



Eng. version

FLEXIBLE HOSE & BELLOWS

TOTAL LINE UP CATALOGUE

OSAKA RAENKAN KOGYO CO., LTD. SINCE 1912

# FILEXIBLE

Osaka Rasenkan Kogyo Co.,Ltd. Japan's first flexible hose and bellows manufacturer, has grown as technology has progressed in its 100 years of providing high-quality products since its founding in 1912.

We have developed products that may not be immediately noticed but affect a wide variety of basic industries. These include steel, shipbuilding, petrochemicals, gas and water, energy field, such as hydrogen-related, solar power etc., high-tech industries related to semiconductor manufacturing, superconductors, ultracold applications, nuclear energy and space development, and life-support industries such as medical devices and disaster prevention equipment.

With pride in our years as a basic technology provider, we have been building up its existing techniques, studying and developing new products and opening up new fields based on reliability, innovative ideas, and creative advanced facilities.

Our greatest pleasure is in helping you be all you can to yourself and to your clients.

We have confidence in bolstering our relationship and your continued patronage is appreciated.

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# & FREE

**FLEXIBLE HOSE & BELLOWS**  
TOTAL LINE UP CATALOGUE

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### Vacuum

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- Bellows
- Joints & piping parts
- Special models



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- Hybridflex
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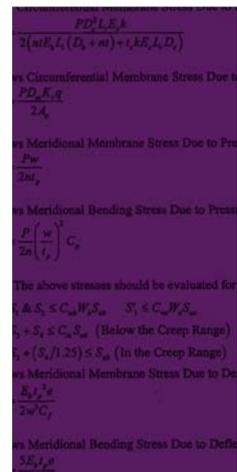


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### Technical information

- How to use flexible hose
- Instruction for usage
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# 1. COMPANY PROFILE

# COMPANY PROFILE

## PROFILE

Name of company	Osaka Rasenkan Kogyo Co., Ltd.
President	Seiji Koizumi
Inauguration of business	March, 1912
Establishment of company	December, 1937
Capital	80 million yen
Location of head office, sales office and plants	
Head office and OSAKA plant	3-12-33, Himesato, Nishi-yodogawa-ku, Osaka 555-0025, Japan Tel: 06-6473-6151 Fax: 06-6473-6150
TOKYO sales office	2-20-4, 7F, Higashi-gotanda, Shinagawa-ku, Tokyo 141-0022, Japan Tel: 03-5423-2600 Fax: 03-5423-2611
FUKUROI plant	1700, Oyama, Fukuroi-city, Shizuoka 437-0056, Japan Tel: 0538-42-4103 Fax: 0538-42-0628
Main financing banks	
Mitsui Sumitomo Banking Corporation, Osaka Nishi Branch	Mitsui Sumitomo Banking Corporation, Sales Dept., Head Office
Mizuho Bank, Ltd., Nishinoda Branch	The Bank of Tokyo-Mitsubishi UFJ, Ltd., Utajimabashi Branch

## Major sites and buildings

Head office and OSAKA plant Site area	3,641 m <sup>2</sup>
OSAKA plant 1st plant	1,041 m <sup>2</sup>
2nd plant	2,382 m <sup>2</sup>
FUKUROI plant Site area	37,382 m <sup>2</sup>
1st plant	2,475 m <sup>2</sup>
2nd plant	2,900 m <sup>2</sup>
3rd plant	5,640 m <sup>2</sup>

## Product line

- Flexible hoses
- Expansion joints (bellows)
- Vibration absorber
- Flexible hoses conforming to Fire Service Act
- Universal expansion joints conforming to Fire Service Act
- Teflon hoses
- Joint pipes
- Helical pipes

## Approvals

- Welding qualification under Electricity Business Act
- Fire Equipment and Safety Center of Japan (FESC)
- American Bureau of Shipping (ABS)
- Korean Register of Shipping (KR)
- China Classification Society (CCS)
- Nippon Kaiji Kyokai (NK)
- Bureau Veritas (BV)
- Welding qualification under Gas Business Act
- Japan Water Works Association (JWWA)
- Registro Italiano Navale (RINA)
- Central Research of Ships S.A. (CR)
- DNV GL AS
- Lloyd's Register of Shipping (LR)

