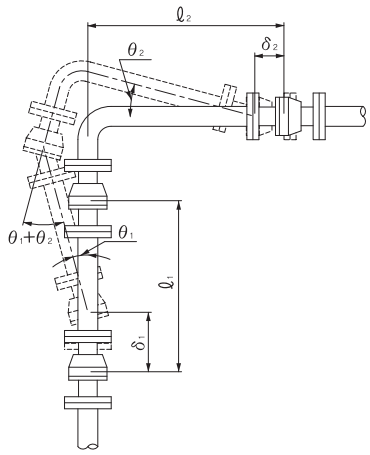
1. One-directional pipeline expansion/contraction

Using three ball joints enables efficient absorption of flexural or bending stress. The installation distances among ball joints remain the same as those of two ball joints.

2. Two-directional pipeline expansion/contraction

Three ball joints are also used when absorbing a pipeline's two-directional expansion/contraction.
The distance between ball joints is determined based on l1=l2, using the longer expansion/contraction length between $\delta 1$ and $\delta 2$.
Here, $\theta 1+\theta 2$ should be restricted to the allowed displacement angle (θ / 2) range.

≫ Diagram 2



■ Installation of anchor and guide no. 1

ⓐ Anchors should be installed at the bifurcation point of a pipeline's expansion/contraction length and the two ends of the pipeline.
ⓑ Guide no. 1 should be installed as closely as possible to the ball joint. Observe the instructions on the previous page in case two ball joints are used.
ⓒ Use the following formula to calculate the load on the anchors and guide no. 1, and install them with sufficient strength to withhold the load.

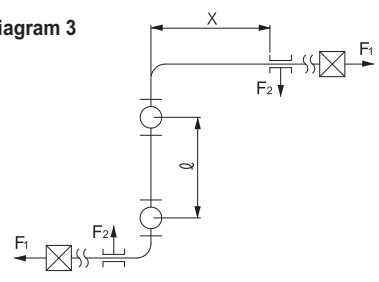
$F1 = \frac{2T}{R} \times 1000$

$F2 = \frac{3EIY}{X^3}$

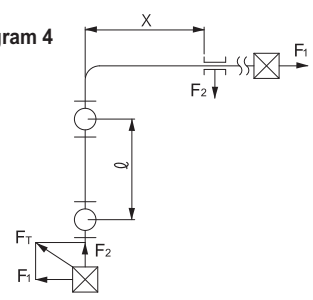
$F_T = \sqrt{F_1^2 + F_2^2}$
$F_z = \sqrt{F_A^2 + F_B^2 - 2F_AF_B\cos\alpha}$
$F_z = \sqrt{F_A^2 + F_B^2}$ (In case of $\propto$=90°)
F1 : Load on guide no. 1 when anchors and three ball joints are used (N) (Refer to Table 1)
F2 : Load on guide no. 1 when two ball joints are used (N) (Refer to Table 2)
F_T, F_z : Combined load of anchors (N)
F_A : Axial load of pipeline A (N) (Refer to Diagram 7)
F_B : Axial load of pipeline B (N) (Refer to Diagram 7)

$\propto$: Reflection angle of pipelines A and B (deg.)
I : Distance between ball joints
T : Torque of ball joint (N.m)
I : Moment of inertia
$I = \frac{\pi}{64}(D^4 - d^4)$
D : External diameter of pipeline
d : Inside diameter of pipeline
E : Young's modulus
191 x 103 N/mm² in case of a steel pipe of 200° C
X : Distance to guide no. 1
Y : Pipeline flexure

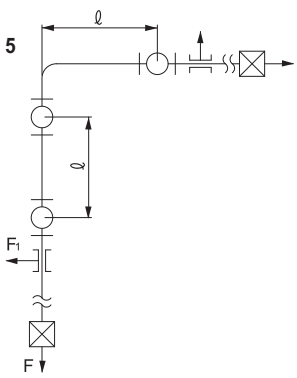
≫ Diagram 3



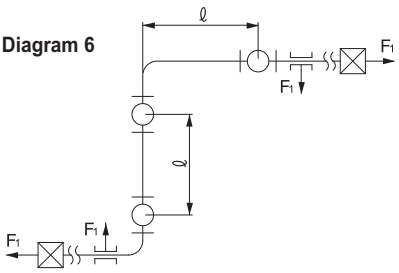
≫ Diagram 4



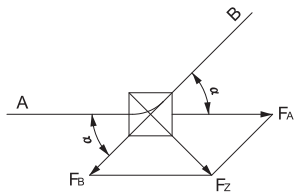
≫ Diagram 5



≫ Diagram 6

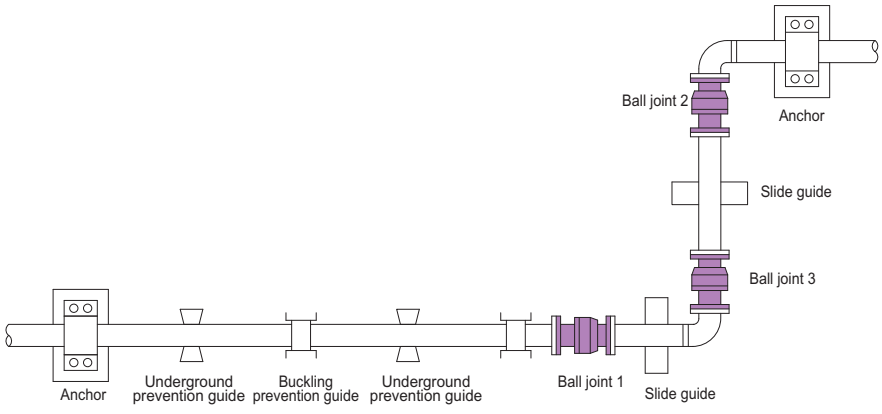


≫ Diagram 7

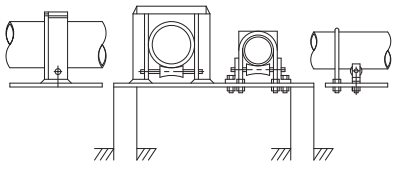


■ Example of pipeline application

● In case of a horizontal pipeline



● Example of guide for buckling prevention



● In case of a vertical pipeline

Install a slide guide in a vertical or a horizontal pipeline so that ball joint ② does not sway according to the slide direction.

■ Guide

1. Guide for buckling prevention

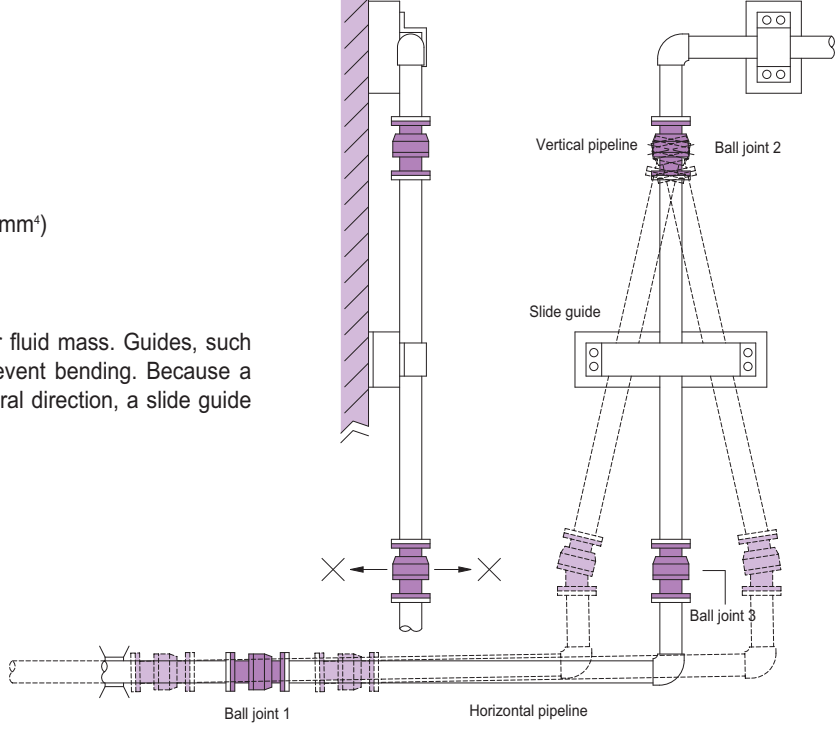
For a pipeline to expand/contract properly, guides need to be installed to prevent buckling and to provide support for pipeline weight. The installation interval for buckling prevention guides is calculated based on the following formula:

$$L = \sqrt{\frac{\pi^2 EI}{fF}}$$

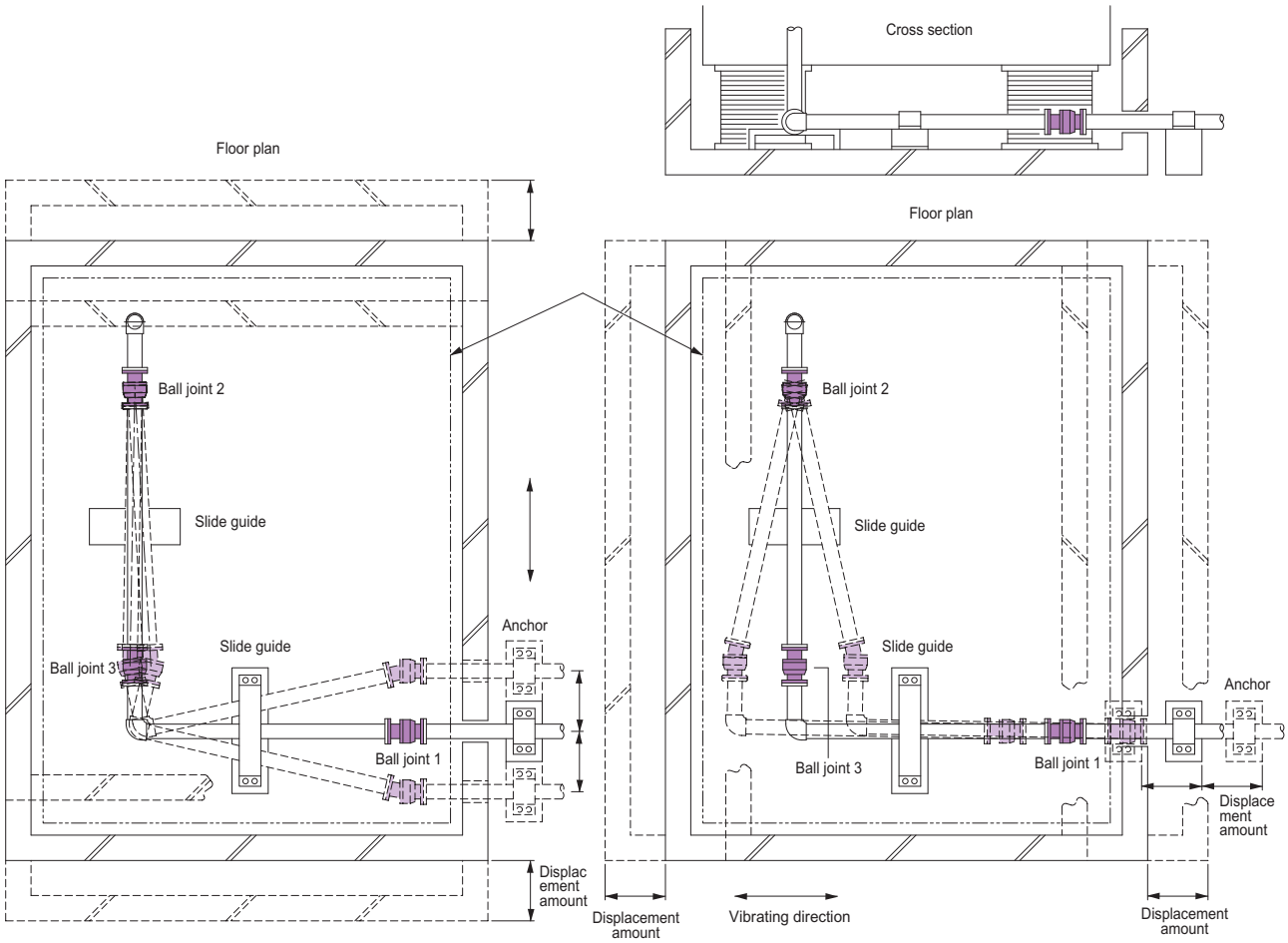
L : Pipeline interval (mm)
F : Pipeline's axial load (N)
E : Pipeline's Young's modulus (N/mm^2)
I : Pipeline's geometrical moment of inertia (mm^4)
f : Safety factor (3 or more)

2. Pipeline weight support

A pipeline can bend due to its own weight or fluid mass. Guides, such as a roller and a hanger, are installed to prevent bending. Because a pipeline between ball joints moves in the lateral direction, a slide guide needs to be installed.



■ Example of use of three ball joints in a seismic isolation building



■ F1 when pressure is 10K

(N)

Pipe diameter	Distance between ball joints ℓ (mm)					
	1000	1500	2000	2500	3000	3500
50	400	270				
65	600	400				
80	800	540	400			
100	1400	940	700			
125		1200	900	720		
150		1740	1300	1040		
200		3200	2400	1920	1600	
250			4000	3200	2670	2000
300			6000	4800	4000	3000

■ F2 when Y equals 1 mm

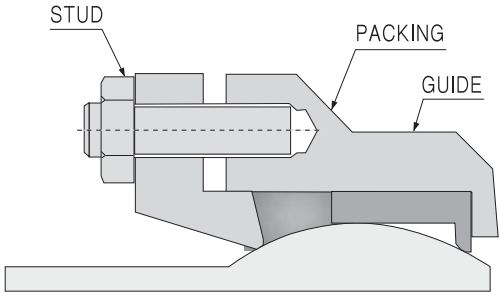
(N)

Pipe diameter	Distance of guide no. 1 × (mm)						
	1000	2000	3000	4000	5000	6000	7000
50	170	21	6.1	2.6			
65	430	54	16	6.8			
80	740	93	28	12			
100		220	65	28	14		
125		450	140	56	29		
150		810	240	110	52	30	
200			630	270	140	79	50
250			1360	580	300	170	110
300			2560	1080	560	320	210

Based on the condition of SPPS Sch. 40

■ Packing

● Grand Packing



1. SG NO. 100

As a packing used for air, water, and wet steam, its maximum running pressure is 20 kg/cm², and maximum applicable temperature is 200° C
It consists of a composition of Teflon and graphite.

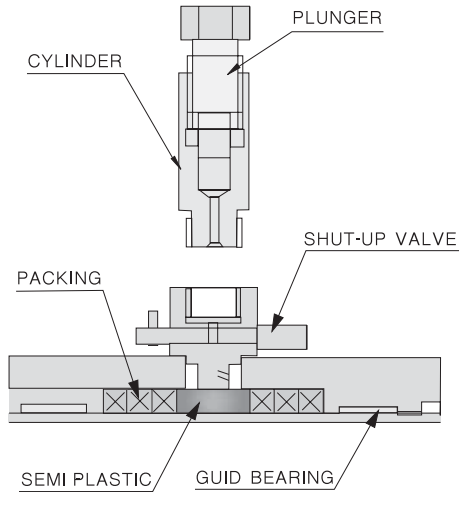
2. SG NO. 200

As a packing used for air, water, and wet steam, its maximum running pressure is 30 kg/cm², and maximum applicable temperature is 250° C
It consists of such materials as non-asbestos fiber, Teflon, and flake graphite.

3. SSG NO. 300

As a packing used for dried saturated steam and superheated steam, its maximum running pressure is 40 kg/cm², and it is mainly used for high temperatures of at least 250° C
It consists of non-asbestos fiber and flake graphite.

● Injection packing



1. SI NO. 700

As a packing used for air, water, and steam, it' s maximum use pressure of 20kg/cm², and could be used up to maximum use temperature of 200° C. The left and right packings are made of zeolite fiber and high-density graphite, and NO.53 Semi-Plastic is used for the inserted packing.

2. SI NO.800

As a packing used for air, water, and steam, its maximum running pressure is 20 kg/cm²
The packings on the right and the left consist of non-asbestos fiber for high temperature and high-density graphite, and No. 55 semi-plastic is used for injection packing.

3. SI No. 900

As a packing mainly used for superheated steam, its maximum running pressure is 40 kg/cm², and maximum applicable temperature is 450° C.
The packings on the right and the left consist of non-asbestos fiber for high temperature and high-density graphite, and No. 60 semi-plastic is used for injection packing.

■ What is a super packing?

Super packing has been developed to ensure outstanding sealing performance and a stable life span. It is a packing that combined, based on a transparent ratio, the expansion sides with special oil and other inorganic substances. Super packing offers superb performance in its thermal resistance range from -200° C to 450° C as well as its internal characteristics, internal size, and internal mechanism.

■ Method based on calculation

Basic formula $\Delta \ell = \alpha \times \Delta t \times L$
Maximum expansion length calculation formula $\Delta \ell = \alpha \times (t1 - t2) \times L$
Maximum contraction length calculation formula $\Delta \ell = \alpha \times (t1 - t3) \times L$

$\Delta \ell$: Expansion/contraction length of pipe
α : Pipe's expansion coefficient
Steel pipe : 12.2×10-3mm/m℃
Copper pipe : 17.7×10-3mm/m℃
STS : 18.4×10-3mm/m℃

Δt : Temperature difference (°C)
L : Pipeline length (m)
t_1 : Maximum applicable temperature (°C)
t_2 : Maximum ambient temperature(°C)
t_3 : Minimum ambient temperature (°C)

※ The expansion/contraction of a pipe is heavily dependent on the temperature of the applied fluid. The pipe expands or contracts according to changes in the maximum applicable temperature, minimum ambient temperature, etc. based on the temperature at the point of installation.

■ Expansion/contraction length of a pipeline (Expansion/contraction length corresponding to different pipeline lengths)

Pipe type	Pipe length	Fluid temperature difference Δt℃																						Pipe length
		10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	
Steel pipe	1	0.122	0.244	0.366	0.488	0.61	0.732	0.854	0.976	1.1	1.22	1.34	1.46	1.59	1.71	1.83	1.95	2.07	2.2	2.32	2.44	2.56	2.68	1
	5	0.61	1.22	1.83	2.44	3.05	3.66	4.27	4.88	5.49	6.1	6.71	7.32	7.93	8.54	9.15	9.76	10.4	11.0	11.6	12.2	12.8	13.4	5
	10	1.22	2.44	3.66	4.88	6.1	7.32	8.54	9.76	11.0	12.2	13.4	14.6	15.9	17.1	18.3	19.5	20.7	22.0	23.2	24.4	25.6	26.8	10
	15	1.83	3.66	5.49	7.32	9.15	11.0	12.8	14.6	16.5	18.3	20.1	22.0	23.8	25.6	27.5	29.3	31.1	32.9	34.8	36.6	38.4	40.3	15
	20	2.44	4.88	7.32	9.76	12.2	14.6	17.1	19.5	22.2	24.4	26.8	29.3	31.7	34.2	36.6	39.0	41.5	43.9	46.6	48.8	51.2	53.7	20
	25	3.05	6.1	9.15	12.2	15.3	18.3	2200	25.6	29.3	32.9	36.8	40.3	43.9	47.6	51.2	54.9	58.6	62.2	65.9	69.5	73.2	76.9	25
	30	3.66	7.32	11.0	14.6	18.3	2200	25.6	29.3	32.9	36.6	40.3	43.9	47.6	51.2	54.9	68.6	62.2	65.9	69.5	73.2	76.9	80.5	30
	35	4.27	8.54	12.8	17.1	21.4	25.6	29.9	34.2	38.4	42.7	47.0	51.2	55.5	59.8	64.1	68.3	72.6	76.9	81.1	85.4	89.7	93.9	35
	40	4.88	9.76	14.6	19.5	24.4	29.3	34.2	39.0	43.9	48.8	53.7	58.6	63.4	68.3	73.1	78.1	83.0	87.8	92.7	97.6	102.5	107.4	40
Copper pipe	1	0.177	0.354	0.531	0.708	0.885	1.06	1.24	1.42	1.59	1.77	1.95	2.12	2.30	2.48	2.66	2.83	3.01	3.19	3.36	3.54	3.72	3.89	1
	5	0.885	1.77	2.66	3.54	4.43	5.31	6.2	7.1	7.97	8.85	9.74	10.6	11.5	12.4	13.3	14.1	15.1	16.8	17.7	18.6	18.6	19.5	5
	10	1.77	3.54	5.31	7.1	8.85	10.6	12.4	15.9	17.7	19.5	21.2	23.0	24.8	26.6	28.3	30.1	31.9	33.6	35.4	37.2	3	38.9	10
	15	2.66	5.31	7.97	10.6	13.3	15.9	18.6	21.2	23.9	26.6	29.2	31.9	34.5	37.2	39.8	42.5	45.1	47.8	50.5	53.1	55.8	58.4	15
	20	3.54	7.1	10.6	14.2	17.7	21.2	24.8	28.3	31.9	35.4	38.9	42.5	46.0	49.6	53.1	56.6	50.2	63.7	67.3	70.8	74.3	77.9	20
	25	4.43	8.85	13.3	17.7	22.1	26.6	31.0	35.4	39.8	44.3	48.7	53.1	57.5	62.0	66.4	70.8	75.2	79.7	84.1	88.5	92.9	97.4	25
	30	5.31	10.6	15.9	21.2	26.6	31.0	37.2	42.5	47.8	53.1	58.4	63.7	69.0	74.3	79.7	85.0	90.3	95.6	100.9	106.2	111.5	116.8	30
	35	6.2	12.4	19.3	24.8	31.0	37.2	43.4	49.6	55.8	62.0	74.3	74.3	90.2	86.7	92.9	99.1	105.3	111.5	117.7	123.9	130.0	136.3	35
	40	7.1	14.2	21.2	28.3	35.4	42.5	49.6	56.6	63.7	70.8	77.9	85.0	92.0	99.1	106.2	113.1	120.4	127.4	134.5	141.6	148.7	155.8	40
Stainless steel pipe	1	0.184	0.368	0.552	0.736	0.92	1.1	1.129	1.047	1.66	1.84	2.02	2.21	2.39	2.58	2.76	2.94	3.13	3.31	3.5	3.68	3.86	4.05	1
	5	0.92	1.84	2.76	3.68	4.6	5.52	6.44	7.36	8.28	9.2	10.1	11.0	12.0	12.9	13.8	14.7	15.6	16.6	17.5	18.4	19.3	20.2	5
	10	1.84	3.68	5.52	7.36	9.2	11.0	12.9	14.7	16.6	18.4	20.2	22.1	23.9	25.8	27.6	29.4	31.3	33.1	35.0	36.8	38.6	40.51	10
	15	2.76	5.52	8.28	11.0	13.8	16.6	19.3	22.1	24.8	27.6	30.4	33.1	35.9	38.6	41.4	44.2	26.9	29.7	52.4	55.2	58.0	60.7	15
	20	3.68	7.36	11.0	14.7	18.4	22.1	25.8	29.4	24.8	36.8	40.5	44.2	47.8	51.5	55.2	58.9	62.6	66.2	69.6	73.6	77.3	81.0	20
	25	4.6	9.2	13.8	18.4	23.0	27.6	32.2	36.8	31.0	46.0	50.6	55.2	59.8	64.4	69.0	73.6	78.2	82.8	87.4	92.0	96.6	101.2	25
	30	5.52	11.0	16.6	22.1	27.6	33.1	38.6	44.2	37.2	55.2	60.7	66.2	71.8	77.3	82.8	88.3	93.8	99.4	104.9	110.4	115.9	121.4	30
	35	6.44	12.9	19.3	25.8	32.2	38.6	45.1	51.5	51.5	64.4	70.8	77.3	83.7	90.2	96.6	103	109.5	115.9	122.4	128.8	135.5	141.7	35
	40	7.36	14.7	22.1	29.4	36.8	44.2	51.5	58.0	51.5	73.6	81.0	88.3	95.7	103	110.4	117.8	125.1	132.5	139.8	147.2	154.6	161.9	40

MEMO

Hammerless Check Valve / Foot Valve

9

Hammerless Check Valve / Foot Valve

Used to prevent the backward flow of fluid in the pump outlet side, this valve prevents water hammers, protects pump pipelines, and functions as a bypass valve.