## Obtained certifications

- ISO9001
- ISO14001

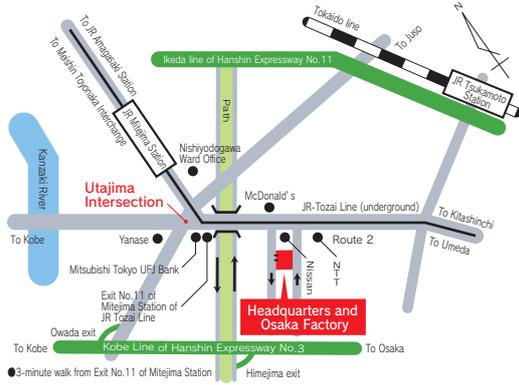
# COMPANY HISTORY

## HISTORY

- Mar. 1912** Succeeded in domestically producing metallic flexible hoses and inaugurated production and sales at Minami-dori 5-chome, Shin-machi, Nishi-ku, Osaka
- Dec. 1937** Established a company organization with capital of 300,000 yen.
- Jan. 1938** Produced 80 percent of fuel hoses and electric conduits for military and naval aircrafts.
- Apr. 1948** Relocated the head office at the present address and unified all the Plant.
- Dec. 1965** The capital was increased to 20 million yen.
- Jun. 1967** The capital was doubled to 40 million yen accepting a capital increase from the Osaka Small Business Investment Co., Ltd.
- Nov. 1968** The then president Koizumi received an Academy Prize from International American Scientific Association.
- Jun. 1969** Had a technical tie-up with Vulcan Australia Limited, and succeeded in domestic production of SIDEWINDER ducts.
- Nov. 1969** Started construction of Fukuroi First Plant.
- Mar. 1972** Started construction of Fukuroi Second Plant.
- May. 1978** Became an authorized factory of American Gas Association.
- Dec. 1980** Successfully Developed a highly flexible, ultra thin hose [**Superfree**]
- Aug. 1982** At the head of the flexible hose industry, acquired type certification from the Japan Fire Protection Equipment and Safety center for products conforming to the Fire Service Act.
- Jan. 1984** Developed the flexible hose and bellows for piping of vacuum apparatus.
- Mar. 1986** Developed flexible hose [**Hybridflex**] and bellows [**Hybrid bellows**] consisting of metallic and Teflon components.
- Jul. 1989** Developed [**Megaflex**<sup>®</sup>] a flexible hose with inner surface polished, and placed it on the market.
- Sept. 1990** Developed formed bellows [**Pressup bellows**<sup>®</sup>] having the same sectional shape as welded bellows and high flexibility.
- Feb. 1991** Succeeded in automatic brazing system for flexible hose by using welding robot.
- Sept. 1991** Developed flexible hose [**Hasty-22**] using HASTELLOY C-22.
- Jun. 1992** Completion of No.3 Fukuroi Plant. Achieved a mass production system for large size and long bellows.
- Nov. 1992** Celebrated the company's 80th anniversary
- Jun. 1993** The Tokyo sales office was moved to the present location.
- Sept. 1993** The first private placement bond was issued.
- Jan. 1995** Established a joint venture named "Beijing **BORK** Metal Hose Company Limited in Beijing".
- Mar. 1995** The second private placement bond was issued.
- Sept. 1996** Developed [**Megaflex**<sup>®</sup>], provided with inner surface polished and vacuum double-melted materials at both pipe end fittings.
- Feb. 1997** BORK received ISO 9002 certification.
- Mar. 1998** The Capital was increased to 80 million yen.
- Apr. 1998** ORK Fukuroi plant (Shizuoka) acquired certification of ISO 9002 quality system.
- Jun. 1998** Clean-room completed at Fukuroi plant.
- Jan. 2000** Developed earthquake-proof piping system [**Dodge<sup>3</sup>Joint**<sup>®</sup>].
- Mar. 2000** The third private placement bond was issued.
- Apr. 2001** Developed the smallest flexible hose in the world [**3A Super Mini Flex**].
- Oct. 2002** Beijing BORK Metal Hose Company Limited acquired certification of ISO 9001.
- May. 2003** ORK comprehensively acquired certification of ISO9001. Fukuroi plant acquired certification of ISO14001
- Jul. 2003** [**Dodge<sup>3</sup>Joint**<sup>®</sup>] acquired type certificate of Fire protection Equipment and Safety Center of Japan (FESC)
- Apr. 2005** ORK comprehensively acquired certification of ISO14001
- Dec. 2006** The fourth, fifth private placement bond were issued.
- Sept. 2007** Started construction of the Second plant at the Head office, and completed clean rooms.
- Dec. 2008** Implemented Fukuroi Plant with a vacuum heat-treating furnace.
- Feb. 2012** Developed [**Clear Flow Flex**], turbulence suppressive low-vibration flexible hose.
- Dec. 2013** The sixth, seventh private placement bond were issued.
- Feb. 2014** Developed [**Worm Free Flex**], ultra flexible and long service life hose.
- Nov. 2016** Begun operation of two types of FCV (Fuel Cell Vehicle) at Osaka head office and Tokyo sales office.
- Jun. 2017** Begun operation of solar power (0.6MW) at Fukuroi plant.
- Oct. 2017** Developed low reaction force, long service life, new type formed bellows [**Light Free Bellows**].