Hammerless check valve

Type	Size	Applicable fluid	Applicable pressure (kgf/cm²g)	Materials		End connection	Page
				Body	Disc, seat		
YHL-100	40(1½")~500(20")	Water	Maximum 14	GC200	NBR, BC6	KS 10K RF FLANGE	154
YHL-200	50(2")~500(20")		Maximum 20	GCD450, SCPH2		KS 20K RF FLANGE	

Foot valve

Type	Size	Applicable fluid	Applicable pressure (kgf/cm²g)	Materials		End connection	Page
				Body	Disc/Seat		
YFV-1	40(1½")~250(10")	Water	Maximum 14	GC200	NBR, BC6	KS 10K RF FLANGE	157

Type YHL-100, 200 Hammerless Check Valve

This product is used to prevent fluid from flowing backwards into a hammerless check valve pump outlet.
It prevents water hammers, protects pump pipelines, and also functions as a bypass valve.

Type YHL-100

Type YHL-200

■ Features

- Water Hammer free.
  Prevent Water Hammer :
  The valve closes when fluid inside the pipeline becomes a speed of stoppage, based on precise movements of the spring & built-in buffer (a part inside the valve that resembles an umbrella playing an essential role in preventing Water Hammer).
- Suitable for pumps, pipelines protection & environmental preservation :
  Heavy noise & pressure loss, this is the most ideal valve for high-rise apartment buildings and other types of high-rise buildings, underground shopping malls, public office buildings, and other public buildings with little Water Hammer shock.
- Breakdown-free simple structure.
- One-year warranty if there is malfunction.
- Bypass valve function.
- Withdraw water inside pipeline on pump outlet side as bypass valve & replenishes guiding water when vacuum establishes on pump inlet side.

■ Specifications

Type		YHL-100	YHL-200
Maximum running pressure		Maximum 14kgf/cm²g	Maximum 20kgf/cm²g
Applicable fluid		Water	
Fluid temperature		5~80° C	
Leakage allowance		0	
End connection		KS 10K RF FLANGE	KS 20K RF FLANGE
Materials	Body	GC200	GCD450, SCPH2
	Disc, seat	NBR, BC6	
Hydraulic test pressure		20kgf/cm²g	30kgf/cm²g

▶ Valves for hot water and other fluid are also available by made-to-orders.

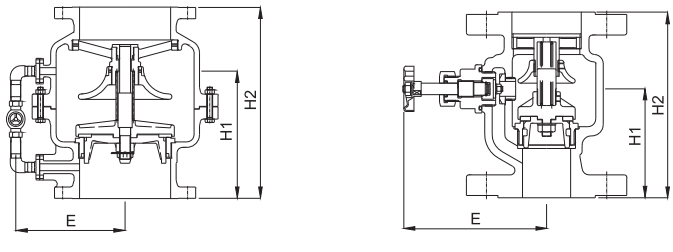
■ Dimensions

(mm)

Size	E	H1	H2	Weight (kg)
40(1½")	120	95	162	7.3
50(2")	135	100	183	9.3(15.8)
65(2½")	145	100	200(196)	11.2(19)
80(3")	150	110	210	15(25.5)
100(4")	160	120	217	20(31)
125(5")	190	125	255(259)	31(52.7)
150(6")	200	135	280(284)	40(68)
200(8")	235	210	416(424)	80(136)
250(10")	275	260	560(568)	92(160)
300(12")	340	402	622	126.3(215)
350(14")	370	488	834	168(290)
400(16")	415	582	932(970)	212.3(361)

▶ Dimensions in the parentheses are for YHL-200.

■ Dimensional drawing

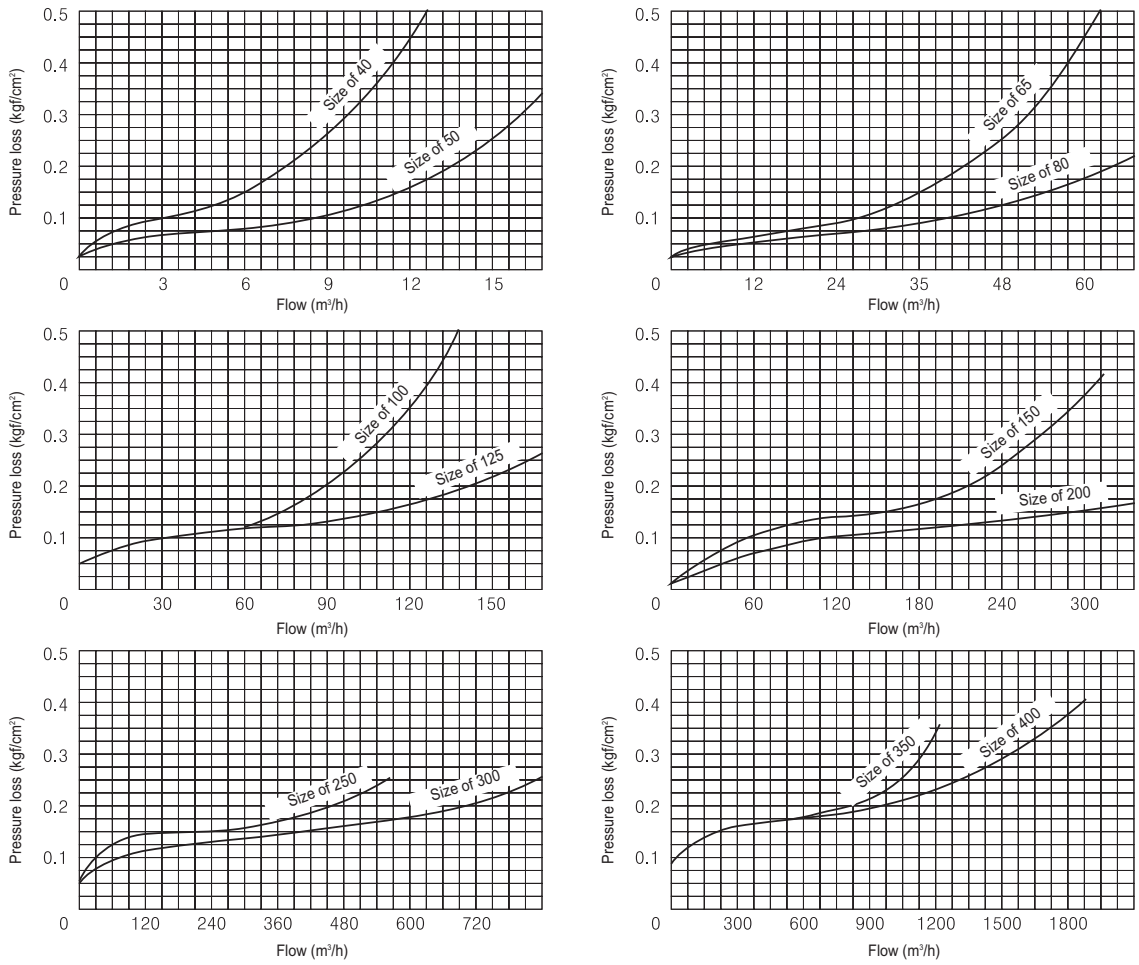


Size of 40 to 50 Size of 300 to 400

Types YHL-100, 200

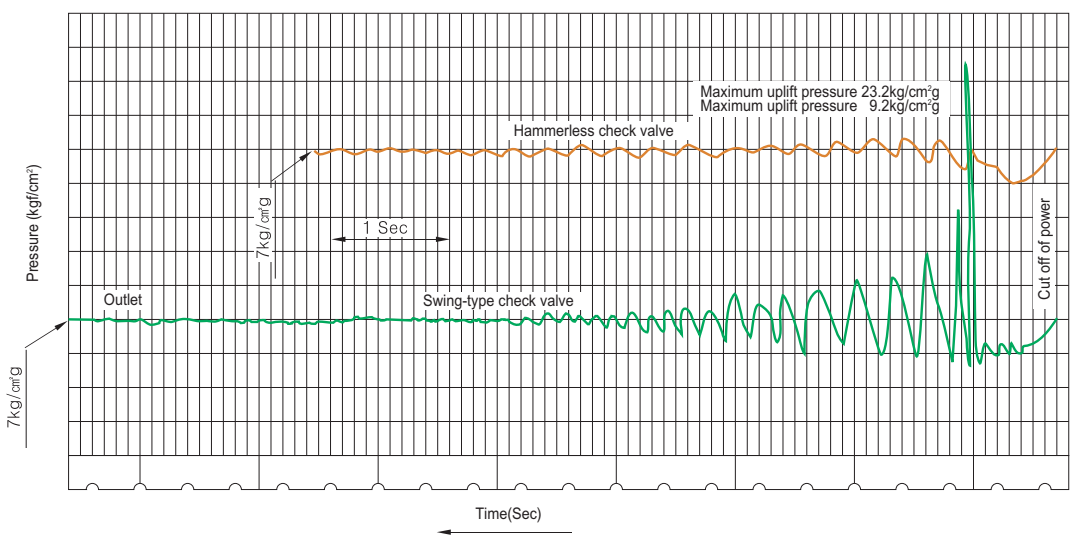
Type YHL-100, 200 Hammerless Check Valve

■ Pressure loss curve



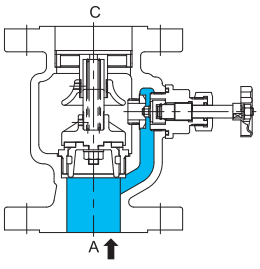
■ Water hammer test and pressure increase

The pressure loss and characteristics chart below makes a comparison between the characteristics of Samyang's hammerless check valve and a general swing-type check valve. When tested under the same conditions, the closing time of the hammerless check valve is shorter, and thus there is little surge in pressure

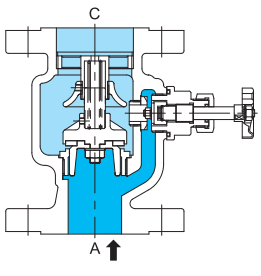


Type YHL-100, 200 Hammerless Check Valve

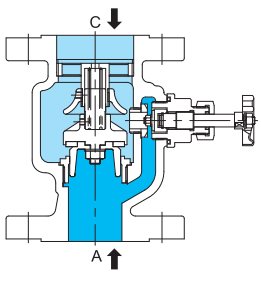
■ How it works



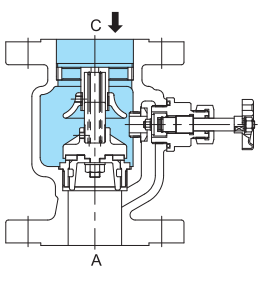
1. When the pump commences operation, the fluid's pressure arrives at side A, as seen in the diagram.



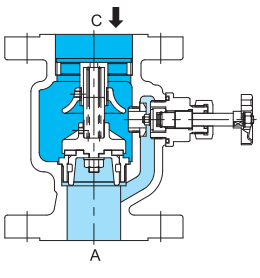
2. The fluid, which reached A, raises the disc even at extremely little pressure (0.1 kgf/cm^{2}g), resulting in the fluid passing through.



3. Resulting from subtle operation, the disc is completely pushed upwards, as seen in the diagram, even when the pressure is merely 0.3 kgf/cm^{2}g. In other words, the disc comes into complete contact with buffer C, enabling the fluid's flow to reach the most satisfactory state.



4. When the pump stops operating, the supply pressure drops, and when the supply pressure becomes 0.1 kgf/cm^{2}g, the valve has been closed already by the spring's force. As a result, there is no pressure shock or vibration that occurs from the commencement of the backward flow of fluid. This is why there is no water hammer.



5. The bypass valve installed next to the valve is used to prevent freezing damages by draining water from the pipeline when the pump stops operating, and to replenish the empty pump with water when the pump starts to operate again.

■ Cautions for use

1. Leave the bypass valve closed during normal operation. (If the foot valve breaks down, open the valve and replenish the fluid to an appropriate level.)
2. Special attention is needed so that foreign substances, such as sand or welding particles, do not get mixed with the fluid and flow inside the pipeline.
3. If the applicable fluid is different or the valve is intended to be used for high temperatures of 60°C or more, consult with Samyang prior to placing an order.

Type YFV-1 Foot Valve

When installed on the pump inlet side of an underground water tank, this product is suitable for preventing the backward flow of fluid.

■ Specifications

Applicable fluid		Water
Maximum running pressure		Maximum 14kgf/cm²g
Fluid temperature		80° C below
Leakage allowance		0
End connection		KS 10K RF FLANGE
Materials	Body	GC200
	Disc, seat	NBR, BC6
	Screen	STS
Hydraulic test pressure		20kgf/cm²g

▶ Valves for 20 kgf/cm²g are available by made-to-orders.

■ Dimensions

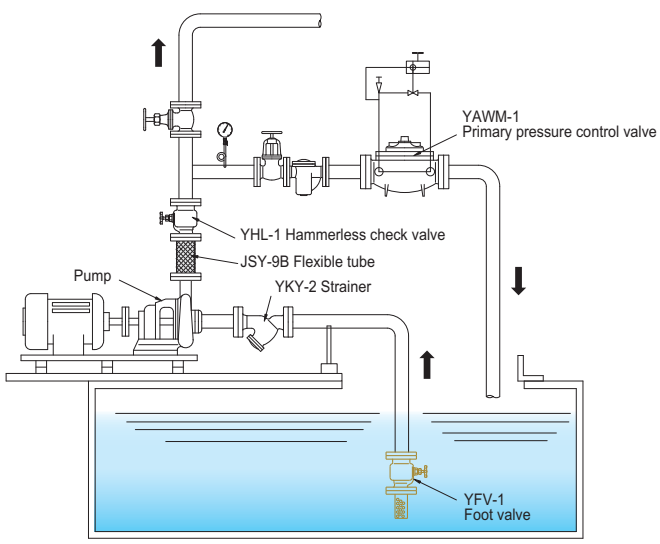
(mm)

Size	E	H1	H2	H3	Weight (kg)
40(1½")	120	95	162	324	9.2
50(2")	135	100	183	366	11.7
65(2½")	145	100	200	400	14.2
80(3")	150	110	210	420	17.8
100(4")	160	120	217	434	23.6
125(5")	190	125	255	510	36.5
150(6")	200	135	280	560	47.3
200(8")	235	210	416	832	88.5
250(10")	275	260	560	1120	106

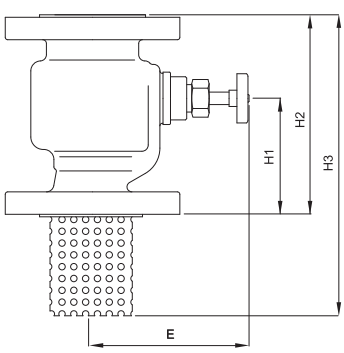
■ Notes for installation in a pump line

- Using the type YHL-1 hammerless check valve, instead of a swing-type valve, on the outlet side of a pump, will prevent a water hammer and protect the pump and pipeline.
- Since the disc of the hammerless check valve and the foot valve is made of NBR, a perfect sealing is maintained. In particular, there is little pressure loss, resulting in less electricity consumption.
- Install a flexible tube on the upper part of the check valve to prevent pipeline vibration resulting from pump vibration.
- The primary pressure control valve (relief valve) maintains a constant pressure level on the pump outlet side, according to the set pressure.
- Install a strainer on the inlet side of the pump to protect facilities in the pipeline and the pump.

■ Application Diagram (Example)



■ Dimensional drawing



MEMO

Air Vent Valve

10

Air Vent Valve

Samyang's air vent valve eliminates air-related problems and prevents pipeline corrosion by automatically discharging air generated in construction facilitie's cold/hot water pipelines, water supply and water heating pipelines, as well as plant's cold/hot water pipelines and tanks. In addition, it automatically takes air in when liquid is discharged from pipelines and tanks, thereby ensuring easy discharge by preventing a creation of a vacuum.

Air vent valve

Type	Size	Applicable fluid	Applicable pressure (kgf/cm²g)	Materials		End connection	Page
				Body	Disc, seat		
YAC-3	15(½")~25(1")	Water	Maximum 10	C3771	NBR, C3604	KS PT SCREW	160
YAC-3A				BsC3	EPDM, STS		161
YAC-3M							
YAC-4				GC200			162

Type YAC-3 Air Vent Valve

This is a compact air vent valve that is used for pipelines, hot water boilers, fan coils, and small- to medium-sized pressure tanks. The adoption of the BBC (Bubble Crush) method ensures safe operation and prevents water hammers, hunching, etc.

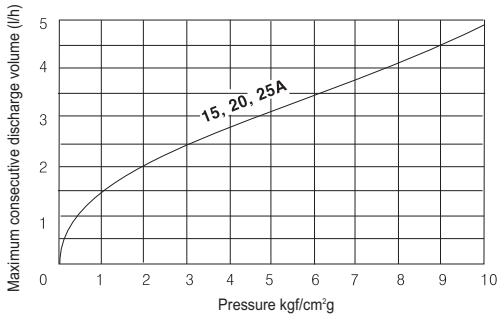
■ Features

- Bubble Crush(BBC) structure prevent Water Hammers & chattering caused by float in special form distributes rising pressure & bubbles.
- Reliable operation is ensured by spring's force seat closing.
- Simple & strong structure.
- Compact & outstanding air discharge performance.
- Manual closing device installed on outlet side.
- Manufacture as air vent valve for steam.

■ Specifications

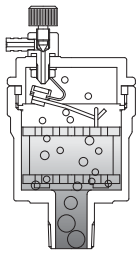
Size		15(½"), 20(¾"), 25(1")
Applicable fluid		Cold / hot water
Applicable pressure		Maximum 10kgf/cm²g
Fluid temperature		5~100° C
End connection		KS PT SCREW
Materials	**Body**	C3771
	Disc, seat	NBR, C3604
Hydraulic test pressure		15kgf/cm²g

■ Air discharge volume curve

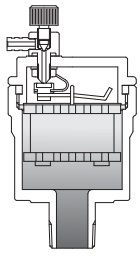


■ Air discharge volume curve

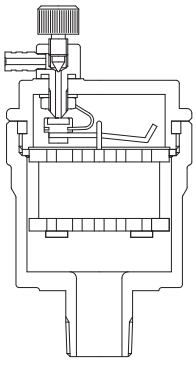
When discharging air
It discharges air that comes in when the seat is opened by the float's own weight.



When discharge stops
If the water level and float rises immediately after air discharge, the valve closes by the float's buoyancy and spring's elasticity.

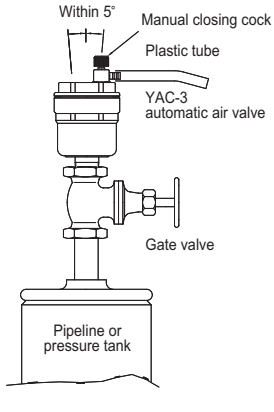


■ Dimensional drawing



■ Installation example and cautions during handling

- When installing the valve in a pipeline, install it within 5° of a vertical line.
- When installing the valve indoors, connect the outlet side to the drainage just in case there is leakage.
- Install a manual valve on the inlet side for repair and inspections.
- Close the manual closing cock if there is a leakage.



Type YAC-3A, 3M Automatic Air Vent Valve

As an air vent valve for liquid, it automatically discharges remaining air from pipelines and air from sealed tanks, thereby allowing for smooth flow of fluid.

Type YAC-3A

Type YAC-3M
Multi-functional air vent valve
(air vent + strainer + stop valve)

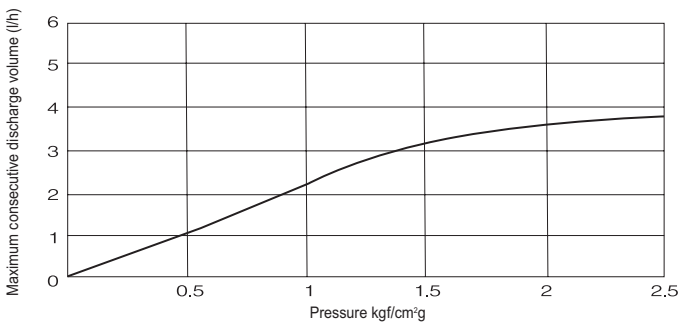
■ Features

- Operates smoothly even at low pressure.
- Flexible disc structure for smooth & subtle operation.
- Easy repair & inspections designed.
- Steel ball installation prevents reverse entry of air.

■ Specifications

Size		YAC-3A, 3M
Applicable fluid		Cold / hot water
Applicable pressure		Maximum 10kgf/cm^{2}g
Fluid temperature		5~80° C
End connection		KS PT SCREW(Female)
Materials	**Body**	BsC3
	Disc, seat	EPDM, STS
Hydraulic test pressure		15kgf/cm^{2}g

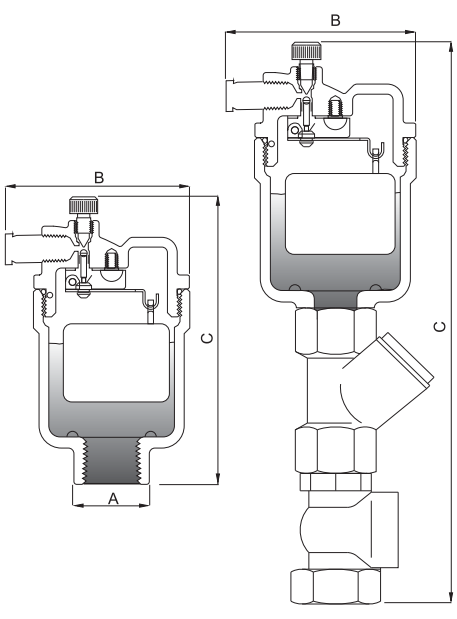
■ Air discharge volume curve



■ Dimensions

Type	A	B	C	Weight (kg)
YAC-3A	27	56	103	0.7
YAC-3M	27	56	200	1.7

■ Dimensional drawing



Type YAC-3A Type YAC-3M

■ Installation method and cautionary measures

1. Install it vertically (within 5°).
2. When installing indoors, connect the outlet side to the drainage.
3. Install a manual valve on the inlet side.
4. In case of leakage, close by using the handle.

■ Measures in case of leakage

1. In case of leakage, close the manual valve on the lower part of the air vent, open the cap, check if there are any foreign substances on top of the disc or seat, wash the foreign substances away, if any, and then resume normal operation.
2. When reassembling, take caution so that the float is not detached from the press part.

Type YAC-4 Air Vent Valve

As an air vent valve for liquid, it automatically discharges remaining air from pipelines and air from sealed tanks, thereby allowing for smooth flow of fluid.

■ Features

- Large discharge capacity covers up to 10~20 kgf/cm²g.
- Flexible disc structure for smooth & subtle operation.
- NBR-based seat features outstanding level of air tightness.
- Easy repair & inspections manufactured.

■ Specifications

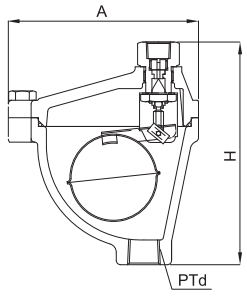
Type		YAC-4
Applicable fluid		Cold / hot water
Applicable pressure		Maximum 10kgf/cm²g
Fluid temperature		5~80° C
End connection		KS PT SCREW
Materials	**Body**	GC200
	Disc, seat	EPDM, STS
Hydraulic test pressure		15kgf/cm²g

■ Dimensions

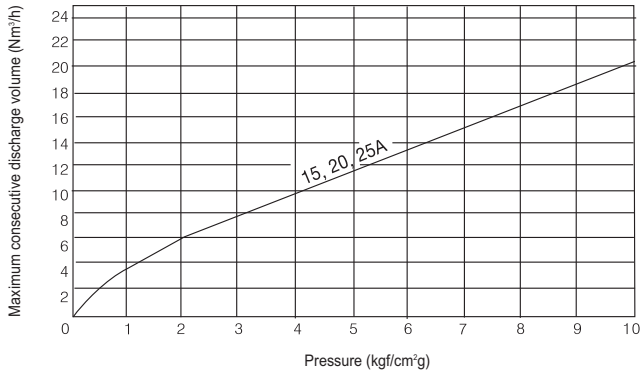
(mm)

Size	d	A	H	Weight (kg)
15(½")	½"	115	153	2.0
20(¾")	¾"	115	153	2.0
25(1")	1"	115	153	2.2

■ Dimensional drawing



■ Air discharge volume curve



Intelligent Control Check Valve / Suction Diffuser

11

Intelligent Control Check Valve / Suction Diffuser

Control check valve

Type	Size	Applicable fluid	Applicable pressure (kgf/cm²g)	Materials (Body)	End connection	Page
YCC-1, 1R	50(2")~600(24")	Water, Liquid	Maximum 10	GC200	KS 10K FF FLANGE	164
YCC-2, 2R			Maximum 20	GCD450	KS 20K FF FLANGE	
YCC-3, 3R			Maximum 30	SCPH2	KS 30K FF FLANGE	

Suction diffuser

Type	Size	Applicable fluid	Applicable pressure (kgf/cm²g)	Materials (Body)	End connection	Page
YSD-1, 1R	50(2")~600(24")	Water, Liquid	Maximum 10	GC200	KS 10K FF FLANGE	165
YSD-2, 2R			Maximum 20	GCD450	KS 20K FF FLANGE	
YSD-3, 3R			Maximum 30	SCPH2	KS 30K FF FLANGE	

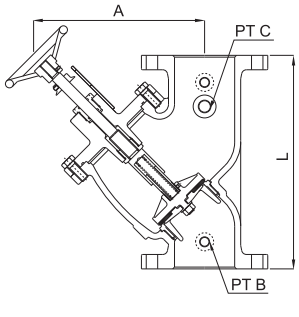
Type YCC-1, 2, 3 / 1, 2, 3R Intelligent Control Check Valve

This check valve protects the pump by bypassing the discharge pressure that instantaneously rises when the pump starts.
It also absorbs shock by linearly opening the water hammer cushion valve to prevent a water hammer resulting from a surge in pressure by the backward flow of water inside a standing pipeline when the pump stops.
In addition, this product has a port soft sealing structure, thereby ensuring perfect air tightness at normal times.

Type YCC-1, 2, 3

Type YCC-1, 2, 3R

■ Dimensional drawing



Flanged End Type

■ Features

- Performs 5 different functions : check valve, balancing valve, bypass valve, and relief valve.
- No Water Hammer in the pump : The spring reacts to the Pump Discharge Pressure (PDP) so that the disc closes in time.
- No need to install a separate balancing valve & attached indicator enables easy identification : The valve can regulate the flow of fluid according to the accurately controlling valve opening degree and the attached indicator visually provides the open/closed status of the valve.
- Possible to install in any direction, horizontally or vertically : Installation space is reduced and construction is convenient.

■ Specifications

Type		YCC-1, 1R	YCC-2, 2R	YCC-3, 3R
Applicable fluid		Water, Liquid		
Applicable pressure		Maximum 10kgf/cm²g	Maximum 20kgf/cm²g	Maximum 30kgf/cm²g
Fluid temperature		Maximum 80° C	Maximum 120° C	Maximum 120° C
End connection		KS 10K FF FLANGED	KS 20K RF FLANGED	KS 30K RF FLANGED
Hydraulic test pressure		15kgf/cm²	30kgf/cm²	45kgf/cm²
Materials	Body	GC200	GCD450	SCPH2
	Seat	BC6		
	Disc	EPDM		
	Gasket	NBR, EPDM	NBR, EPDM	NBR, EPDM

■ Categorization of types

Category	Main functions
YCC-1, YCC-2, YCC-3	Check, Balancing, Stop valve, By-pass
YCC-1R, YCC-2R, YCC-3R	Check, Balancing, Stop valve, By-pass, Relief + Pressure gauge + Special internal coating

■ Dimensions

(mm)

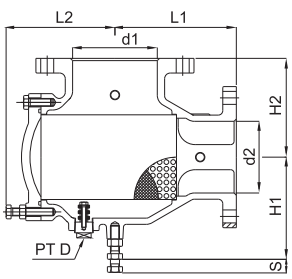
Size	L		A	PT B	PT C
	10K	20K		By-pass	Relief conn
50(2")	235	235	184	3/8	1/2
65(2½")	270	270	206	3/8	1/2
80(3")	295	295	232	3/8	3/4
100(4")	355	355	278	3/8	3/4
125(5")	420	424	328	1/2	1
150(6")	470	474	372	1/2	1
200(8")	550	558	451	3/4	1¼
250(10")	670	678	542	3/4	1½
300(12")	780	788	645	1	2
350(14")	890	902	720	1	2½
400(16")	980	1000	768	1½	3
450(18")	1100	1140	850	1½	3
500(20")	1220	1260	950	2	4
550(22")	-	1360	1060	2	4
600(24")	-	1480	1150	2	6

Type YSD-1, 2, 3 / 1, 2, 3R Intelligent Suction Diffuser

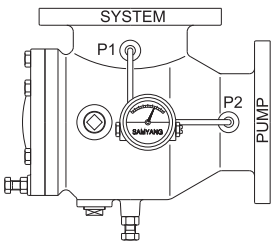
Type YSD-1, 2, 3

Type YSD-1, 2, 3R

■ Dimensional drawing



Type Flanged



Type Flanged (Standard)

■ Features

- Structure to verify whether internal screen need cleaning.
- Quick-changeable hinge structure enable quick cleaning of the screen.
- Built-in magnet protects the pump & pipeline from damage caused by iron content & welding slags.
- Maximized pump efficiency & little pressure loss by outlet side located vane.

■ Specifications

Type		YSD-1, 1R	YSD-2, 2R	YSD-3, 3R
Applicable fluid		Water, Liquid		
Applicable pressure		Maximum 10kgf/cm^{2}g	Maximum 20kgf/cm^{2}g	Maximum 30kgf/cm^{2}g
Fluid temperature		Maximum 80° C	Maximum 120° C	Maximum 120° C
End connection		KS 10K FF FLANGED	KS 20K RF FLANGED	KS 30K RF FLANGED
Materials	Body	GC200	GCD450	SCPH2
	Screen	STS304		
	Gasket	NBR, EPDM	EPDM	
	Drain plug	SS400, GC200		
Hydraulic test pressure		15 kgf/cm^{2}g	30 kgf/cm^{2}g	45 kgf/cm^{2}g

■ Categorization of types

Category	Main functions
YSD-1, YSD-2, YSD-3	Suction diffuser + Built-in magnet + Pressure loss measuring device (Standard)
YSD-1R, YSD-2R, YSD-3R	Suction diffuser + Intelligent element

■ Dimensions

(mm)

Systrm (d1)	Pump (d2)	L1	L2	H1	H2	S	PT D
50(2")	50A	113	78	110	78	10	3/8
65(2½")	65A	125	89	115	121	10	3/8
80(3")	80A	144	109	124	140	10	1/2
	65A	144	109	124	140	10	1/2
100(4")	100A	180	164	150	160	12	3/4
	80A	180	164	150	160	12	3/4
	65A	180	164	150	160	12	3/4
125(5")	125A	215	192	175	181	12	1
	100A	180	163	150	160	12	3/4
	80A	180	163	150	160	12	3/4
150(6")	150A	250	224	205	212	14	1
	125A	215	193	175	181	12	1
	100A	215	193	175	181	12	1
250(10")	200A	320	285	260	274	17	1¼
	150A	250	223	205	216	14	1
	125A	250	223	205	216	14	1
250(10")	250A	360	330	310	323	18	1¼
	200A	320	280	260	274	17	1¼
	150A	320	280	260	274	17	1¼
300(12")	300A	410	372	360	392	23	1½
	250A	360	332	310	323	18	1¼
	200A	360	332	310	323	18	1¼
350(14")	350A	480	421	390	421	23	2
	300A	410	372	360	392	23	1½
	250A	360	331	310	323	18	1¼
400(16")	400A	560	484	450	471	23	2
	350A	560	484	450	471	23	2
	300A	560	484	450	471	23	2
450(18")	450A	640	550	510	535	28	2
500(20")	500A	710	610	570	590	30	2
550(22")	550A	780	670	625	650	34	2
600(24")	600A	840	720	680	710	40	2

※ Reducing sizes of the outlet side (d2), other than those listed above, are available based on customer request.

Data / Intelligent Control Check Valve, Suction Diffuser

■ Items that become unnecessary or can be saved with control check valve installation

1. Check Valve
2. Gate Valve
3. Balancing Valve
4. Relief Valve
5. Flange
6. Gasket, Bolt, Nut
7. Reduced construction time
8. Reduced labor costs, etc.

■ Cautions for installation

1. It can be installed on a horizontal or vertical pipeline.
2. Install a flexible joint to prevent damage to the pipeline resulting from pump vibration.
3. Install after checking the direction of the fluid's flow (arrow).
4. Use a spanner or the handle to open the valve and operate the pump.
5. If there is a bypass valve attached, operate after closing the external ball valve.

■ Information required when placing an order

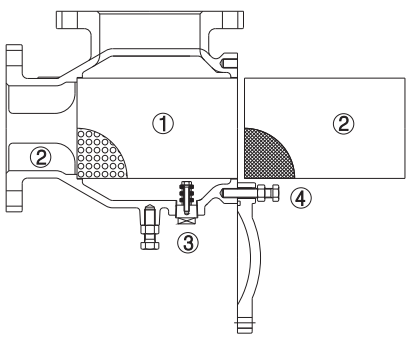
1. Model
2. Type of fluid
3. Maximum running pressure (kgf/cm^{2}g)
4. Maximum temperature used (° C)
5. Pump's discharge pipeline diameter (mm)
6. Maximum flow (m^3/hr or LPM)
7. Other options

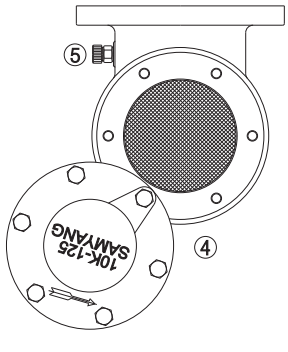
■ Items that become unnecessary or can be saved with suction diffuser installation

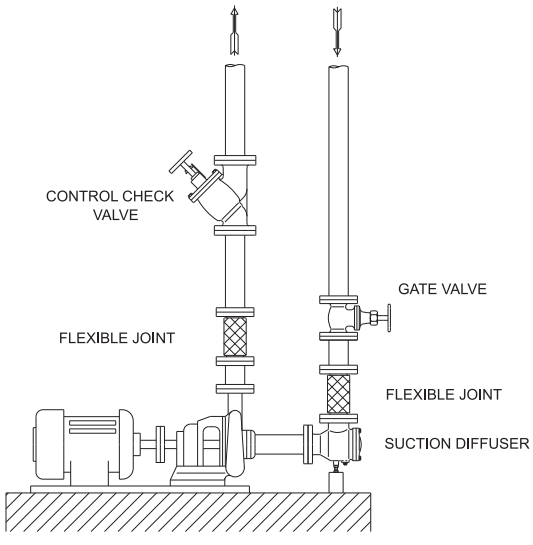
1. Reduced pipe on the inlet side
2. Reducing elbow
3. Strainer
4. Flange (2 each)
5. Gasket, bolt, nut
6. Pipe support
7. Reduced labor costs
8. Reduced construction time

■ Test operation tips

1. The valve is in a closed state when delivered to the customer. (Indicator says 0%)
2. After installation, open the valve by loosening the square part of the stem that protrudes towards the cover part or the handle towards the left (counterclockwise direction)
3. The opening degree can be checked through the indicator that is attached to the cover.
4. It is recommended to maintain the opening degree at 100%. Controlling the pump's discharge amount by adjusting the opening degree leads to pump overload. This is why the opening degree should not be adjusted unless in special cases.
5. Install a pressure gauge on the outlet side of the valve to check for leakage. (If the outlet pressure drops when the pump is not in operation or the fluid is not flowing, it means that there is leakage.)







Piping method using control check valves

■ How to clean the screen and remove the wire and wire mesh net

1. Sufficiently flush the inside of the pipeline after opening all valves.
2. Close the gate valve in front of the suction diffuser.
3. Open the drain plug ③ in the lower part of the main body to completely withdraw water and remove foreign substances.
4. Disassemble the bolts on the cover and open the cover by turning it based on the hinge ④.
5. Open the screen ① simultaneously.
6. Remove the wire mesh net ② located outside the screen.
7. Clean the screen ①, and assemble in reverse order.

Reference Data

12

Length

cm	m	km	in	ft	Cheok (Korean foot)
1	0.01	$0.0_4 1$	0.3937	0.0328	0.033
100	1	0.001	39.371	3.2809	3.3
100,000	1,000	1	39,371	3,280.9	3,300
2.54	0.02540	$0.0_4 254$	1	0.08333	0.08382
30.48	0.3048	$0.0_3 3048$	12	1	1.0058
30.30	0.30303	$0.0_3 3030$	11.9303	0.9942	1

Area

cm^2	m^2	in^2	ft^2	$Cheok^2$ (Korean foot)
1	$0.0_3 1$	0.1550	0.001076	0.001089
1×10^4	1	1,550.1	10.7643	10.89
6.4514	$0.0_3 6451$	1	0.006944	0.007026
929	0.0929	144	1	1.0117
918.27	0.09183	142.34	0.9885	1

Volume

dm^3	m^3	ft^3	Gal (British)	Gal (U,S)	Seok	$Cheok^3$ (Korean foot)
1	0.001	0.03532	0.220	0.2642	$0.0_2 5544$	0.03594
1,000	1	35.317	219.95	264.19	5.5435	35.937
28.315	0.02832	1	6.2279	7.4806	0.1570	1.0175
4.5465	$0.0_2 4547$	0.1606	1	1.2011	0.02520	0.1633
3.7852	$0.0_2 3785$	0.1337	0.8325	1	0.02098	0.1360
180.39	0.18039	6.3707	39.676	47.656	1	6.4827
27.826	0.02783	0.9827	6.1203	7.3514	0.15425	1

Mass

g	kg	t(tonne)	lb	Ton (British)	Ton (U,S)	Gwan (3,75 kg)	Geun (0,6 kg)
1	0.001	$0.0_3 1$	0.002205	$0.0_6 984$	$0.0_3 1102$	$0.0_3 2267$	0.001667
1,000	1	0.001	2.2046	$0.0_3 984$	$0.0_2 1102$	0.2667	1.6667
1×10^6	1,000	1	2,204.6	0.9842	1.1023	266.67	1,666.7
453.6	0.4536	$0.0_3 4536$	1	$0.0_3 446$	$0.0_3 51$	0.121	0.760
1,016,047	1,016.05	1.01605	2,240	1	1.12	270.94	1,693.4
907,185	907.185	0.90719	2,000	0.89286	1	241.91	1,519.8
3,750	3.75	0.00375	8.2673	$0.0_2 3691$	$0.0_2 4134$	1	6.25
600	0.6	$0.0_3 6$	1.3228	$0.0_3 5905$	$0.0_3 6613$	0.16	1

Viscosity

Poise=g/cm · s (CGS unit)	centipoise. cP	kg/m · s	kg/m · h	lb/ft · s
1	100	0.1	360	0.0672
0.01	1	0.001	3.6	0.000672
10	1,000	1	3,600	0.672
0.00278	0.278	$0.0_3 278$	1	0.000187
14.88	1,488	1.488	5,356.8	1

Velocity

m/s	m/h	km/h	ft/s	ft/min	mile/h
1	3,600	3.6	3.281	196.85	2.2370
$0.0_3 2778$	1	0.001	$0.0_3 9114$	0.05468	$0.0_3 6214$
0.2778	1,000	1	0.9114	54.682	0.6214
0.3048	1,097.25	1.0973	1	60	0.68182
$0.0_2 5080$	18.287	0.01829	0.01667	1	0.01136
0.4470	1,609.31	1.6093	1.4667	88	1

Flow

ℓ/s	m^3/h	m^3/s	Gal/min (British)	Gal/min (U.S)	ft^3/h	ft^3/s
1	3.6	0.001	13.197	15.8514	127.14	0.03532
0.2778	1	$0.0_3$2778	3.6658	4.4032	35.317	$0.0_2$9801
1,000	3,600	1	13,197	15,851	127,150	35.3165
0.075775	0.27279	$0.0_4$75775	1	1.2011	9.6342	$0.0_2$2676
0.06309	0.2271	$0.0_4$6304	0.8325	1	8.0208	$0.0_2$2228
$0.0_2$7865	0.02832	$0.0_5$7865	0.1038	0.1247	1	$0.0_3$2778
28.3153	101.935	0.02832	373.672	448.833	3,600	1

Pressure

kPa	MPa	kgf/cm^2	lb/in^2	atm	mHg	inHg	mH_2O (mAq)	inH_2O (inAq)
1	0.001	0.010197	0.14504	0.009869	0.007501	0.29530	0.10197	4.01463
100	0.1	1.0197	14.50	0.9869	0.7500	29.55	10.21	401.8
98.0665	0.098067	1	14.223	0.9678	0.7355	28.96	10.01	394.0
6.8948	0.006895	0.07031	1	0.06804	0.05171	2.0355	0.7037	27.70
101.325	0.101325	1.0333	14.70	1	0.760	29.92	10.34	407.2
133.322	0.133322	1.3596	19.34	1.316	1	39.37	13.61	535.67
3.3864	0.003386	0.03453	0.4912	0.03342	0.02540	1	0.3456	13.61
9.8067	0.009807	0.09991	1.421	0.0967	0.07349	2.893	1	39.37
0.24909	0.000249	0.002538	0.03609	0.002456	0.001867	0.07349	0.0254	1

Stress

Pa	MPa or N/mm^2	kg/mm^2	kgf/cm^2
1	0.000001	$0.0_6$101972	$0.0_4$101972
1,000,000	1	0.101972	10.1972
9,806,650	9.80655	1	100
98,066.5	0.0980665	0.01	1

Power

N	dyn	kgf	lbf
1	100,000	0.101972	0.22480894
0.00001	1	$0.0_5$101972	$0.0_5$22480894
9.80665	980,665	1	2.2046226
4.4482216	444,822.16	0.45359237	1

Work / Energy / Calorie

J	kw·h	kgf·m	kcal
1	$0.0_6$277778	0.101972	0.000238889
3,600,000	1	367,098	860
9.80665	$0.0_5$272407	1	0.00234270
4,186.05	0.00116279	426.858	1

■ Comparison between SI units and conventionally used units

Measurement	SI unit	Units jointly used with SI units	Conventionally used units	SI unit conversion rate	Notes
Plane angle	rad	° Degree ′ Minute ″ Second		— 1.74533×10^{-2}rad 2.90888×10^{-4}rad 4.84814×10^{-6}rad	$1^\circ=(\pi/180)$rad $1'=(1/60)^\circ$ $1''=(1/60)'$
Mass	kg	t		— 1×10^{3} kg	
Density	kg/m^3	kg/ℓ t/m^3		— $1\times10^{-3}kg/m^3$ $1\times10^{3}kg/m^3$	
Force	N		dyn kgf	— 1×10^{-5}N 9.80665N	
Pressure	Pa	bar	mmAq, mmH_2O mAq, mH_2O kgf/cm^2 mmHg atm (Steam pressure)	— 1×10^{5} Pa 9.80665Pa 9.80665×10^{3}Pa 9.80665×10^{4}Pa 1.3322×10^{2}Pa 1.0135×10 Pa	Used for fluid pressure
Viscosity	Pa·S	P		— 1×10^{-1} Pa·S	
Kinematic viscosity	m^2/S	St		— 1×10^{-4} m^2/S	
Work/Calorie/ Electric energy	J		kcal kgf·m kW·h	— 4.18605kJ 9.80665J 3.6MJ	According to IT calorie, which indicates values of measurement, 1cal it = 4.1868okj
Temperature	K ℃				Thermodynamical temperature Celsius temperature T(K)273.15+t(°C)
Temperature unit	K ℃				Indicated as deg before
Specific heat/Entropy	J/(kg·K)		kcal/kg·℃	— 4.18605kJ/(kg·K)	
Enthalpy/Specific latent heat	J/kg		kcal/kg	— 4.18605kJ/kg	
Stress	Pa N/m^2		kgf/m^2	9.80665Pa	

SI unit conversion table

SI stands for the International System of Units (from the French Le Systeme International d'Unites), which was adopted during the General Conference on Weights and Measures (CGPM) in 1960.