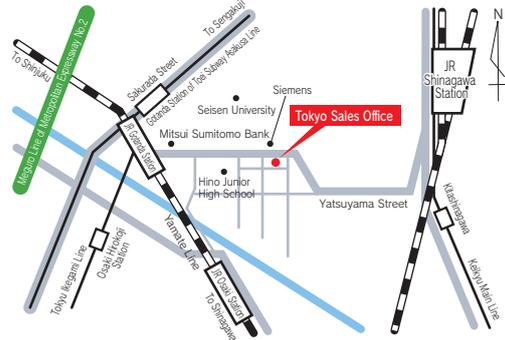
● **Head office and OSAKA plant**

3-12-33, Himesato, Nishi-Yodogawa-ku, Osaka 555-0025, Japan  
 TEL:06-6473-6151 FAX:06-6473-6150



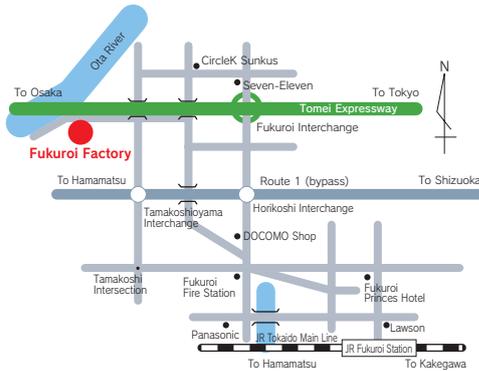
● **TOKYO sales office**

2-20-4, 7F, Higashi-Gotanda, Shinagawa-ku, Tokyo 141-0022, Japan  
 TEL:03-5423-2600 FAX:03-5423-2611



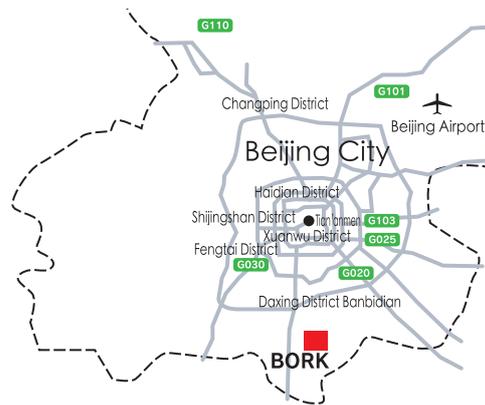
● **FUKUROI plant**

1700, Oyama, Fukuroi-shi, Shizuoka 437-0056, Japan  
 TEL:0538-42-4103 FAX:0538-42-0628