● Main measurement units that were changed to SI units

Measurements	Changed measurement unit (symbol)	SI unit (symbol)	Unit conversion factors (note 1)
Pressure	(kgw/㎡, kgf/㎡, kg/㎡) (mHg) Notes 2 (mH_2O, mAq) (Torr) Notes 3	Pascal (pa)	1kgf/㎡ ≒ 9.8Pa 1mHg ≒ 133kPa 1mH_2O ≒9.8kPa 1Torr=133Pa
Force	(kgw, kgf)	(N)	1kgf ≒ 9.8N
Work	(kgw·m, kgf·m, kg·m)	(N·m)	1kgfm ≒ 9.8N·m
Stress	(kgf/㎡)	(Pa)	1kgf/㎡ ≒ 9.8Pa
Calorie	(kal) Notes 4	(J)	1cal ≒ 4.2J
Length	(μ)	(m)	1μ = 1㎛

● The following are main prefixes that compose the integer powers of 10 of SI units.

Factor	Prefix	Symbol	Factor	Prefix	Symbol
10^6	Mega	M	10^{-2}	Centimeter	C
10^3	Kilo	k	10^{-3}	Millimeter	m
10^2	Hectare	h	10^{-6}	Micrometer	μ

Notes 1) The accurate figures for unit conversion are 9.8 → 9.8066, 133 → 133.322, 4.2 → 4.18605.
Notes 2) Certified for use in measuring blood pressure levels. Notes 3) Certified for use in medical-related matters.
Notes 4) Certified for use in nutrition-related matters.

Data / Saturated Steam Table

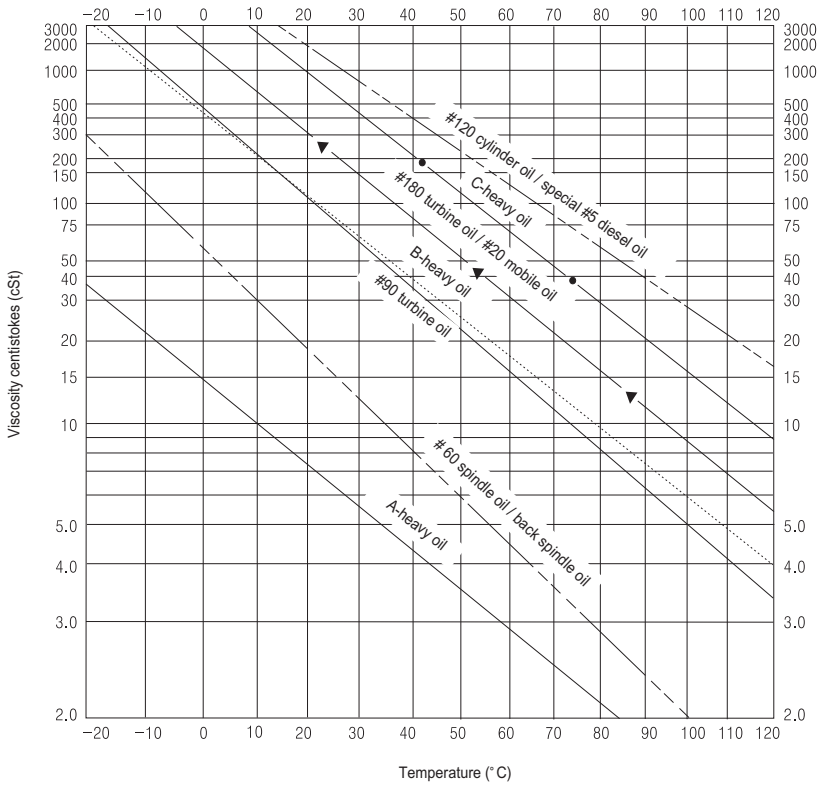
Absolute pressure of steam (abs)		Steam temperature		Volume of 1 kg of water before evaporation	Volume of 1 kg of steam	Weight of 1 m³ of steam	Calorie of 1 kg of steam (Kal)			Absolute pressure of steam (abs)		Steam temperature		Volume of 1 kg of water before evaporation	Volume of 1 kg of steam	Weight of 1 m³ of steam	Calorie of 1 kg of steam (Kal)		
(kgf/㎠)	(lb/in²)	(℃)	(°F)				Water calorie	Latent heat	Total calorie	(kgf/㎠)	(lb/in²)	(℃)	(°F)				Water calorie	Latent heat	Total calorie
0.02	0.28	17.2	62.9	1.0012	68.26	0.0147	17.2	587.8	605.0	13.50	192.0	192.4	378.3	1.1451	0.1485	6.734	195.5	469.9	665.4
0.04	0.57	28.6	83.5	1.0039	35.46	0.0282	28.7	581.3	610.0	14.00	199.1	194.1	381.4	1.1476	0.1436	6.974	197.3	468.4	665.7
0.06	0.85	35.8	96.4	1.0063	24.18	0.0414	35.8	577.3	613.1	14.50	206.2	195.8	384.4	1.1500	0.1386	7.214	199.0	466.9	665.9
0.08	1.14	41.2	106.2	1.0083	18.44	0.0542	41.2	574.2	615.4	15.00	213.3	197.4	378.3	1.1524	0.1342	7.454	200.7	465.5	666.2
0.10	1.42	45.5	113.9	1.0101	14.95	0.0669	45.4	571.8	617.2	16.00	227.4	200.4	392.7	1.1572	0.1260	7.934	204.1	462.6	666.7
0.15	2.13	53.6	128.5	1.0138	10.21	0.0980	53.5	567.1	620.6	17.00	241.7	203.4	398.1	1.1618	0.1189	8.414	207.2	459.9	667.1
0.20	2.84	59.7	136.5	1.0170	7.791	0.1284	59.6	563.5	623.1	18.00	256.0	206.2	403.2	1.1663	0.1124	8.894	210.2	457.2	667.4
0.25	3.56	64.6	148.3	1.0197	6.319	0.1583	64.5	560.8	625.2	19.00	270.2	208.8	407.8	1.1706	0.1067	9.375	213.1	454.6	667.7
0.30	4.27	68.7	155.7	1.0221	5.326	0.1878	68.7	558.2	626.9	20.00	2844	211.4	412.5	1.1749	0.1015	9.857	215.9	452.1	668.0
0.35	4.98	72.3	162.1	1.0242	4.609	0.2170	72.2	556.1	628.3	21.00	298.6	213.9	417.0	1.1791	0.0967	10.34	218.6	459.6	668.2
0.40	5.69	75.4	167.7	1.0362	4.067	0.2459	75.4	554.2	629.6	22.00	312.8	216.2	421.2	1.1833	0.0924	10.82	221.2	447.2	668.4
0.45	6.40	78.3	172.9	1.0281	3.642	0.2746	78.3	552.5	630.8	23.00	327.1	218.5	425.3	1.1873	0.0885	11.31	223.8	444.8	668.6
0.50	7.11	80.9	177.6	1.0298	3.300	0.3030	80.9	550.9	631.8	24.00	341.3	220.8	429.4	1.1913	0.0848	11.79	226.2	442.6	668.8
0.60	8.53	85.5	185.9	1.0329	2.782	0.3594	85.5	548.1	633.6	25.00	355.5	222.9	433.2	1.1953	0.0815	12.28	228.6	440.3	668.9
0.70	9.95	89.5	193.1	1.0357	2.408	0.4152	89.5	545.7	635.2	26.00	369.7	225.0	437.0	1.1991	0.0784	12.76	230.9	438.1	669.0
0.80	11.4	93.0	199.4	1.0383	2.125	0.4705	93.0	543.5	636.5	27.00	383.9	227.0	440.6	1.203	0.0755	13.25	233.2	435.9	669.1
0.90	12.8	96.2	205.2	1.0407	1.904	0.5253	96.2	541.5	637.7	28.00	398.2	229.0	444.2	1.207	0.0728	13.74	235.4	433.8	669.2
1.00	14.2	99.1	210.4	1.0430	1.755	0.5797	99.2	539.6	638.8	29.00	412.4	230.9	447.6	1.210	0.0703	14.23	237.5	431.7	669.2
1.20	17.1	104.3	219.7	1.0471	1.454	0.6875	104.4	536.3	640.7	30.00	426.6	232.8	451.0	1.214	0.0679	14.72	239.6	429.7	669.3
1.40	19.9	108.7	227.7	1.0508	1.259	0.7942	108.9	535.5	652.4	32.00	455.0	236.4	457.5	1.221	0.0637	15.70	243.7	425.6	669.3
1.60	22.8	112.7	234.9	1.0542	1.111	0.8999	112.9	530.8	643.7	34.00	483.5	239.8	463.6	1.229	0.0599	16.69	247.6	421.7	669.3
1.80	25.6	116.3	241.3	1.0573	0.9952	1.005	116.6	528.4	645.0	36.00	511.9	243.0	469.4	1.236	0.0565	17.69	251.3	417.9	669.2
2.00	28.4	119.6	247.3	1.0603	0.9018	1.109	199.6	526.3	646.2	38.00	540.4	246.2	475.2	1.243	0.0535	18.69	254.9	414.2	669.1
2.50	35.6	126.8	260.2	1.0669	0.7317	1.367	127.2	521.4	648.6	40.00	566.8	249.2	480.6	1.249	0.0508	19.70	258.4	410.5	669.9
3.00	42.7	132.9	271.2	1.0728	0.6168	1.621	133.4	517.2	650.6	42.00	597.2	252.1	485.8	1.256	0.0483	20.72	261.7	407.0	669.7
3.50	49.8	138.2	280.8	1.0782	0.5337	1.874	138.8	513.4	652.2	44.00	625.7	254.9	490.8	1.263	0.0406	21.74	265.0	403.5	668.5
4.00	56.9	142.9	289.2	1.0831	0.4708	2.124	143.7	510.0	653.7	46.00	654.1	257.6	495.7	1.269	0.0439	22.77	268.2	400.0	668.2
4.50	64.0	147.2	297.0	1.0877	0.4214	2.373	148.1	506.8	654.9	48.00	682.6	260.2	500.4	1.276	0.0420	23.80	271.3	396.6	667.9
5.00	71.1	151.1	304.0	1.0920	0.3816	2.620	152.1	503.9	656.0	50.00	711.0	262.7	504.9	1.283	0.0402	24.85	274.3	393.3	667.6
5.50	78.2	154.7	310.5	1.0961	0.3489	2.877	155.8	501.2	657.0	55.00	782.1	268.7	515.7	1.299	0.0364	27.49	218.5	385.1	666.6
6.00	85.3	158.1	316.6	1.1000	0.3213	3.112	159.3	498.6	657.9	60.00	853.2	274.3	525.7	1.315	0.3331	30.18	288.3	377.2	666.5
6.50	92.4	161.2	322.2	1.1307	0.2980	3.356	162.6	496.1	658.7	65.00	924.3	279.5	535.1	1.331	0.0304	32.93	294.8	369.4	664.2
7.00	99.5	164.2	327.6	1.1072	0.2778	3.600	165.7	493.8	659.5	70.00	995.4	284.5	544.1	1.347	0.0280	35.75	301.0	361.8	662.8
7.50	106.7	167.0	332.6	1.111	0.2602	3.843	168.6	491.6	660.2	75.00	1066.5	289.2	552.6	1.363	0.0259	38.62	307.0	354.3	661.3
8.00	113.8	169.6	337.3	1.1140	0.2448	4.086	171.3	489.5	660.8	80.00	1137.6	293.6	560.5	1.379	0.0241	41.56	312.8	346.9	659.7
8.50	120.9	172.1	341.8	1.1172	0.2311	4.328	174.0	487.4	661.4	85.00	1208.7	297.9	568.2	1.395	0.0224	44.58	318.4	339.6	658.0
9.00	128.0	174.5	346.1	1.1203	0.2188	4.570	176.5	485.4	661.9	90.00	1279.8	301.9	585.4	1.412	0.0210	47.67	323.8	332.4	656.2
9.50	135.1	176.8	350.2	1.1233	0.2079	4.811	178.9	483.5	662.4	95.00	1350.9	305.8	585.4	1.429	0.0197	50.85	329.1	325.2	654.3
10.00	142.2	179.0	354.2	1.1262	0.1979	5.052	181.3	481.6	662.9	100.00	1422.0	309.5	589.1	1.446	0.0185	54.12	334.3	318.0	652.3
10.50	149.3	181.2	358.2	1.1291	0.1890	5.293	183.5	479.8	663.3	120.00	1706.4	323.1	613.6	1.518	0.0147	68.22	354.0	289.4	643.4
11.00	156.4	183.2	361.8	1.1319	0.1807	5.533	185.6	478.1	663.7	140.00	1990.8	335.1	653.2	1.599	0.0118	84.52	372.8	260.0	632.8
11.50	163.5	185.2	365.4	1.1346	0.1732	5.774	187.7	476.4	664.1	160.00	2275.2	345.8	654.4	1.693	0.0096	104.0	391.8	228.4	619.7
12.00	170.6	187.1	368.8	1.1373	0.1663	6.014	189.8	474.7	664.5	180.00	2559.6	355.4	671.7	1.814	0.0078	128.3	410.8	192.9	603.7
12.50	177.8	188.9	372.0	1.1400	0.1599	6.254	191.7	473.1	664.8	200.00	2844.0	364.1	687.4	1.990	0.0062	161.6	431.6	151.2	582.8
13.00	184.9	190.7	375.3	1.1425	0.1540	6.494	193.6	471.5	665.1	225.56	3208.7	374.15	705.47	3.170	0.0032	315.5	503.3	0	503.3

Absolute pressure (kgf/cm²)		Steam temperature (°C)							
		100	150	200	250	300	350	400	450
0.1	v	17.54	19.90	22.26	24.61	26.97	29.32	31.68	34.03
(45.45)	*i*	641.9	664.7	687.8	711.2	734.8	783.3	758.9	808.1
0.5	v	3.486	3.967	4.442	4.916	5.388	5.860	6.332	6.803
(80.86)	*i*	640.7	664.0	687.3	710.8	734.6	758.7	783.2	808.0
1	v	1.730	1.975	2.215	2.454	2.691	2.927	3.164	3.400
(99.09)	*i*	639.3	663.1	686.8	710.5	734.3	758.5	783.0	807.9
2	v		0.6466	1.102	1.223	1.342	1.461	1.580	1.698
(119.61)	*i*		661.3	685.6	709.7	733.8	758.1	782.6	807.6
3	v		0.9788	0.7307	0.8123	0.8927	0.9724	1.052	1.131
(132.88)	*i*		659.4	684.5	708.9	733.2	757.6	782.3	807.3
4	v		0.4803	0.5450	0.6071	0.6679	0.7280	0.7878	0.8474
(142.92)	*i*		657.5	683.3	708.1	732.6	757.2	781.9	807.0
5	v			0.4336	0.4840	0.5330	0.5814	0.6294	0.6772
(151.11)	*i*			682.1	707.3	732.1	756.7	781.6	806.7
6	v			0.3592	0.4018	0.4431	0.4836	0.5238	0.5638
(158.08)	*i*			680.8	706.5	731.51	756.3	781.2	806.4
7	v			0.3060	0.3432	0.3788	0.4138	0.4484	0.4827
(164.17)	*i*			679.5	705.7	730.9	755.8	780.8	806.1
8	v			0.2662	0.2992	0.3307	0.3614	0.3918	0.4220
(169.61)	*i*			678.2	704.8	730.3	755.4	780.5	805.8
9	v			0.2351	0.2649	0.2932	0.3207	0.3478	0.3747
(174.53)	*i*			676.8	704.0	729.7	754.9	780.1	805.5
10	v			0.2103	0.2375	0.2632	0.2881	0.3126	0.3369
(179.04)	*i*			675.4	703.1	729.1	754.5	779.8	805.2
12	v			0.1729	0.1964	0.2182	0.2392	0.2598	0.2802
(187.08)	*i*			672.6	701.3	727.9	753.6	779.0	804.6
15	v			0.1353	0.1552	0.1732	0.1903	0.2070	0.2234
(197.37)	*i*			668.0	689.6	726.0	752.2	777.9	803.6
20	v				0.1139	0.1282	0.1414	0.1542	0.1667
(211.39)	*i*				693.6	722.8	749.8	776.1	802.1
30	v				0.07218	0.08291	0.09242	0.1014	0.1100
(232.76)	*i*				682.6	715.8	744.9	772.3	799.0
40	v				0.05093	0.06016	0.06787	0.07491	0.08160
(249.18)	*i*				669.7	708.1	739.7	768.4	795.9
50	v					0.04637	0.05309	0.05902	0.06457
(262.69)	*i*					699.6	734.1	764.3	792.7
60	v					0.03706	0.04318	0.04841	0.05320
(274.28)	*i*					690.3	728.2	760.1	789.4
80	v					0.02500	0.03068	0.03509	0.03897
(293.61)	*i*					667.7	715.2	751.1	782.6
100	v						0.02302	0.02703	0.03041
(309.53)	*i*						700.4	741.4	755.5
120	v							0.01030	0.01305
(364.07)	*i*							677.1	733.8

V=Volume of 1 kg of steam (m^3/kg), i=Calorie of 1 kg of steam (kcal/kg)

Data / Fluid Viscosity

■ Oil temperature and viscosity curve



Engineering viscosity unit conversion

$v = \frac{\mu}{\rho}$

v = Viscosity(stokes : St. centistolkes : cSt)

μ : Absolute viscosity(Poise : P.centiposise : cP)

ρ : Density(g/cm^2)

1Poise = 100 centipoise

1stokes = 100 centistokes

■ Viscosity conversion table

Centistokes (c s t)	Saybolt Universal Second (SSU) (Second)	Redwood (No. 1) Second R (Second)	Engler Degree E (Degree)	Centistokes (c s t)	Saybolt Universal Second (SSU) (Second)	Redwood (No. 1) Second R (Second)	Engler Degree E (Degree)
2.7	35	32.2	1.18	103	475	419	13.5
4.3	40	36.2	1.32	108	500	441	14.2
5.9	45	40.6	1.46	119	550	485	15.6
7.4	50	44.9	1.60	130	600	529	17.0
8.9	55	49.1	1.75	141	650	573	18.5
10.4	60	53.5	1.88	152	700	617	19.9
11.8	65	57.9	2.02	163	750	661	21.3
13.1	70	62.3	2.15	173	800	705	22.7
14.5	75	67.6	2.31	184	850	749	24.2
15.8	80	71.0	2.42	195	900	793	25.6
17.0	85	75.1	2.55	206	950	837	27.0
18.2	90	79.6	2.68	217	1000	882	28.4
19.4	95	84.2	2.81	260	1200	1058	34.1
20.6	100	88.4	2.95	302	1400	1234	39.8
23.0	110	97.1	3.21	347	1600	1411	45.5
25.0	120	105.9	3.49	390	1800	1587	51
27.5	130	114.8	3.77	433	2000	1763	57
29.8	140	123.6	4.04	542	2500	2204	71
32.1	150	132.4	4.32	650	3000	2646	85
34.3	160	141.1	4.59	758	3500	3087	99
36.5	170	150.0	4.88	867	4000	3526	114
38.8	180	158.8	5.15	974	4500	3967	128
41.0	190	167.5	5.44	1082	5000	4408	142
43.2	200	176.4	5.72	1150	5500	4849	156
47.5	220	194.0	6.28	1300	6000	5290	160
51.9	240	212	6.85	1400	6500	5730	185
56.5	260	229	7.38	1510	7000	6171	199
60.5	280	247	7.95	1630	7500	6612	213
64.9	300	265	8.51	1740	8000	7053	227
70.3	325	287	9.24	1850	8500	7494	242
75.8	350	309	9.95	1960	9000	7934	256
81.2	375	331	10.7	2070	9500	8375	270
86.8	400	353	11.4	2200	10000	8816	284
92.0	425	375	12.1				
97.4	450	397	12.8				

Data / Vapor Viscosity Table

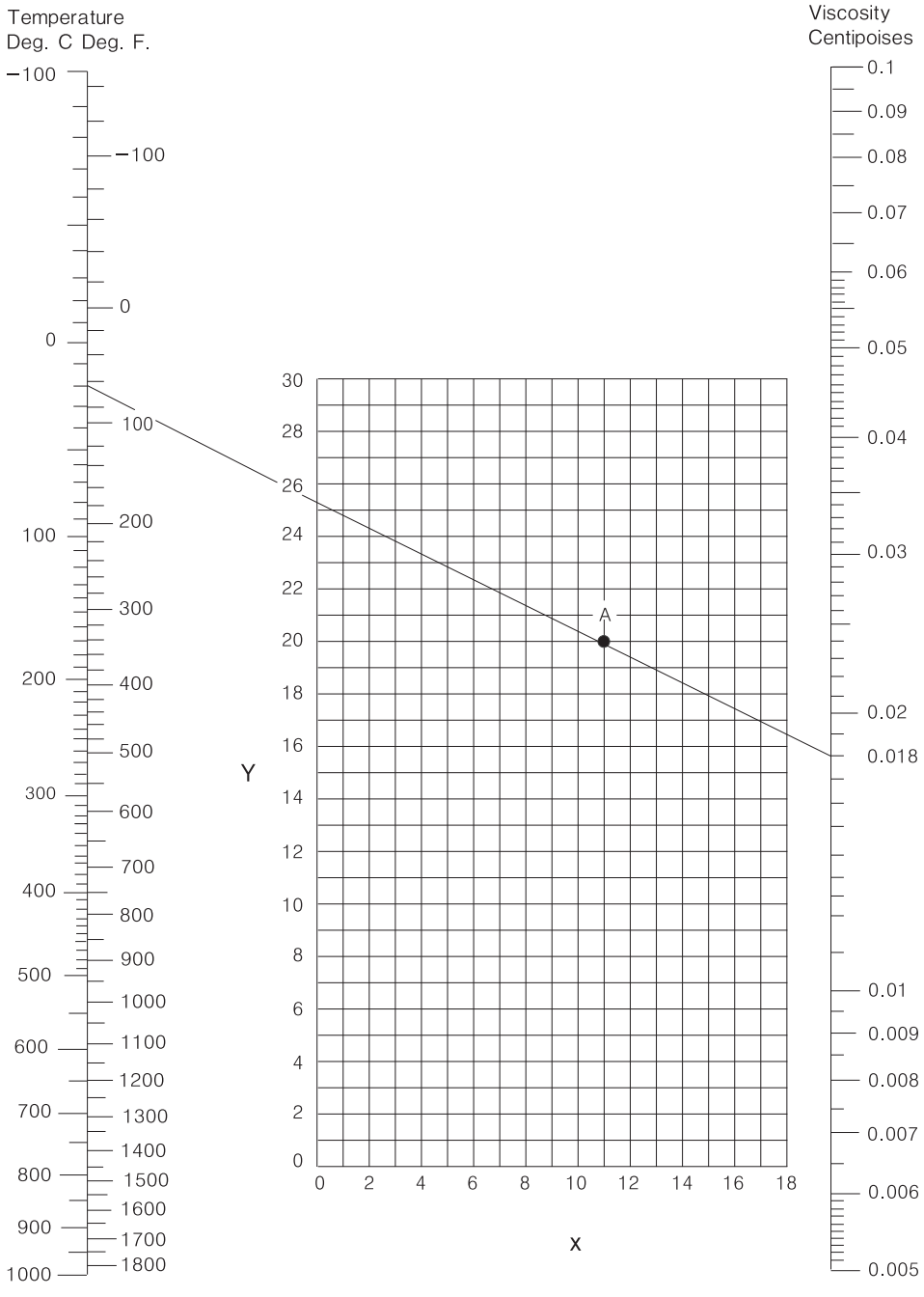
Number	Vapor	X	Y	Number	Vapor	X	Y
1	Acetic acid	7.7	14.6	29	Freon-113	11.3	14.0
2	Acetone	8.9	13.0	30	Helium	10.9	20.5
3	Acetylene	9.8	14.9	31	Hexane	8.6	11.8
4	Air	11.0	20.0	32	Hydrogen	11.2	12.4
5	Ammonia	8.4	16.0	33	$3H_2+N_2$	11.2	17.2
6	Argon	10.5	22.4	34	Hydrogen bromide	8.8	20.9
7	Benzene	8.5	13.2	35	Hydrogen chloride	8.8	18.7
8	Bromine	8.9	19.2	36	Hydrogen cyanide	9.8	14.9
9	Butene	9.2	13.7	37	Hydrogen iodide	9.0	21.3
10	Butylene	8.9	13.0	38	Hydrogen sulfide	8.6	18.0
11	Carbon dioxide	9.5	18.7	39	Iodine	9.0	18.4
12	Carbon disulfide	8.0	16.0	40	Mercury	5.3	22.9
13	Carbon monoxide	11.0	20.0	41	Methane	9.9	15.5
14	Chlorine	9.0	18.4	42	Methyl alcohol	8.5	15.6
15	Chloroform	8.9	15.7	43	Nitric oxide	10.9	20.5
16	Cyanogen	9.2	15.2	44	Nitrogen	10.6	20.0
17	Cyclohexane	9.2	12.0	45	Nitrosyl chloride	8.0	17.6
18	Ethane	9.1	14.5	46	Nitrous Oxide	8.8	19.0
19	Ethyl acetate	8.5	13.2	47	Oxygen	11.0	21.3
20	Ethyl alcohol	9.2	14.2	48	Pentane	7.0	12.8
21	Ethyl chloride	8.5	15.6	49	Propane	9.7	12.9
22	Ethyl ether	8.9	13.0	50	Propyl alcohol	8.4	13.4
23	Ethylene	9.5	15.1	51	Propylene	9.0	13.8
24	Fluorine	7.3	23.8	52	Sulfur dioxide	9.6	17.0
25	Freon-11	10.6	15.1	53	Toleune	8.6	12.4
26	Freon-12	11.1	16.0	54	2,3,3-Trimethylbutane	9.5	10.5
27	Freon-21	10.8	15.3	55	Water	8.0	16.0
28	Freon-22	10.1	17.0	56	Xenon	9.3	23.0

■ How to find viscosity by chart

Assuming that the vapor type is 20°C air
1) Find the air's coordinates in the table above. (X=11.0, Y=20.0)
2) Indicate the X and Y values on the coordinates table on the next page. (Point A)
3) Read the value of the point of intersection between the viscosity table on the right and the extended line that connects point A with the 20°C point of the temperature table on the left.
4) The viscosity of 20°C air is 0.018cP.

■ How to convert cP into cSt

Vapor cP / Vapor density (g/cm^3) = Vapor cSt
Example) When converting the viscosity of 20°C air (0.018cP) into cSt (air density : 1.20 X 10-3g/cm^3)



Refer to the previous page for the viscosity (1 atm) and coordinates of vapor and steam.

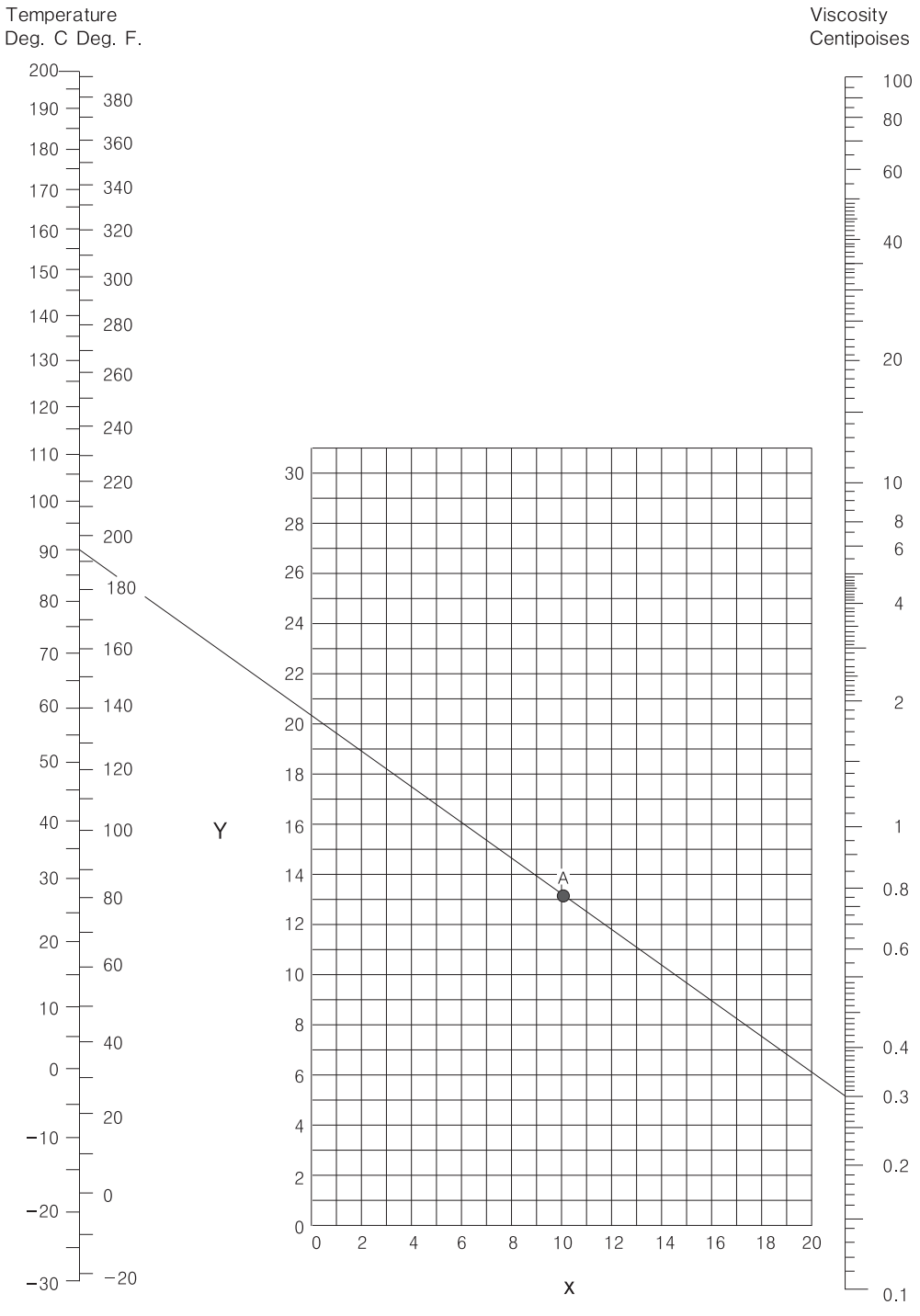
Data / Liquid Viscosity Table

Number	Vapor	X	Y	Number	Vapor	X	Y
1	Acetaldehyde	15.2	4.8	56	Freon-22	17.2	4.7
2	Acetic acid, 100%	12.1	14.2	57	Freon-113	12.5	11.4
3	Acetic acid, 70%	9.5	17.0	58	Glycerol, 100%	2.0	30.0
4	Acetic anhydride	12.7	12.8	59	Glycerol, 50%	6.9	19.6
5	Acetone, 100%	14.5	7.2	60	Heptane	14.1	8.4
6	Acetone, 35%	7.9	15.0	61	Hexane	14.7	7.0
7	Allyl aicohol	10.2	14.3	62	Hydrochloric acid, 31.5%	13.0	16.6
8	Ammonia, 100%	12.6	2.0	63	Isobutyl alcohol	7.1	18.0
9	Ammonia, 26%	10.1	13.9	64	Isobutyl acid	12.2	14.4
10	Amyl acetate	11.8	12.5	65	Isobutyric alcohol	8.2	16.0
11	Amyl alcohol	7.5	18.4	66	Kerosene	10.2	16.9
12	Aniline	8.1	18.7	67	Linseed oil, raw	7.5	27.2
13	Anisole	12.3	13.5	68	Mercury	18.4	16.4
14	Arsenic trichloride	13.9	14.5	69	Methanol, 100%	12.4	10.5
15	Benzene	12.5	10.9	70	Methanol, 90%	12.3	11.8
16	Bimethyl oxalate	12.3	15.8	71	Methanol, 40%	7.8	15.5
17	Biphenyl	12.0	18.3	72	Methyl acetate	14.2	8.2
18	Brine, CaCl2, 25%	6.6	15.9	73	Methyl chloride	15.0	3.8
19	Brine NaCl, 25%	10.2	16.6	74	Methyl ethyl ketone	13.9	8.6
20	Bromine	14.2	13.2	75	Naphthalene	7.9	18.1
21	Bromotoluene	20.0	15.9	76	Nitric acid, 95%	12.8	13.8
22	Butyl acetate	12.3	11.0	77	Nitric acid, 60%	10.8	17.0
23	Butyl alcohol	8.6	17.2	78	Nitrobenzene	10.6	16.2
24	Butyric acid	12.1	15.3	79	Nitrotoluene	11.0	17.0
25	Carbon dioxide	11.6	0.3	80	Octane	13.7	10.0
26	Carbon disulfide	16.1	7.5	81	Octyl alcohol	6.6	21.1
27	Carbon tetrachloride	12.7	13.4	82	Pentachloroethane	10.9	17.3
28	Chlorobenzene	12.3	12.4	83	Pentane	14.9	5.2
29	Chloroform	14.4	10.2	84	Phenol	6.9	20.8
30	Chlorosulfonic acid	11.2	18.1	85	Phosphorus tribromide	13.8	16.7
31	o-Chlorotoluene	13.0	13.3	86	Phosphorus trichloride	16.2	10.9
32	m-Chlorotoluene	13.3	12.5	87	Propionic acid	12.8	13.8
33	p-Chlorotoluene	13.3	12.5	88	Propyl alcohol	9.1	16.5
34	m-resol	2.5	20.8	89	Propyl bromide	14.5	9.6
35	Cyclohexanol	2.9	24.3	90	Propyl chloride	14.4	7.5
36	Dibromoethane	12.7	15.8	91	Propyl iodide	14.1	11.6
37	Dichloroethane	13.2	12.2	92	Sodium	16.4	13.9
38	Dichloromethane	14.6	8.9	93	Sodium hydroxide, 50%	3.2	25.8
39	Diethyl oxalate	11.0	16.4	94	Stannic chloride	13.5	12.8
40	Dipropyl oxalate	10.3	17.7	95	Sulfur dioxide	15.2	7.1
41	Ethyl acetate	13.7	9.1	96	Sulfuric acid, 110%	7.2	27.4
42	Ethyl alcohol, 100%	10.5	13.8	97	Sulfuric acid, 98%	7.0	24.8
43	Ethyl alcohol, 95%	9.8	14.3	98	Sulfuric acid, 60%	10.2	21.3
44	Ethyl alcohol, 40%	6.5	16.6	99	Sulury chloride	15.2	12.4
45	Ethyl benzene	13.2	11.5	100	Tetrachloroethane	11.9	15.7
46	Ethyl bromide	14.5	8.1	101	Tetrachloroethylene	14.2	12.7
47	Ethyl chloride	14.8	6.0	102	Titanium tetrachloride	14.4	12.3
48	Ethyl ether	14.5	5.3	103	Toluene	13.7	10.4
49	Ethyl formate	14.2	8.4	104	Trichloroethylene	14.8	10.5
50	Ethyl iodide	14.7	10.3	105	Turpentine	11.5	14.9
51	Ethylene glycol	6.0	23.6	106	Vinyl acetate	14.0	8.8
52	formic acid	10.7	15.8	107	Water	10.2	13.0
53	Freon-11	14.4	9.0	108	o-Xylene	13.5	12.1
54	Freon-12	16.8	5.6	109	m-Xylene	13.9	10.6
55	Freon-21	15.7	7.5	110	p-Xylene	13.9	10.9

■ How to find viscosity by chart

Assuming that the liquid type is 90°C water

1) Find the wate's coordinates in the table above. (X=10.2, Y=13.0)
2) Indicate the X and Y values on the coordinates table on the next page. (Point A)
3) Read the value of the point of intersection between the viscosity table on the right and the extended line that connects point A with the 90°C point of the temperature table on the left.
4) The viscosity of 90°C water is 0.3cP.



Refer to the previous page for the viscosity (1 atm) and coordinates of liquid and steam.

Method based on Cv formula

Cv value : A valve's Cv value refers to clear water, with a temperature of 60° F(15.6° C) flowing for 1 minute, when the differential pressure between the inlet and outlet side of the valve is maintained at 1 psi (0.07 kgf/cm³), indicated in US gal/min.

■ Calculation procedure

1. Selection of a nominal diameter is usually based on the Cv method. In this case, calculate the Cv value for each of the differential pressures for maximum, normal, and minimum flows. In other words, the Cv value when there is maximum flow and minimum differential pressure becomes the maximum Cv value. The Cv value when there is minimum flow and maximum differential pressure becomes the minimum Cv value.
2. A nominal diameter is usually selected by making room for an additional 10 to 20% to the maximum Cv value. In addition, the minimum adjustable flow or rangeability (ratio of the controllable maximum flow and minimum flow) is defined according to the control valve type. As such, attention should be paid to the calculated minimum Cv value as well.

■ Cv value calculation formula

1. Steam

In the case of , $\triangle P < \frac{P_1}{2}$ $Cv = \frac{WK}{13.67\sqrt{\triangle P(P_1+P_2)}}$, $W = Cv \times \frac{13.67\sqrt{\triangle P(P_1+P_2)}}{K}$

In the case of , $\triangle P \geq \frac{P_1}{2}$ $Cv = \frac{WK}{11.9P_1}$, $W = Cv\frac{11.9P_1}{K}$

W = Maximum flow kg/h
P_1 = Primary pressure kgf/cm²(abs)
P_2 = Secondary pressure kgf/cm²(abs)
$\triangle P = P_1 - P_2$ kgf/cm²
K = 1+(0.0013 × Degree of superheating ° C)

2. Vapor

In the case of , $\triangle P < \frac{P_1}{2}$ $Cv = \frac{Q}{287}\sqrt{\frac{G(273+t)}{\triangle P(P_1+P_2)}}$, $Q = Cv \times \frac{287}{\sqrt{\frac{G(273+t)}{\triangle P(P_1+P_2)}}}$

In the case of , $\triangle P \geq \frac{P_1}{2}$ $Cv = \frac{Q\sqrt{G(273+t)}}{249P_1}$, $Q = Cv \times \frac{249P_1}{\sqrt{G(273+t)}}$

Q = Maximum flow Nm³/h
(In the case of 15° C 760mmHg abs)
G = Specific gravity (Air=1)
t = Temperature ° C
P_1 = Primary pressure kgf/cm²(abs)
P_2 = Secondary pressure kgf/cm²(abs)
$\triangle P = P_1 - P_2$ kgf/cm²

3. Liquid

$Cv = \frac{1.167V\sqrt{G}}{\sqrt{P1-P2}}$, $V = Cv \times \frac{\sqrt{P1-P2}}{1.167\sqrt{G}}$

V = Maximum flow m³/h
G = Specific gravity (Water=1)
P_1 = Primary pressure kgf/cm²(abs)
P_2 = Secondary pressure kgf/cm²(abs)

■ Viscosity correction calculation formula

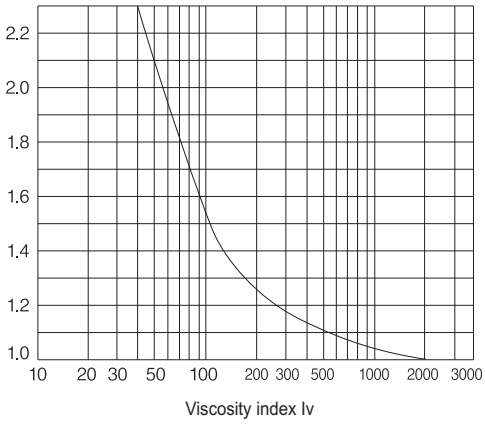
Carry out viscosity correction based on the following method for liquid that has a viscosity of 100 (SSU) or 20(cSt) or higher.
1. Use the liquid's Cv calculation formula to determine the Cv value, without considering the viscosity's effect.
2. Determine the viscosity coefficient (Iv) by the following formula.
3. Determine the correction coefficient (K) by the Viscosity Coefficient Iv-Cv Correction Coefficient K Relationship Chart.
4. Multiply the correction coefficient (K) by the Cv value that was initially calculated.
5. This value is the corrected Cv value.