● **Beijing BORK Metal Hose Co., Ltd.**

PO Box 1286 Banbidian Daxing District, Beijing, China  
 TEL:010-8923-1222~6 FAX:010-8923-1227



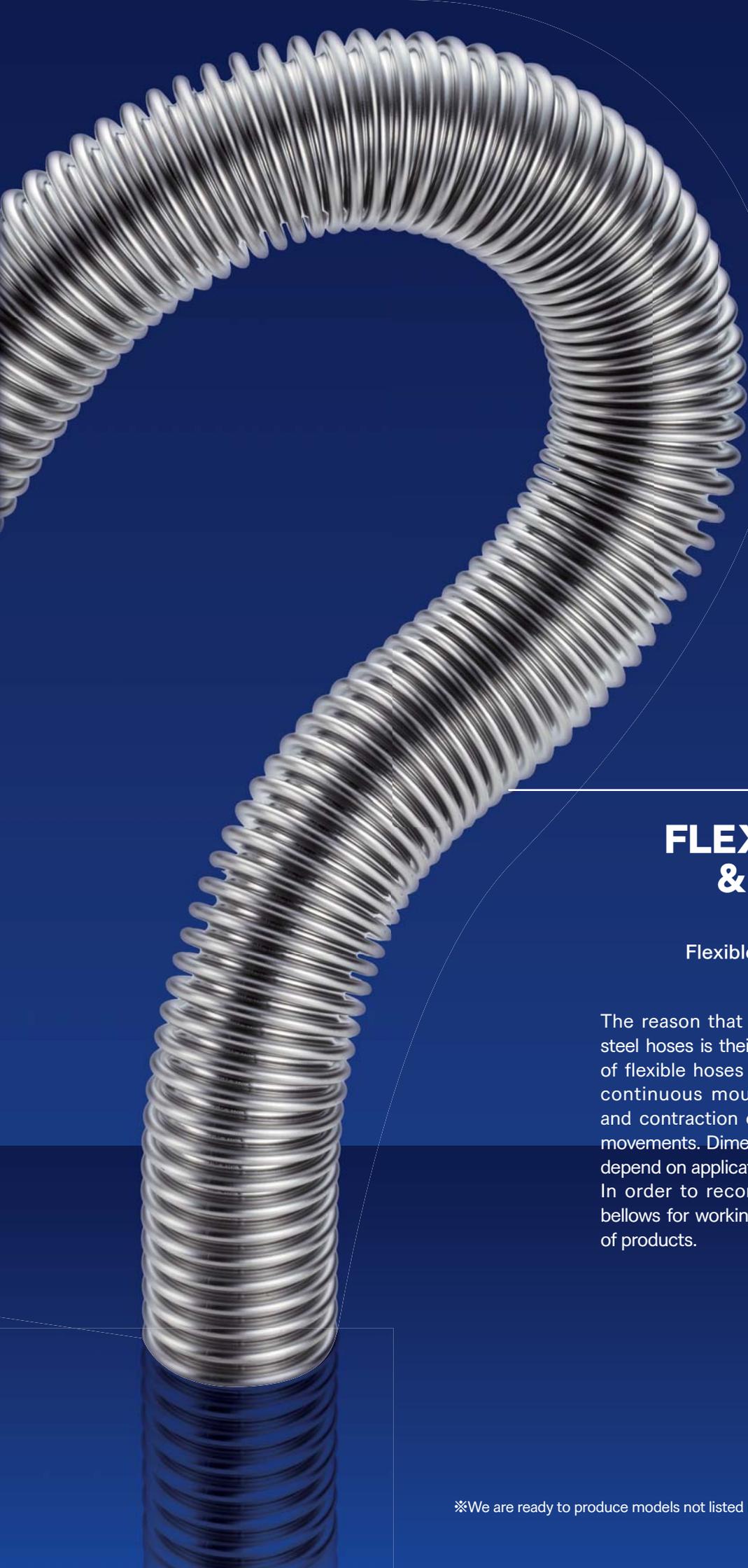
Head office and OSAKA plant



FUKUROI plant



Beijing BORK Metal Hose Co., Ltd.