$Iv = \frac{44{,}000Q}{\sqrt{Cv}\ McSt}$ or, $Iv = \frac{205{,}000Q}{\sqrt{Cv}\ Mssu}$

Viscosity-corrected Cv = Cv before viscosity correction X K

Q = Maximum flow m²/h
McSt = Viscosity cSt
Mssu = Viscosity SSU (Saybolt Universal Second)
Cv = Cv value before viscosity correction

■ Viscosity Index Iv-Cv Correction Coefficient K Relationship Chart



■ Unit flow table (Water)

P1 = Primary pressure (kgf/㎠g)

(㎥/h)

P2 \ P1	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	11	12	13	14	15	16	18	20	22	24	26	28	30
0(Air)	0.8568	0.049	1.211	1.354	1.484	1.603	1.713	1.817	1.916	2.009	2.098	2.184	2.267	2.346	2.423	2.498	2.570	2.641	2.709	2.842	2.968	3.089	3.206	3.318	3.427	3.635	3.832	4.019	4.197	4.369	4.534	4.693
0.2	0.7664	0.9770	1.149	1.299	1.433	1.556	1.670	1.776	1.877	1.972	2.063	2.150	2.234	2.315	2.393	2.468	2.541	2.613	2.682	2.816	2.943	3.065	3.183	3.296	3.406	3.615	3.812	4.000	4.180	4.352	4.518	4.677
0.35	0.6908	0.9189	1.100	1.256	1.394	1.520	1.637	1.745	1.847	1.944	2.036	2.125	2.209	2.291	2.370	2.446	2.520	2.592	2.561	2.796	2.924	3.047	3.165	3.279	3.389	3.599	3.798	3.987	4.167	4.339	4.505	4.665
0.5	0.6059	0.8568	1.049	1.211	1.354	1.484	1.603	1.713	1.817	1.916	2.009	2.098	2.184	2.267	2.346	2.423	2.498	2.570	2.641	2.776	2.905	3.029	3.148	3.262	3.373	3.584	3.783	3.973	4.153	4.327	4.493	4.654
1		0.6059	0.8568	1.049	1.211	1.354	1.484	1.603	1.713	1.817	1.916	2.009	2.098	2.184	2.267	2.346	2.423	2.498	2.570	2.709	2.842	2.968	3.089	3.206	3.318	3.533	3.735	3.926	4.109	4.284	4.452	4.614
1.5			0.6059	0.8568	1.049	1.211	1.354	1.484	1.603	1.713	1.817	1.916	2.009	2.098	2.184	2.184	2.346	2.423	2.498	2.641	2.776	2.905	3.029	3.148	3.262	3.480	3.685	3.879	4.064	4.241	4.411	4.574
2				0.6059	0.8568	1.049	1.211	1.354	1.484	1.603	1.713	1.817	1.916	2.009	2.098	2.098	2.267	2.346	2.423	2.570	2.709	2.842	2.968	3.089	3.206	3.427	3.635	3.832	4.019	4.197	4.369	4.534
2.5					0.6059	0.8568	1.049	1.211	1.354	1.484	1.603	1.713	1.817	1.916	2.009	2.009	2.184	2.267	2.346	2.498	2.641	2.776	2.905	3.029	3.148	3.373	3.584	3.783	3.973	4.153	4.327	4.493
3						0.6059	0.8568	1.049	1.211	1.354	1.484	1.603	1.713	1.817	1.916	1.817	2.098	2.184	2.267	2.423	2.570	2.709	2.842	2.968	3.089	3.318	3.533	3.735	3.926	4.109	4.284	4.452
4								0.6059	0.8568	1.049	1.211	1.354	1.484	1.603	1.713	1.603	1.916	2.009	2.098	2.267	2.423	2.570	2.709	2.842	2.968	3.206	3.427	3.635	3.832	4.019	4.197	4.369
5									0.6059	0.8568	1.049	1.211	1.354	1.484	1.354	1.713	1.817	1.916	2.098	2.267	2.423	2.570	2.709	2.842	3.089	3.318	3.533	3.735	3.926	4.109	4.284
6										0.6059	0.8568	1.049	1.211	1.049	1.603	1.716	1.916	2.098	2.267	2.423	2.570	2.709	2.968	3.206	3.427	3.635	3.832	4.019	4.197			
7												0.6059	0.8568	0.6059	1.211	1.354	1.484	1.713	1.916	2.097	2.267	2.423	2.570	2.842	3.089	3.318	3.533	3.735	3.926	4.109		
8															0.8568	1.049	1.211	1.484	1.713	1.916	2.098	2.267	2.423	2.709	2.968	3.206	3.427	3.635	3.832	4.019		
9																	0.6059	0.8568	1.211	1.484	1.713	1.916	2.098	2.267	2.570	2.842	3.089	3.318	3.533	3.735	3.926	
10																			0.8568	1.211	1.484	1.713	1.916	2.098	2.423	2.709	2.968	3.206	3.427	3.635	3.832	
12																					0.8568	1.211	1.484	1.713	2.098	2.423	2.709	2.968	3.206	3.427	3.635	
14																							0.8568	1.211	1.713	2.098	2.423	2.709	2.968	3.205	3.427	

P2 = Secondary pressure (kgf/㎠g)

■ Cv value

Product name \ Type \ Size	15	20	25	32	40	50	65	80	100	125	150	200	250	300	350	400
Pressure reducing valve YPR-2A	2.1	2.1	3.5	8	8	14	22	32	48		108					
Pressure reducing valve YAWR-1						40	62.5	90	160	250	360	640	1000	1440	1960	2560
Pressure reducing valve YPR-2,20F			6	9.4	13.5	24	37.5	54	96	150	216					
Pressure reducing valve YPR-40F					8	14	22	32	48	75	108					
Pressure reducing valve YPR-10S,10F			3.5	5.7	8.5	13.5	17	25	40							
Primary pressure control valve YPR-2W	2.1	2.1	3.5	8	8	14	22	32	48		108					
Primary pressure control valve YAWM-1						40	62.5	90	160	250	360	640	1000	1440	1960	2560

[How to select a nominal diameter]

1 : (Cv value to be calculated) = $\frac{\text{(Maximum designated flow)}}{\text{(unit flow)}}$ (Possible flow) = (Unit flow) x (Cv value)

2 : Correction by specific gravity (G) (Correction unit flow) = (Unit flow) $\times \sqrt{\frac{1}{G}}$

[Cautions]

1 : Unit flow refers to the flow per 1 Cv value under each pressure condition.

2 : The pressure range and off set are different for each type.

■ Unit flow table (Saturated steam)

P1 = Primary pressure (kgf/㎠g)

(kg/h)

P2 = Secondary pressure (kgf/㎠g)

P2 \ P1	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	11	12	13	14	15	16	18	20	22	24	26	28	30
0.35	20.17	28.76	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
0.5	18.08	27.34	35.70	41.65																												
1		20.50	30.56	39.26	47.60	53.55																										
1.5			22.66	33.48	42.68	51.14	59.50	65.45																								
2				24.64	36.16	45.85	54.68	63.01	71.40	77.35																						
2.5					26.47	38.66	48.81	57.99	66.61	74.87	83.30	89.25																				
3						28.18	41.01	51.60	61.13	70.03	78.52	86.72	95.20	101.1																		
3.5							29.79	43.22	54.25	64.11	73.29	82.02	90.41	98.57	107.1	113.0																
4								31.32	45.33	56.77	66.96	76.41	85.36	93.96	102.2	110.4	119.0	124.9														
4.5									32.77	47.35	59.19	69.70	79.41	88.59	97.38	105.8	114.1	122.2	130.9													
5										34.17	49.28	61.51	72.33	82.30	91.70	100.6	109.3	117.7	126.0	142.8												
5.5											35.51	51.14	63.75	74.87	85.09	94.70	103.8	112.7	121.3	137.8	154.7											
6												36.80	52.94	65.91	77.32	87.79	97.62	106.9	115.9	133.2	149.7	166.6										
6.5													38.05	54.68	68.00	79.70	90.41	100.4	109.9	128.0	145.1	161.6	178.5									
7			For low pressure											39.26	56.36	70.03	82.02	92.96	103.2	122.2	140.0	157.0	173.4	190.4									
7.5			P2 \ P1		0.4		0.6		0.8						40.43	57.99	72.01	84.26	95.44	115.7	134.4	152.0	168.9	185.3	202.3								
8			0.2		9.857		14.46		18.34							41.57	59.58	73.93	86.45	108.5	128.2	146.5	164.0	180.8	197.1								
8.5			0.4				10.58		15.46								42.68	61.13	75.80	100.2	121.3	140.5	158.6	175.9	192.7	226.1							
9																		43.76	62.64	90.67	113.5	133.9	152.8	170.7	187.9	220.8							
9.5																			44.82	79.41	104.7	126.5	146.4	165.0	182.7	216.4	249.9						
10																				65.55	94.70	118.3	139.4	158.8	177.1	211.7	244.5	273.7					
11																					68.35	98.57	123.0	144.6	164.6	201.3	235.5	268.2	297.5				
12																						71.03	102.2	127.5	149.7	189.4	225.4	259.3	291.9	321.3	345.1	368.9

■ Cv value

Product name \ Size / Type		15	20	25	32	40	50	65	80	100	125	150	200	250	300	350	400
Pressure reducing valve	YPR-100	5	7.2	10.9	14.3	18.8	32	60	78	120							
	YPR-1S	1	2.5	4	6.5	9	16	25	36	64	100	144	256				
	YPR-1A	3	3	6	9.5	13.5	24	37.5	54	96	150	216					
	YPR-3S	1.2	2.7	4.5	7	9.5	17	26	38	68							
	YPR-50	0.8	0.8	1					1								
Temperature control valve	YTD-2			4		8	12.5	18	25	40							
	YTP-2	1	2.5	4	6.5	9	16	25	36	64	100	144	256				

[How to select a nominal diameter]

1 : (Cv value to be calculated) = $\frac{\text{(Maximum designated flow)}}{\text{(unit flow)}}$ (Possible flow) = (Unit flow) x (Unit flow)

2 : Correction by superheated steam (Correction unit flow) = (Unit flow) x $\sqrt{\frac{29}{M}}$ Molecular weight

[Cautions]

1 : Unit flow refers to the flow per 1 Cv value under each pressure condition.

2 : The pressure range and off set are different for each type.

■ Unit flow table (Air)

P1 = Primary pressure (kgf/㎠g)

(N㎥/h)

P2 = Secondary pressure (kgf/㎠g)

P2 \ P1	0.1	0.2	0.4	0.6	0.8	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	7	8	9	10	12	14	16	18	20	22	24	26	28	30	35	40	45	50
0(Air)	7.683	11.12	16.42	20.94	25.09	29.04	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
0.01(100	7.306	10.86	16.25	20.80	24.94	28.94																												
0.05	5.497	9.740	15.52	20.24	24.51	28.54																												
0.1		8.041	14.52	19.48	23.88	28.00																												
0.2			12.09	17.74	22.49	26.82	36.36																											
0.35			6.217	14.39	19.96	24.74	35.27																											
0.5				9.335	16.68	22.18	33.53	43.64	50.91																									
1							25.15	37.49	48.15	58.18	65.46																							
1.5								27.80	41.06	52.35	62.73	72.73	80.00																					
2									30.22	44.36	56.23	67.06	77.29	87.28	94.55																			
2.5										32.46	47.42	59.86	71.13	81.71	91.83	101.8																		
3											34.56	50.30	63.29	74.98	85.90	96.31	116.3	130.9																
4													38.41	55.60	69.63	82.13	104.7	125.4	145.4	160.0														
5															41.91	60.45	88.72	112.4	134.1	154.5	189.1													
6																	64.93	94.84	119.7	142.2	183.6	218.2												
7																		69.13	100.6	126.5	171.8	212.7	247.2											
8																			73.08	106.0	157.2	201.2	241.8	276.3										
9																				76.83	139.2	187.4	230.5	270.8	305.4									
10																					116.1	170.9	217.3	259.7	299.9	334.5	363.6							
12																						125.4	183.6	232.3	276.5	318.1	358.0	392.7	421.8					
14																							134.1	195.5	246.4	292.3	335.3	376.4	416.1	450.9				
16																								142.2	206.7	259.7	307.3	351.7	393.9	434.6	523.6	596.4		
20																										157.2	227.4	284.5	335.3	382.3	490.2	590.4	669.1	741.8
25																												122.0	215.3	283.0	417.4	531.5	636.2	735.6
30																															306.8	449.8	569.8	679.0

■ Cv value

Product name \ Type \ Size	15	20	25	32	40	50	65	80	100	125	150
Pressure reducing valve YPR-2A	2.1	2.1	3.5	8	8	14	22	32	48		108
Pressure reducing valve YPR-11	2.1	2.1	3.5	5.5	8	14	22	32	48	75	108

[How to select a nominal diameter]

1 : (Cv value to be calculated) = $\frac{\text{(Maximum designated flow)}}{\text{(Unit flow)}}$ (Possible flow) = (Unit flow) x (Cv value)

2 : Correction by various types of gas (Correction unit flow) = $\frac{\text{(Unit flow)}}{K}$ K = 1+(0.0013 x Degree of superheating)

[Cautions]

1 : Unit flow refers to the flow per 1 Cv value under each pressure condition.

2 : The pressure range and off set are different for each type.

Data / Flow Velocity within Pipeline Water, Air

■ Water / air flow velocity chart

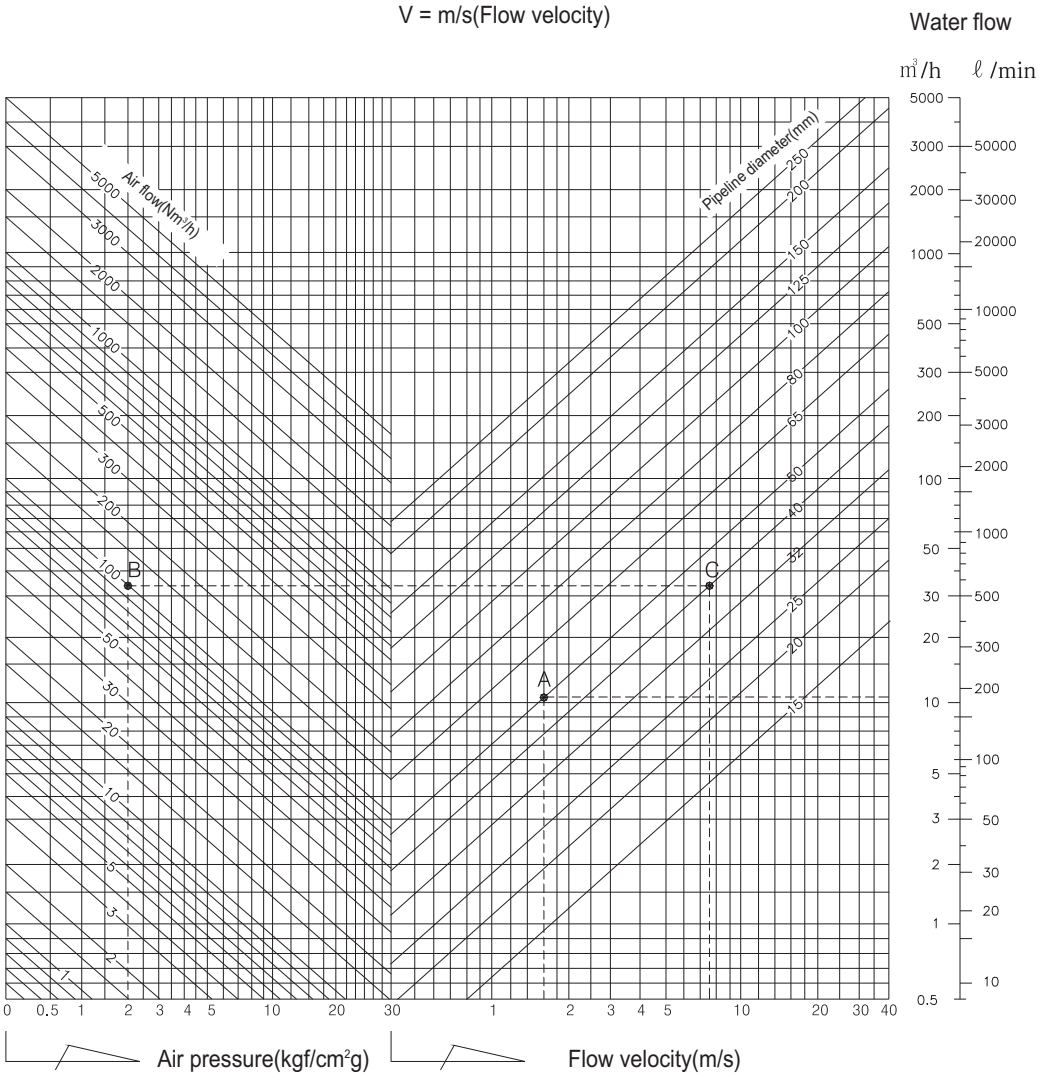
Flow calculation formula

$Q = \frac{\pi}{4} A^2 \times V \times 3600 \times 10^{-6}$

Q = m^3/h(Flow)

A = mm(Nominal diameter of pipeline)

V = m/s(Flow velocity)



■ How to use the chart

Example 1: To obtain the flow velocity when the water flow is 11 m^3/h and the pipeline diameter is 50 mm,

Determine A, the point of intersection between the pipeline diameter of 50 mm and a horizontal line from the flow of 11 m^3/h. Go down vertically from point A to read a flow velocity of 1.6 m/s.

Example 2: To obtain the flow velocity when the air flow is 100 Nm^3/h, pressure is 2 kgf/cm^2g, and pipeline diameter is 40 mm,

Determine B, the point of intersection between the air flow of 100 Nm^3/h and air pressure of 2kgf/cm^2g. Then determine C, the point of intersection between the pipeline diameter of 40 mm with a horizontal line from point B.
Go down vertically from point C to read a flow velocity of 7.5 m/s. This is the flow velocity.

■ Standard flow velocity by use

1. Pump
   - Suction pipe : 2.0-2.5 m/s
   - Low pressure discharge pipe : 2.5-3.0 m/s
   - High pressure discharge pipe : 3.0-3.5 m/s
2. Liquid transport pipeline
   - Water of 1-10 kgf/cm^2g : 1.5-3 m/s
   - Water of 200-300 kgf/cm^2g : 3-4 m/s
   - Other types of liquid with high viscosity, like oil : 0.5-2 m/s
3. Compressor
   - Suction pipe : 10-20 m/s
   - Low pressure discharge pipe : 20-30 m/s
   - High pressure discharge pipe : 10-15 m/s
4. Compressing gas transport pipe
   - 1~2kgf/cm^2g : 8~15m/s
   - 200~300kgf/cm^2g : 5~7m/s

Data / Flow Velocity within Pipeline Steam

■ Water / steam flow velocity chart

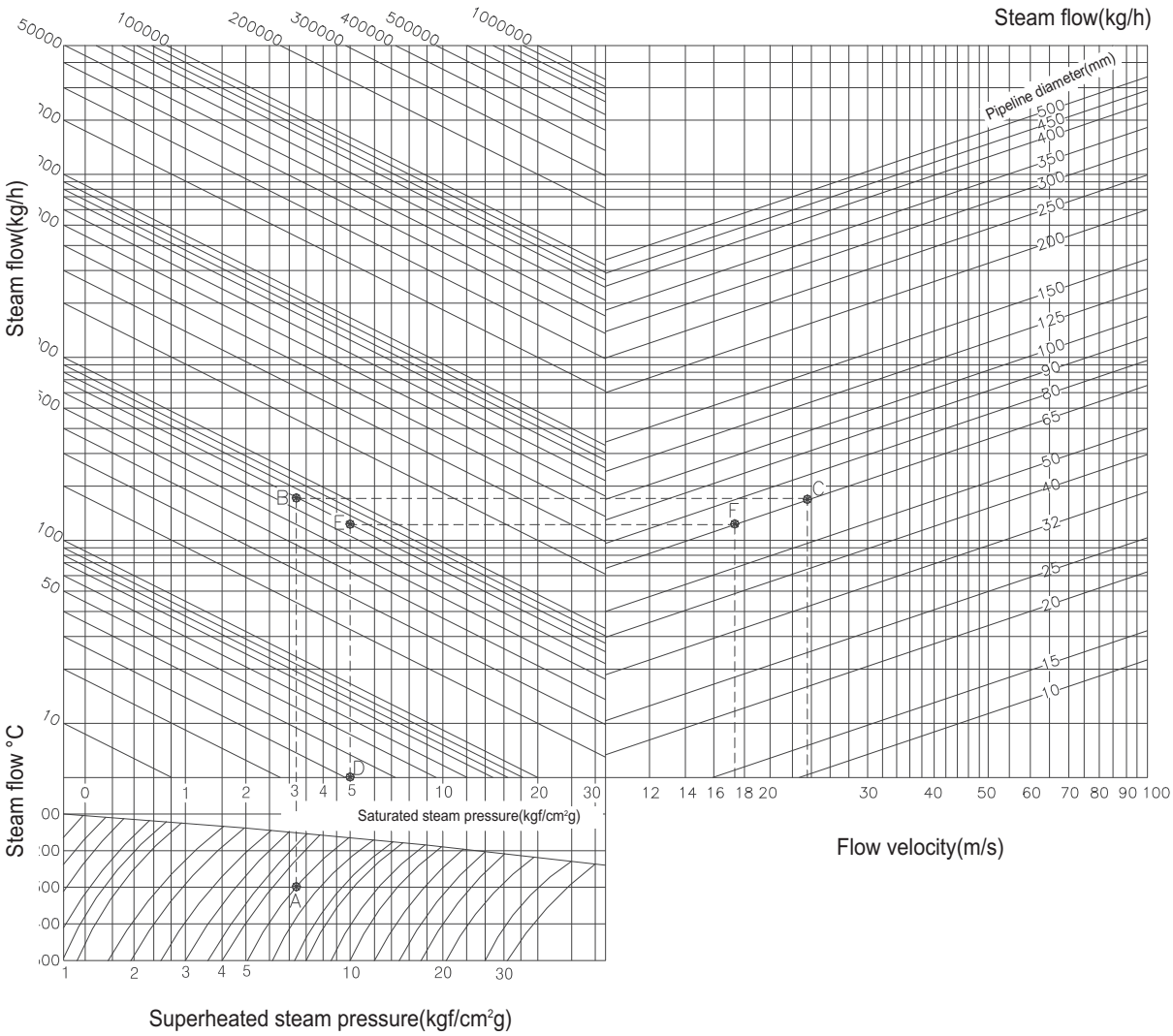
Flow calculation formula

$Q = \frac{\pi}{4} D^2 \times V \times 3600 \times 10^{-6}$

Q = m^3/h(Flow)

A = mm(Nominal diameter of pipeline)

V = m/s(Flow velocity)



■ How to use the chart

Example: To obtain the flow velocity when the steam pressure is 5 kgf/cm^2g, superheated steam is 300°C, flow is 700 kg/h, and pipeline diameter is 65 mm,

Determine A, the point of intersection between the steam pressure of 5 kgf/cm^2g and steam temperature of 300°C; and then B, the point of intersection between the flow of 700 kg/h and a vertical line from point A. Afterwards, determine C, the point of intersection between the pipeline diameter of 65 mm and a horizontal line from point B.

Go down vertically from point C, and this line will reach a flow velocity of 23.7 m/s. This is the flow velocity.

When calculating the flow velocity for saturated steam under the same conditions, determine D, which is on the line of saturated steam. Use the same method to follow E and F to read a flow velocity 17.3 m/s.

■ Standard flow velocity by use

1. Steam engine
   - Saturated steam : 20-30 m/s
   - Superheated steam : 30-45 m/s
2. Steam transport pipe
   - Saturated steam of 2-5 kgf/cm^2g : 15-20 m/s
   - Saturated steam of 5-15 kgf/cm^2g : 20-30 m/s

Data / Pipeline Head Loss

■ Pipeline lengths suitable for different valves (Table 1)

Size (mm)	Appropriate pipeline length (mm)							
	90°C elbow	45°C elbow	90°C T pipe (Branch)	90°C T pipe (Direct)	Gate valve	Ball valve	Angle valve Foot valve	Check valve
15	0.6	0.36	0.9	0.18	0.12	4.5	2.4	1.2
20	0.75	0.45	1.2	0.24	0.15	6.0	3.6	1.6
25	0.95	0.54	1.5	0.27	0.18	7.5	4.5	2.0
32	1.2	0.72	1.8	0.36	0.24	10.5	5.4	2.5
40	1.6	0.9	2.1	0.45	0.3	13.5	7.6	3.1
50	2.1	1.2	3.0	0.6	0.39	16.5	8.4	4.0
65	2.4	1.5	3.6	0.75	0.48	19.5	10.2	4.6
80	3.0	1.8	4.5	0.90	0.63	20.0	12.0	5.7
100	4.2	2.4	6.3	1.20	0.81	37.5	16.5	7.6
125	5.1	3.0	7.5	1.50	0.99	42.0	21.0	10.
150	6.0	3.6	9.0	1.80	1.20	49.5	24.0	12.0
200	6.5	3.7	14.0	4.0	1.40	70.0	33.0	15.0
250	8.0	4.2	20.0	5.0	1.70	90.0	43.0	19.0

■ Pipeline friction loss

(Hazen-Williams Equation) $Q = 1.67Cd^{2.63}i^{0.54} \times 10^4$

Q = Flow(ℓ /min)

C = Flow coefficient (100 in the case of an old cast iron or steel pipeline)

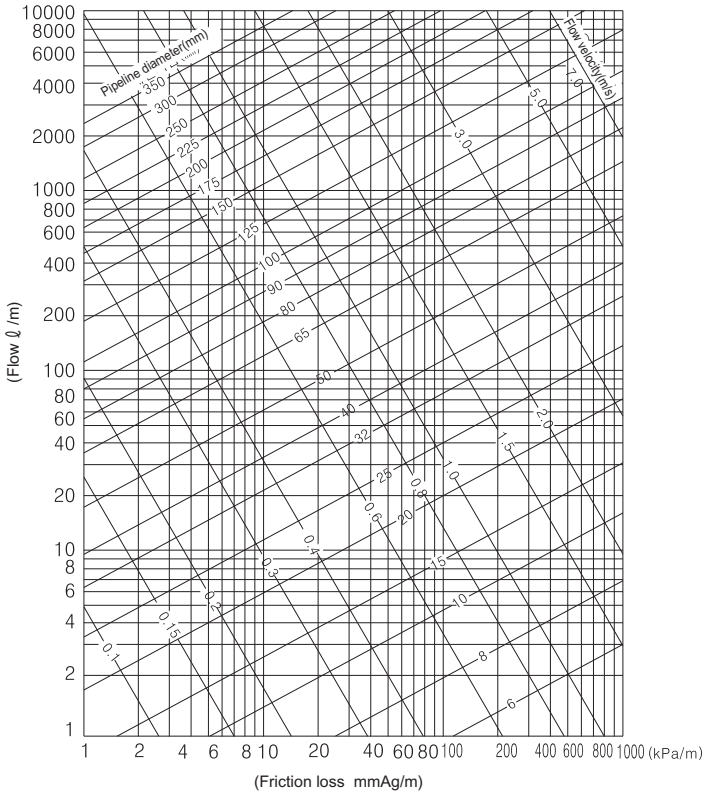
d = Inner diameter of pipeline (m)

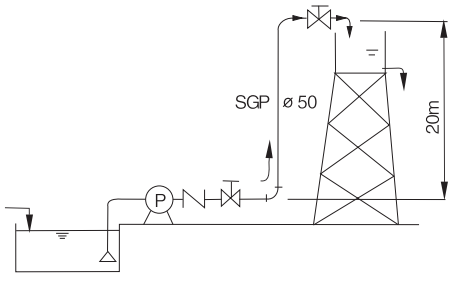
i = Pressure loss per unit length (mAq/m)

■ Calculation example

In the case of determining all heads that are lost and the pump's lift requirement (20 m), when a steel pipeline with a nominal diameter of 50 (actual length of 36 m) pumps 150 liters of water per minute from a water tank to another water tank (actual lift of 20 m),

■ Pipeline head loss chart





1. When determining the pipeline length by Table 1
   - 1 foot valve : 8.4X1=8.4
   - 1 check valve : 4.0X1=4.0
   - 2 gate valves : 0.39X2=0.78
   - 4 elbow pipes : 2.1X4=8.4

   Tota l : 21.58 m
2. Obtain the pipeline length by conversion.
   Converted pipeline length = 36+21.58=57.58 m
3. Based on the chart, when the nominal diameter is 50 and the flow is 150 l/min, the friction head loss is 52 mmAq/m and all head losses are 57.58X52=2.994 16mm=3.0.
   The pump's lift requirement is 20+3.0=23 m.

Data / Generated Condensate Volume of Steam Pipeline

■ Generated condensate volume when steam is initially passing through or of a pipeline that has not been insulated

A : When steam is initially passing through kg/mh
B : Pipeline that has not been insulated kg/mh

Pressure (kgf/cm²) \ Pipeline diameter (mm)		15	20	25	32	40	50	65	80	100	125	150	200	250	300
0.5	A	0.04	0.05	0.07	0.09	0.10	0.13	0.22	0.28	0.39	0.52	0.67	1.01	1.42	1.88
(110.7℃)	B	0.08	0.10	0.13	0.16	0.18	0.23	0.29	0.33	0.42	0.52	0.61	0.80	0.99	1.17
1	A	0.04	0.05	0.07	0.10	0.11	0.15	0.25	0.30	0.43	0.58	0.74	1.11	1.57	2.07
(119.6℃)	B	0.09	0.12	0.15	0.18	0.21	0.26	0.32	0.38	0.48	0.59	0.70	0.91	1.12	1.34
2	A	0.04	0.06	0.08	0.11	0.13	0.17	0.28	0.34	0.48	0.65	0.83	1.26	1.77	2.33
(132.9℃)	B	0.11	0.14	0.18	0.22	0.25	0.31	0.39	0.46	0.58	0.71	0.84	1.10	1.35	1.61
3	A	0.05	0.06	0.09	0.12	0.14	0.18	0.30	0.37	0.52	0.71	0.90	1.37	1.93	2.55
(142.9℃)	B	0.13	0.16	0.20	0.25	0.29	0.35	0.45	0.52	0.67	0.81	096	1.25	1.55	1.85
4	A	0.05	0.07	0.09	0.13	0.15	0.19	0.32	0.40	0.56	0.76	0.97	1.47	2.06	2.73
(151.1℃)	B	0.14	0.18	0.22	0.28	0.32	0.39	0.50	0.58	0.74	0.90	1.07	1.40	1.72	2.05
5	A	0.05	0.07	0.10	0.13	0.16	0.20	0.34	0.42	0.59	080	1.02	1.55	2.18	2.88
(158.1℃)	B	0.15	0.20	0.25	0.32	0.36	0.45	0.56	0.66	0.84	1.03	1.21	1.59	1.88	2.34
6	A	0.06	0.07	0.10	0.14	0.16	0.21	0.36	0.44	0.62	0.84	1.07	1.63	2.29	3.02
(164.2℃)	B	0.16	0.21	0.26	0.33	0.37	0.46	0.58	0.68	0.87	1.06	1.26	1.65	2.03	2.43
7	A	0.06	0.07	0.11	0.14	0.17	0.22	0.37	0.46	0.65	0.87	1.11	1.69	2.38	3.14
(169.6℃)	B	0.18	0.23	0.28	0.35	0.40	0.50	0.62	0.73	0.93	1.14	1.34	1.76	2.17	2.59
8	A	0.06	0.08	0.11	0.15	0.18	0.23	0.38	0.48	0.67	0.91	1.16	1.76	2.47	3.26
(174.5)	B	0.19	0.24	0.30	0.37	0.42	0.53	0.66	0.77	0.99	1.21	1.28	1.87	2.31	2.76
9	A	0.06	0.08	0.12	0.15	0.18	0.24	0.40	0.49	0.70	0.94	1.20	1.82	2.56	3.39
(179.0℃)	B	0.20	0.25	0.31	0.39	0.45	0.56	0.70	0.82	1.04	1.27	1.50	1.97	2.44	2.91
10	A	0.06	0.08	0.12	0.16	0.19	0.25	0.41	0.51	0.72	0.98	1.24	1.89	2.65	3.51
(183.2℃)	B	0.21	0.07	0.33	0.41	0.47	0.58	0.73	0.86	1.09	1.34	1.58	2.07	2.56	3.05
15	A	0.07	0.09	0.13	0.18	0.21	0.28	0.46	0.57	0.81	0.09	1.39	2.12	2.98	3.94
(200.4℃)	B	0.25	0.32	0.40	0.50	0.57	0.71	0.90	1.05	1.34	1.64	1.93	2.53	3.13	3.73
20	A	0.08	0.10	0.14	0.19	0.23	0.30	.50	0.62	0.87	1.18	1.50	2.28	3.21	4.24
(213.9℃)	B	0.29	0.26	0.46	0.57	0.65	0.81	1.02	1.19	1.53	1.87	2.21	2.89	3.57	42.6
30	A	0.00	0.12	0.17	0.23	0.27	0.35	0.59	0.73	1.03	1.39	1.77	2.69	3.78	5.00
(234.6℃)	B	0.37	0.47	059	0.74	0.85	1.05	1.32	1.54	1.97	2.41	2.85	3.73	4.61	5.50

■ Generated condensate volume when a pipeline is insulated

Temperature °C	Pipeline diameter (mm)	15	20	25	32	40	50	65	80	100	125	150	200	250	300
100	Insulation thickness (mm)	15	15	15	15	15	15	15	20	20	20	20	20	20	20
	Condensate volume (kg/mh)	0.05	0.06	0.07	0.08	0.08	0.10	0.11	0.12	0.14	0.17	0.19	0.23	0.27	031
150	Insulation thickness (mm)	15	15	20	20	20	20	25	25	25	25	25	25	30	30
	Condensate volume (kg/mh)	0.09	0.10	0.11	0.12	0.13	0.14	0.17	0.18	0.20	0.23	0.26	0.32	0.37	0.42
200	Insulation thickness (mm)	20	20	20	25	25	25	25	25	30	30	30	35	35	35
	Condensate volume (kg/mh)	0.12	0.14	0.15	0.15	0.17	0.19	0.22	0.24	0.28	0.32	0.36	0.43	0.50	0.58
250	Insulation thickness (mm)	20	25	25	25	25	30	30	30	35	35	35	40	40	40
	Condensate volume (kg/mh)	0.17	1.19	0.20	0.22	0.23	0.26	0.30	0.33	0.38	0.43	0.49	0.58	0.68	0.78
300	Insulation thickness (mm)	25	25	25	30	30	30	35	35	40	40	40	45	45	45
	Condensate volume (kg/mh)	0.22	0.25	0.28	0.30	0.33	0.37	0.42	0.46	0.53	0.60	0.68	0.80	0.94	1.08

Data / Dimensions Table of Carbon Steel Pipe

The following is what is prescribed by KS D3507 and KS D3562 for carbon steel pipes used for pipelines.
A carbon steel pipe for ordinary piping (SPP) is used for pipelines with a comparatively low running pressure, including pipelines for steam, water, oil, gas, and air; and a carbon steel pipe for pressure service (SPPS) is used for pressure pipelines used at 350°C or lower.

Size		Outer diameter (mm)	SPP		SPPS											
					Nominal thickness											
					Schedule 40				Schedule 60				Schedule 60			
			Thickness (mm)	Weight without a socket (kg/m)	Thickness (mm)	Weight (kg/m)	Water pressure test pressure (kg/m)		Thickness (mm)	Weight (kg/m)	Pressure of hydro-pressure test (kg/m)		Thickness (mm)	Weight (kg/m)	Pressure of hydro-pressure test (kg/m)	
(A)	(B)						Type 2	Type 3			Type 2	Type 3			Type 2	Type 3
6	1/8	10.5	2.0	0.419	1.7	0.369	50	50	2.2	0.450	70	70	2.4	0.479	70	70
8	1/4	13.8	2.3	0.652	2.2	0.629	50	50	2.4	0.675	70	70	3.0	0.799	70	70
10	3/8	17.3	2.3	0.851	2.3	0.851	50	50	2.8	1.00	70	70	3.2	1.11	70	70
15	1/2	21.7	2.8	1.31	2.8	1.31	50	50	3.2	0.46	70	70	3.7	1.64	70	70
20	3/4	27.2	2.8	1.68	2.9	1.74	50	50	3.4	2.00	70	70	3.9	2.24	70	70
25	1	34.0	3.2	2.43	3.4	2.57	50	50	3.9	2.89	70	70	4.5	3.27	70	70
32	1 1/4	42.7	3.5	3.38	3.6	3.47	70	50	4.5	4.24	100	120	4.5	4.57	140	130
40	1 1/2	48.6	3.5	3.89	3.7	4.10	70	50	4.5	4.89	100	120	5.1	5.47	140	130
50	2	60.5	3.8	5.31	3.9	5.44	70	50	4.9	6.72	100	120	5.5	7.46	140	130
65	2 1/2	76.3	4.2	7.47	5.2	9.12	70	50	6.0	10.4	100	120	7.0	12.0	140	130
80	3	89.1	4.2	8.79	5.5	11.3	70	50	6.6	13.4	130	140	7.6	115.3	180	180
90	3 1/2	101.6	4.2	10.1	5.7	13.5	100	100	7.0	16.3	140	130	8.1	18.7	180	180
100	4	114.3	4.5	12.2	6.0	16.0	100	100	7.1	18.8	140	140	8.6	22.4	180	180
125	5	139.8	4.5	15.0	6.6	21.7	100	100	8.1	26.3	140	140	9.5	30.5	180	180
150	6	165.2	5.0	19.8	7.1	28.7	100	100	9.3	35.8	140	140	11.0	14.8	180	180
200	8	216.3	5.8	30.1	8.2	42.1	100	100	10.3	52.3	130	140	12.7	63.8	170	160
250	10	267.4	6.6	42.4	9.3	59.2	100	100	12.7	79.8	130	140	15.1	93.9	170	150
300	12	318.5	6.9	53.0	10.3	78.3	100	100	14.3	107	120	130	17.4	129	160	140
350	14	355.5	7.9	67.7	11.1	94.3	70	100	15.1	127	110	130	19.0	158	160	140
400	16	406.4	7.9	77.6	12.7	123	70	100	16.7	160	110	120	21.4	203	160	140

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Data / Pressure stage table of iron / steel pipe flange

KSM 1501 (Pressure stage of iron/steel pipe flange) sets forth the following regulations concerning the maximum running pressure, based on the nominal pressure, materials, and fluid state of iron/steel pipe flanges used for pipelines for steam, Air, Gas, Water, Oil, Etc.

Nominal pressure	Material	Fluid state and maximum running pressure									
		Fluid state									
		W 120°C or lower	G_1 220°C or lower	G_2 350°C	G_3 350°C	H_1 400°C	H_2 425°C	H_3 450°C	H_4 475°C	H_5 490°C	Pressure of hydro-pressure test (Reference)
2	FC 200	3	5	—	—	—	—	—	—	—	4
	FCMB35	3	6	—	—	—	—	—	—	—	
5	SS41, SF40, S20C, SC42, SCPH1	7	6	—	—	—	—	—	—	—	10
	FC 200	7	10	5	—	—	—	—	—	—	
10	FCM35	14	12	—	—	—	—	—	—	—	20
	SS41, SF40, S20C, SC42, SCPH1	14	12	10	—	—	—	—	—	—	
16	FC 200	22	16	—	—	—	—	—	—	—	32
	FCMB35	27	20	18	16	—	—	—	—	—	35
	SS41(2), SF44, SFV1, S20C, SC25, SC49(2), SCPH2	28	25	23	21	18	16	—	—	—	40
20	FCMB35	28	25	—	20	—	—	—	—	—	44
	SS41(2), SF45, SFVIS20C, S25C, SC49(2), SCPH	34	31	29	26	23	20	—	—	—	50
30	SF45, S25C, SFV1, SC49(2)SCPH2	51	46	43	39	34	30	—	—	—	75
	SCPH11, SFHV12B	(51)	(46)	(43)	(39)	38	36	34	30(4)	—	
	SCPH21, SFHV23B	(51)	(46)	(43)	(39)	(38)	(36)	(34)	32	30	

FC20	KS D 4301	JIS G 5501
FCMB35	KS D 4303	JIS G 5702
SS41	KS D 3503	JIS G 3101
SF40, SF45	KS D 3710	JIS G 3201
SFV1	KS D 4109	JIS G 3211
SFHV12B, SFHV23B	KS D 4100	JIS G 3213
S20C, S25C	KS D 3752	JIS G 4051
SC42, SC49	KS D 4101	JIS G 5101
SCPH1, SCPH2 SCPH11, SCPH21	KS D 4315	JIS G 5151

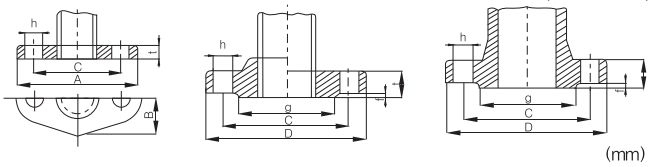
Notes : (1) Select a material from the nominal pressure step table or that satisfies the required flange performance.
(2) Apply to a maximum running temperature of 350° C
(3) There is the possibility of SCPH 11 and ½ Mo forged steel resulting in ductile fracture, and therefore should not be used at a temperature of 450 ° C or higher.
(4) The 'pressure of hydro-pressure test' lists test pressure levels for reference in case of installation of a flange in a pipeline. Exceptions are separately regulated.

Notes : 1. W is applied only to running water with almost no flow (with little pressure fluctuation) and with a temperature of 120° C or lower.
2. G1, G2, and G3 are applied to water with pressure fluctuations or steam, gas, and oil of the corresponding temperature regulated above.
3. H1 is applied to steam, air, gas, oil, etc. of 400° C
4. If the temperature or pressure is in the middle of the table above, the maximum running pressure or temperature can be determined based on interpolation.
5. H2 through H4 are applied to steam, air, gas, oil, etc. of 425 to 510°C. They are applied when there is a need to consider a material creep because of high temperature.
6. When shock, corrosion, or other special conditions are accompanied, apply a maximum running pressure that corresponds to a higher temperature or that of a higher nominal pressure.
7. The values in parentheses are generally not used, but are specified for reference.
8. When there is a need to indicate a fluid's state using a symbol, use W through H4.