# 2

## **FLEXIBLE HOSES & BELLOWS**

Flexible hoses / Bellows / Braid

The reason that hoses can move flexibly despite of steel hoses is their cross-sectional shape. Cross section of flexible hoses and bellows is wave-like shape with continuous mountain and valley parts. Expansion and contraction of each convolution enables various movements. Dimensions of wave shape and model types depend on application.

In order to recommend suitable flexible hoses and bellows for working conditions, we prepare several types of products.

※We are ready to produce models not listed in the catalog. Please feel free to consult us.

## Type A (standard)

■ Type A (standard) flexible hoses are made by corrugating thin-walled stainless steel pipes. They are high-quality flexible hoses exposed to complete solution heat treatment. The corrugations are formed like individual rings (annular type) which are not twisted under high pressure.

■ The hoses are highly flexible and have excellent strength, corrosion resistance and pressure resistance.

### Standard specifications

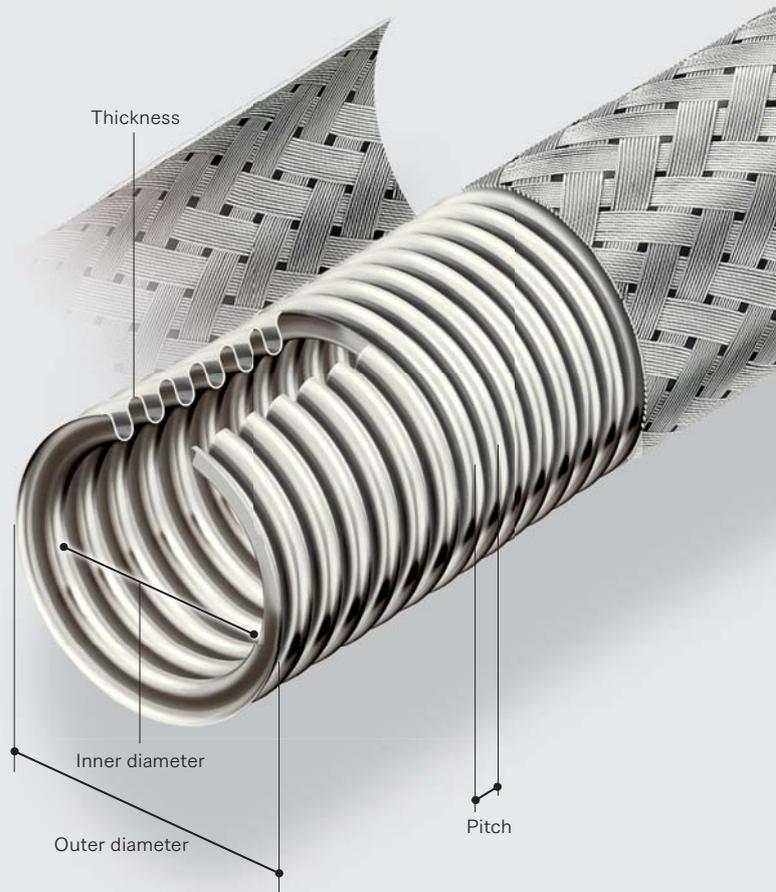
Flexible hose materials  
SUS304, SUS316L

Braid material  
SUS304

Wire braid: 250 A (10<sup>B</sup>) or less

Tape braid: 50 A (2<sup>B</sup>) or more

※For other materials, please consult us.