Data / Standard Dimensions of Flange

■ Standard dimensions of a 5 kgf/cm² pipe flange

(KS B 1511 - 1987)
(JIS B 2210 - 1987)

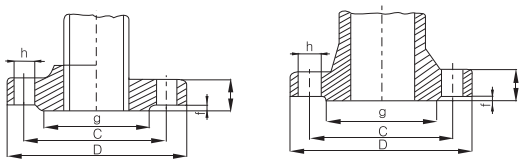


(mm)

Size	Outer diameter of applied steel pipe	Outer diameter of flange D	Dimensions of each part of flange				Bolt hole			Nominal diameter of bolt screw (name)
			t		f	Diameter (g)	Diameter of center circle (c)	Number	Diameter (h)	
			Other than grey cast iron	Grey cast iron						
10	17.3	75(75×45)	9	12	1	39	55	4(2)	12	M10
15	21.7	80(80×50)	9	12	1	44	60	4(2)	12	M10
20	27.2	85	10	14	1	49	65	4	12	M10
25	34.0	95	10	14	1	59	75	4	12	M10
32	42.7	115	12	16	2	70	90	4	15	M12
40	48.6	120	12	16	2	75	95	4	15	M12
50	60.5	130	14	16	2	85	105	4	15	M12
65	76.3	155	14	18	2	110	130	4	15	M12
80	89.1	180	14	18	2	121	145	4	19	M16
(90)	101.6	190	14	18	2	131	155	4	19	M16
100	114.3	200	16	20	2	141	165	8	19	M16
125	139.8	235	16	20	2	176	200	8	19	M16
150	165.2	265	18	22	2	216	230	8	19	M16
(175)	190.7	300	18	22	2	232	260	8	23	M20
200	216.3	320	20	24	2	252	280	8	23	M20
(225)	241.8	345	20	24	2	277	305	12	23	M20
250	267.4	385	22	26	2	317	345	12	23	M20
300	318.5	430	22	28	3	360	390	12	23	M20
350	355.6	480	24	30	3	403	435	12	25	M22
400	406.4	540	24	30	3	463	495	16	25	M22
450	457.2	605	24	30	3	523	555	16	25	M22
500	508.0	655	24	32	3	573	605	20	25	M22

■ Standard dimensions of a 10 kgf/cm² pipe flange

(KS B 1511 - 1987)
(JIS B 2210 - 1987)

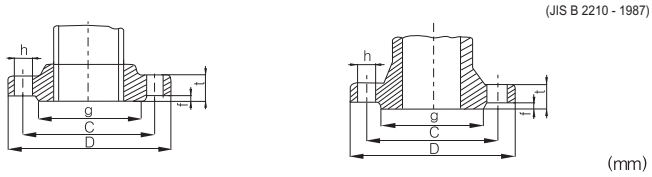


(mm)

Size	Outer diameter of applied steel pipe	Outer diameter of flange D	Dimensions of each part of flange				Bolt hole			Nominal diameter of bolt screw (name)
			t		f	Diameter (g)	Diameter of center circle (c)	Number	Diameter (h)	
			Other than grey cast iron	Grey cast iron						
10	17.3	90	12	14	1	46	65	4	15	M12
15	21.7	95	12	16	1	51	70	4	15	M12
20	27.2	100	14	18	1	56	75	4	15	M12
25	34.0	125	14	18	1	67	90	4	19	M16
32	42.7	135	16	20	2	76	100	4	19	M16
40	48.6	140	16	20	2	81	105	4	19	M16
50	60.5	155	16	20	2	95	120	4	19	M16
65	76.3	175	18	22	2	116	140	4	19	M16
80	89.1	185	18	22	2	126	150	8	19	M16
(90)	101.6	195	18	22	2	136	160	8	19	M16
100	114.3	210	18	24	2	151	175	8	19	M16
125	139.8	250	20	24	2	182	210	8	23	M20
150	165.2	280	22	26	2	212	240	8	23	M20
(175)	190.7	305	22	26	2	237	265	12	23	M20
200	216.3	330	22	26	2	262	290	12	23	M20
(225)	241.8	350	22	28	2	282	310	12	23	M20
250	267.4	400	24	30	2	324	355	12	25	M22
300	318.5	445	24	32	3	368	400	16	25	M22
350	355.6	490	26	34	3	413	445	16	25	M22
400	406.4	560	28	36	3	475	510	16	27	M24
450	457.2	620	30	38	3	530	565	20	27	M24
500	508.0	675	30	40	3	585	620	20	27	M24

■ Standard dimensions of a 16 kgf/cm² pipe flange

(KS B 1511 - 1987)
(JIS B 2210 - 1987)

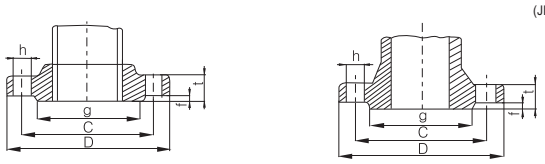


(mm)

Size	Outer diameter of applied steel pipe	Outer diameter of flange D	Dimensions of each part of flange				Bolt hole			Nominal diameter of bolt screw (name)
			t		f	Diameter (g)	Diameter of center circle (c)	Number	Diameter (h)	
			Other than grey cast iron	Grey cast iron						
10	17.3	90	12	–	1	41	65	4	15	M12
15	21.7	95	12	–	1	51	70	4	15	M12
20	27.2	100	14	–	1	56	75	4	15	M12
25	34.0	125	14	–	1	67	90	4	19	M16
32	42.7	135	16	–	2	76	100	4	19	M16
40	48.6	140	16	–	2	81	105	4	19	M16
50	60.5	155	16	20	2	96	120	8	19	M16
65	76.3	175	18	22	2	116	140	8	19	M16
80	89.1	200	20	24	2	132	160	8	23	M20
(90)	101.6	210	20	24	2	145	170	8	23	M20
100	114.3	225	22	26	2	160	185	8	23	M20
125	139.8	270	22	26	2	195	225	8	25	M22
150	165.2	305	24	28	2	230	260	12	25	M22
200	216.3	350	26	30	2	275	305	12	25	M22
250	267.4	430	28	34	2	345	380	12	27	M24
300	318.5	480	30	36	3	395	430	16	27	M24
350	355.6	540	34	38	3	440	480	16	33	M30×3
400	406.4	605	38	42	3	495	540	16	33	M30×3
450	457.2	675	40	46	3	560	605	20	33	M30×3
500	508.0	730	42	50	3	615	660	20	33	M30×3

■ Standard dimensions of a 20 kgf/cm² pipe flange

(KS B 1511 - 1987)
(JIS B 2210 - 1987)



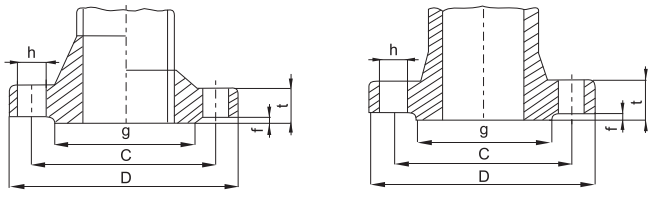
(mm)

Size	Outer diameter of applied steel pipe	Outer diameter of flange D	Dimensions of each part of flange				Bolt hole			Nominal diameter of bolt screw (name)
			t		f	Diameter (g)	Diameter of center circle (c)	Number	Diameter (h)	
			Other than grey cast iron	Grey cast iron						
10	17.3	90	14	16	1	46	65	4	15	M12
15	21.7	95	14	16	1	51	70	4	15	M12
20	27.2	100	16	18	1	56	75	4	15	M12
25	34.0	125	16	20	1	67	90	4	19	M16
32	42.7	135	18	20	2	76	100	4	19	M16
40	48.6	140	18	22	2	81	105	4	19	M16
50	60.5	155	18	22	2	96	120	8	19	M16
65	76.3	175	20	24	2	116	140	8	19	M16
80	89.1	200	22	26	2	132	160	8	23	M20
(90)	101.6	210	24	28	2	145	170	8	23	M20
100	114.3	225	24	28	2	160	185	8	23	M20
125	139.8	270	26	30	2	195	225	8	25	M22
150	165.2	305	28	32	2	230	260	12	25	M22
200	216.3	350	30	34	2	275	305	12	25	M22
250	267.4	430	34	38	2	345	380	12	27	M24
300	318.5	480	36	40	3	395	430	16	27	M24
350	355.6	540	40	44	3	440	480	16	33	M30×3
400	406.4	605	46	50	3	495	540	16	33	M30×3
450	457.2	675	48	54	3	560	605	20	33	M30×3
500	508.0	730	50	58	3	615	660	20	33	M30×3

Data / Standard Dimensions of Flange

■ Standard dimensions of a 30 kgf/cm² pipe flange

(KS B 1511 - 1987)
(JIS B 2210 - 1987)

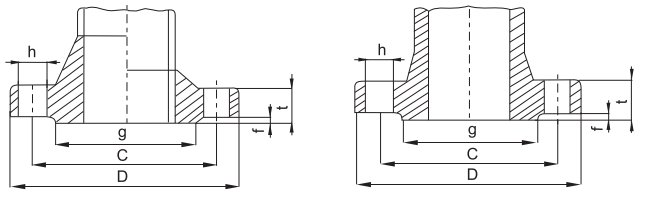


(mm)

Size	Outer diameter of applied steel pipe	Outer diameter of flange D	Dimensions of each part of flange			Bolt hole			Nominal diameter of bolt screw
			t	f	Diameter (g)	Diameter of center circle (c)	Number	Diameter (h)	
10	17.3	110	16	1	52	75	4	19	M16
15	21.7	115	18	1	55	80	4	19	M16
20	27.2	120	18	1	60	85	4	19	M16
25	34.0	130	20	1	70	95	4	19	M16
32	42.7	140	22	2	80	105	4	19	M16
40	48.6	160	22	2	90	120	4	23	M16
50	60.5	165	22	2	105	130	8	19	M20
65	76.3	200	26	2	130	160	8	23	M20
80	89.1	210	28	2	140	170	8	23	M20
(90)	101.6	230	30	2	150	185	8	25	M22
100	114.3	240	32	2	160	195	8	25	M22
125	139.8	275	36	2	195	230	8	25	M22
150	165.2	325	38	2	235	275	12	27	M24
200	216.3	370	42	2	280	320	12	27	M24
250	267.4	450	48	2	345	390	12	33	M30×3
300	318.5	515	52	3	405	450	16	33	M30×3
350	355.6	560	54	3	450	495	16	33	M30×3
400	406.4	630	60	3	510	560	16	39	M36×3

■ Standard dimensions of a 40 kgf/cm² pipe flange

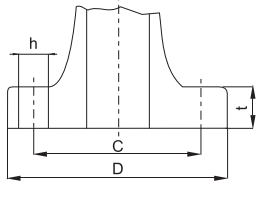
(KS B 1511 - 1987)
(JIS B 2210 - 1987)



(mm)

Size	Outer diameter of applied steel pipe	Outer diameter of flange D	Dimensions of each part of flange			Bolt hole			Nominal diameter of bolt screw
			t	f	Diameter (g)	Diameter of center circle (c)	Number	Diameter (h)	
10	17.3	110	18	1	52	75	4	19	M16
15	21.7	115	20	1	55	80	4	19	M16
20	27.2	120	20	1	60	85	4	19	M16
25	34.0	130	22	1	70	95	4	19	M16
32	42.7	140	24	2	80	105	4	19	M16
40	48.6	160	24	2	90	120	4	23	M16
50	60.5	165	26	2	105	130	8	19	M20
65	76.3	200	30	2	130	160	8	23	M20
80	89.1	210	32	2	140	170	8	23	M20
(90)	101.6	230	34	2	150	185	8	25	M22
100	114.3	250	36	2	165	205	8	25	M22
125	139.8	300	40	2	200	250	8	27	M24
150	165.2	355	44	2	240	295	12	33	M30×3
200	216.3	405	50	2	290	345	12	33	M30×3
250	267.4	475	56	2	355	410	12	33	M30×3
300	318.5	540	60	3	410	470	16	39	M36×3
350	355.6	585	64	3	455	515	16	39	M36×3
400	406.4	645	70	3	515	570	16	39	M36×3

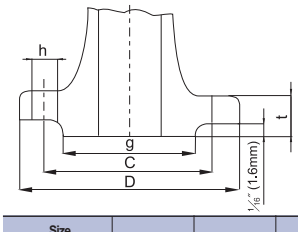
■ Standard dimensions of an ANSI 125 POUND cast iron pipe flange



in (mm)

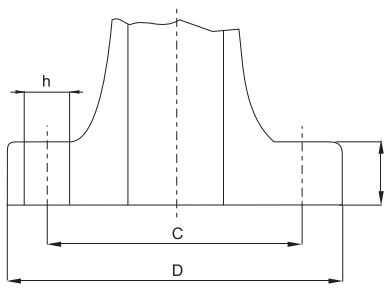
Size		Outer diameter of flange D	Thickness (t)	Bolt hole			Nominal diameter of bolt screw
in	(mm)			Center diameter (c)	Number	Diameter (h)	
1	25	4 1/4 (108)	1 1/16 (11.2)	3 1/8 (79.5)	4	5/8 (16)	1/2
1 1/4	32	4 5/8 (117)	3/4 (12.7)	3 1/2 (89.0)	4	5/8 (16)	1/2
1 1/2	40	5 (127)	13/16 (14.3)	3 7/8 (98.5)	4	5/8 (16)	1/2
2	50	6 (152)	7/8 (15.9)	4 3/4 (120.5)	4	3/4 (19)	1/2
2 1/2	65	7 (178)	1 (17.5)	5 1/2 (139.5)	4	3/4 (19)	5/8
3	80	7 1/2 (191)	1 1/8 (19.1)	6 (152.5)	4	3/4 (19)	5/8
3 1/2	90	8 1/2 (216)	1 3/16 (22.3)	7 (178.0)	8	3/4 (19)	5/8
4	100	9 (229)	1 1/4 (23.9)	7 1/2 (190.5)	8	3/4 (19)	5/8
5	125	10 (254)	1 3/8 (23.9)	8 1/2 (216.0)	8	7/8 (22)	3/4
6	150	11 (279)	1 7/16 (25.4)	9 1/2 (241.5)	8	7/8 (22)	3/4
8	200	13 1/2 (343)	1 5/8 (28.6)	11 3/4 (298.5)	8	7/8 (22)	3/4
10	250	16 (406)	1 7/8 (30.2)	14 1/4 (362.0)	12	1 (25)	7/8
12	300	19 (483)	2 (31.8)	17 (432.0)	12	1 (25)	7/8
14	350	21 (533)	2 1/8 (35.0)	18 3/4 (476.0)	12	1 1/8 (29)	1
16	400	23 1/2 (597)	2 1/4 (36.6)	21 1/4 (539.5)	12	1 1/8 (29)	1

■ Standard dimensions of an ANSI 150 POUND steel pipe flange



in (mm)

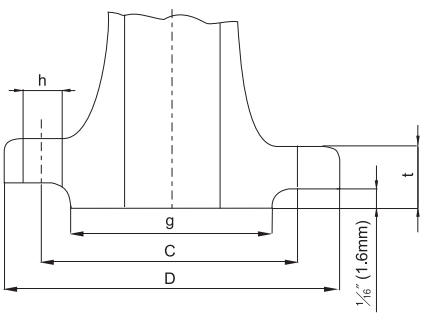
Size		Outer diameter of flange D	Thickness (t)	diameter (h)	Bolt hole			Nominal diameter of bolt screw
in	(mm)				Center diameter (c)	Number	Diameter (h)	
1/2	15	3 1/2 (89)	7/16 (11.2)	1 3/8 (35)	2 3/8 (60.5)	4	5/8 (16)	1/2
3/4	20	3 7/8 (98)	1/2 (12.7)	1 11/16 (43)	2 3/4 (70.0)	4	5/8 (16)	1/2
1	25	4 1/4 (108)	9/16 (14.3)	2 (51)	3 1/8 (79.5)	4	5/8 (16)	1/2
1 1/4	32	4 5/8 (117)	5/8 (15.9)	2 1/2 (64)	3 1/2 (89.0)	4	5/8 (16)	1/2
1 1/2	40	5 (127)	11/16 (17.5)	2 7/8 (73)	3 7/8 (98.5)	4	5/8 (16)	1/2
2	50	6 (152)	3/4 (19.1)	3 5/8 (92)	4 3/4 (120.5)	4	3/4 (19)	5/8
2 1/2	65	7 1/2 (178)	7/8 (22.3)	4 1/8 (105)	5 1/2 (139.5)	4	3/4 (19)	5/8
3	80	7 1/2 (191)	15/16 (23.9)	5 (127)	6 (152.5)	4	3/4 (19)	5/8
3 1/2	90	8 1/2 (216)	15/16 (23.9)	5 1/2 (140)	7 (178.0)	8	3/4 (19)	5/8
4	100	9 (229)	15/16 (23.9)	6 3/16 (157)	7 1/2 (190.5)	8	3/4 (19)	5/8
5	125	10 (254)	15/16 (23.9)	7 5/16 (186)	8 1/2 (216.0)	8	7/8 (22)	5/8
6	150	11 (279)	1 (25.4)	8 1/2 (216)	9 1/2 (241.5)	8	7/8 (22)	3/4
8	200	13 1/2 (343)	1 1/8 (28.6)	10 5/8 (270)	11 3/4 (298.5)	8	7/8 (22)	3/4
10	250	16 (406)	1 3/16 (30.2)	12 3/4 (324)	14 1/4 (362.0)	12	1 (25)	7/8
12	300	19 (483)	1 1/4 (31.8)	15 (381)	17 (432.0)	12	1 (25)	7/8
14	350	21 (533)	1 3/8 (35.0)	16 1/4 (413)	18 3/4 (476.0)	12	1 1/8 (29)	1
16	400	23 1/2 (597)	1 7/16 (36.6)	18 1/2 (470)	21 1/4 (539.5)	16	1 1/8 (29)	1



■ Standard dimensions of an ANSI 250 POUND cast iron pipe flange

in (mm)

Size		Outer diameter of flange D	Thickness (t)	diameter (h)	Bolt hole			Nominal diameter of bolt
in	(mm)				Center diameter (c)	Number	Diameter (h)	
1	25	4 7/8 (124)	1 1/16 (17.5)	2 1/16 (68.5)	3 1/2 (89)	4	3/4 (19)	5/8
1 1/4	32	5 1/4 (133)	3/4 (19.1)	3 1/16 (78.0)	3 7/8 (98)	4	3/4 (19)	5/8
1 1/2	40	6 1/8 (156)	13/16 (21.0)	3 9/16 (90.5)	4 1/2 (114)	4	7/8 (22)	3/4
2	50	6 1/2 (165)	7/8 (22.3)	4 3/16 (106.5)	5 (127)	4	3/4 (19)	5/8
2 1/2	65	7 1/2 (191)	1 (25.4)	4 15/16 (125.5)	5 7/8 (149)	4	7/8 (22)	3/4
3	80	8 1/4 (210)	1 1/8 (23.6)	5 1/16 (144.5)	6 7/8 (168)	8	7/8 (22)	3/4
3 1/2	90	9 (229)	1 3/16 (30.2)	6 5/16 (160.5)	7 1/4 (184)	8	7/8 (22)	3/4
4	150	10 (254)	1 1/4 (31.8)	6 15/16 (176.5)	7 7/8 (200)	8	7/8 (22)	3/4
5	125	11 (279)	1 3/8 (35.0)	8 5/16 (211.5)	9 1/4 (235)	8	7/8 (22)	3/4
6	150	12 1/2 (318)	1 7/16 (36.6)	9 1/16 (246.5)	10 5/8 (270)	8	7/8 (22)	3/4
8	200	15 (381)	1 5/8 (41.3)	11 1/16 (303.5)	13 (330)	12	1 (25)	7/8
10	250	17 1/2 (445)	1 7/8 (47.6)	14 1/16 (357.5)	15 1/4 (387)	12	1 1/8 (29)	1
12	300	20 (521)	2 (50.8)	16 7/16 (418.0)	17 3/4 (451)	16	1 1/4 (32)	1 1/8
14	350	23 (584)	2 1/8 (54.0)	18 15/16 (481.5)	20 1/4 (514)	16	1 1/4 (32)	1 1/8
16	400	25 1/2 (648)	2 1/4 (57.2)	21 1/16 (535.0)	22 1/2 (572)	20	1 3/8 (35)	1 1/4



■ Standard dimensions of an ANSI 300 POUND cast iron pipe flange

in (mm)

Size		Outer diameter of flange D	Thickness (t)	diameter (h)	Bolt hole			Nominal diameter of bolt
in	(mm)				Center diameter (c)	Number	Diameter (h)	
1/2	15	3 3/4 (59)	9/16 (14.3)	1 3/8 (35)	2 5/8 (66.5)	4	5/8 (16)	1/2
3/4	20	4 5/8 (117)	5/8 (15.9)	1 11/16 (43)	3 1/4 (82.5)	4	3/4 (19)	5/8
1	25	4 7/8 (124)	1 1/16 (17.5)	2 (51)	3 1/2 (89.0)	4	3/4 (19)	5/8
1 1/4	32	5 1/4 (133)	3/4 (19.1)	2 1/2 (64)	3 7/8 (98.5)	4	3/4 (19)	5/8
1 1/2	40	6 1/8 (156)	13/16 (20.7)	2 7/8 (73)	4 1/2 (114.5)	4	7/8 (22)	3/4
2	50	6 1/2 (165)	7/8 (22.3)	3 5/8 (92)	5 (127.0)	8	3/4 (19)	5/8
2 1/2	65	7 1/2 (191)	1 (25.4)	4 1/8 (105)	5 7/8 (149.0)	8	7/8 (22)	3/4
3	80	8 1/4 (210)	1 1/8 (28.6)	5 (127)	6 5/8 (168.0)	8	7/8 (22)	3/4
3 1/2	90	9 (229)	1 3/16 (30.2)	5 1/2 (140)	7 1/4 (18400)	8	7/8 (22)	3/4
4	100	10 (254)	1 1/4 (31.8)	6 3/16 (157)	7 7/8 (200.0)	8	7/8 (22)	3/4
5	125	11 (279)	1 3/8 (35.0)	7 5/16 (186)	9 1/4 (235.0)	8	7/8 (22)	3/4
6	150	12 1/2 (318)	1 7/16 (36.6)	8 1/2 (216)	10 5/8 (270.0)	12	7/8 (22)	3/4
8	200	15 (381)	1 5/8 (41.3)	10 5/8 (270)	13 (330.0)	12	1 (25)	7/8
10	250	17 1/2 (445)	1 7/8 (47.7)	12 3/4 (324)	15 1/4 (387.5)	16	1 1/8 (29)	1
12	300	20 1/2 (521)	2 (50.8)	15 (381)	17 3/4 (451.0)	16	1 1/4 (32)	1 1/8
14	350	23 (584)	2 1/8 (54.0)	16 1/4 (413)	20 1/4 (514.5)	20	1 1/4 (32)	1 1/8
16	400	25 1/2 (648)	2 1/4 (57.2)	18 1/2 (470)	22 1/2 (571.5)	20	1 3/8 (35)	1 1/4

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Samsung Valve products have been manufactured based on advanced technology, perfect quality control, and strict inspections. In order to address and prevent the recurrence of breakdowns from initial use of products and quality changes that happen during the product distribution process, we provide free-of-charge repair and tuning services.

Warranty Regulations

If a product breaks down during normal operation, we provide free repair services for 12 months from the date of purchase. Please note, however, that actual expenses are charged even during the warranty period in the following cases, based on relevant regulations.

1. Breakdown resulting from misuse or improper use, and breakdown resulting from inattentiveness in handling the product.
2. Breakdown resulting from a fire or a natural disaster.
3. Breakdown from inappropriate repair and alteration.
4. Breakdown from foreign substances in the pipeline.

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