### Standard dimensions

Nominal diameter		Inner diameter (mm)	Thickness (mm)	Pitch (mm)	Outer diameter (mm)		Min. bending radius (mm)		Max. working pressure (MPa) <sup>※1</sup>		Weight (kg/m)	
A	B				No braid	Single braid	Constant bending	Repeated bending	Single braid	Double braid	No braid	Single braid
8	1/4	7.2	0.26	2.5	12.2	13.5	45	165	9.4	14.9	0.15	0.27
10	3/8	10.0	0.26	3.0	16.0	17.5	50	180	7.4	13.0	0.21	0.36
15	1/2	12.0	0.26	3.3	17.5	19.0	65	245	6.6	13.0	0.21	0.38
20	3/4	19.0	0.30	4.2	26.0	27.5	95	335	3.7	7.4	0.36	0.61
25	1	25.5	0.30	4.5	34.0	35.5	100	340	2.6	5.2	0.53	0.84
32	1·1/4	32.0	0.35	5.0	42.0	44.0	130	405	3.1	6.0	0.80	1.33
40	1·1/2	39.0	0.35	5.5	49.0	51.0	200	505	2.8	4.5	0.88	1.48
50	2	50.0	0.40	6.0	62.0	64.0	240	580	2.0	3.6	1.38	2.18
65	2·1/2	65.0	0.60	10.0	86.0	88.0	320	665	2.0	3.5	2.93	3.95
80	3	77.0	1.00	10.5	104.0	107.0	400	920	1.8	2.6	6.79	8.12
100	4	100.0	1.00	15.0	135.0	137.5	450	980	1.4	1.5	8.25	10.3
125	5	126.0	1.20	15.0	162.0	164.5	520	1400	1.2	2.0	13.0	14.6
150	6	150.0	1.20	18.0	190.0	192.5	540	1550	1.0	1.6	13.8	16.7
200	8	197.0	1.50	18.0	247.0	250.0	720	1800	0.9	1.6	26.9	31.0
250	10	245.0	2.00	22.5	305.0	308.0	960	2500	0.6	1.2	42.6	48.6
300	12	294.0	2.00	30.0	364.0	368.0	1000	2750	0.6	1.3	46.1	54.0
350	14	340.0	1.50	30.0	410.0	414.0	1150	2400	0.6	–	39.8	49.1
400	16	385.0	1.50	35.0	465.0	469.0	1150	2400	0.5	–	44.6	54.9
450	18	435.0	1.50	35.0	515.0	519.0	1250	2650	0.4	–	49.8	60.6
500	20	485.0	1.50	40.0	575.0	579.0	1250	2650	0.4	–	55.1	67.0

※Flexible hoses for high pressure and ultrahigh pressure can be specially designed. ※The specifications are subject to change for product improvement without prior notice. ※The maximum working pressure may vary depending on the design conditions.

※1: Pressure at working temperature of 40° C, safety factor of 3 and weld efficiency of 0.7

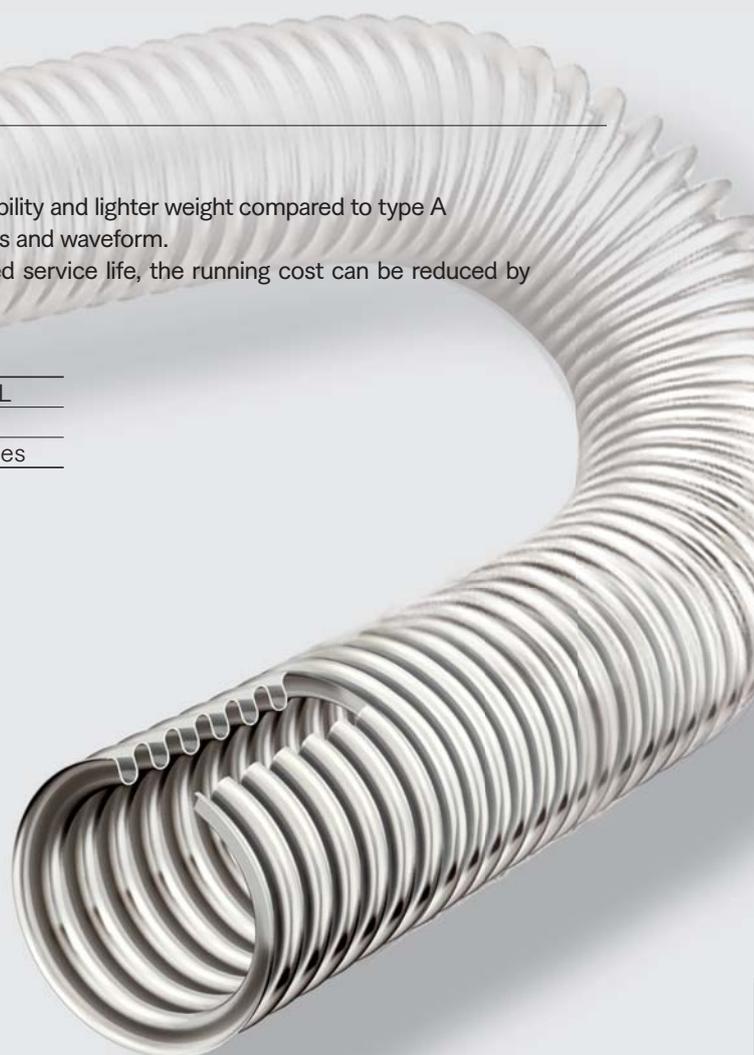
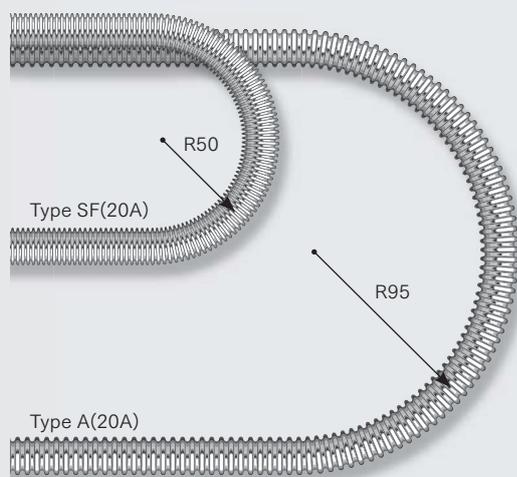
# Type SF (Superfree)

- Type SF (Superfree) flexible hoses have higher flexibility and lighter weight compared to type A (standard) as the result of improvement of thickness and waveform.
- Through improved working efficiency and increased service life, the running cost can be reduced by using this type.

## Standard specifications

Flexible hose materials	SUS304, SUS316L
Braid material	SUS304
Wire braid	Applicable to all sizes

※For other materials, please consult us.



## Standard dimensions

Nominal diameter		Inner diameter (mm)	Thickness (mm)	Pitch (mm)	Outer diameter (mm)		Min. bending radius (mm)		Max. working pressure (MPa) <sup>※1</sup>	Weight (kg/m)	
A	B				No braid	Single braid	Constant bending	Repeated bending		Single braid	No braid
3	—	3.3	0.10	0.7	5.0	6.0	10	75	6.1	0.04	0.07
5	—	4.5	0.15	1.5	7.5	9.0	25	100	5.0	0.06	0.08
8	1/4	5.5	0.15	1.75	8.5	10.0	30	125	4.0	0.06	0.09
10	3/8	10.0	0.15	2.2	13.5	15.0	45	180	3.0	0.10	0.12
15	1/2	12.0	0.15	2.5	16.0	17.5	45	185	2.0	0.12	0.16
20	3/4	21.5	0.20	4.0	29.5	31.0	50	210	1.5	0.30	0.56
25	1	26.5	0.20	5.5	36.0	37.5	70	240	1.3	0.30	0.62
32	1·1/4	33.5	0.20	6.0	44.0	46.0	80	280	1.2	0.40	0.96
40	1·1/2	41.2	0.26	6.5	54.0	56.0	100	330	1.2	0.71	1.35
50	2	50.5	0.26	7.0	65.0	67.0	130	365	1.1	0.98	1.77
65	2·1/2	65.0	0.40	8.0	82.0	85.0	170	545	1.2	1.85	3.00
80	3	77.5	0.40	10.0	98.0	101.0	200	600	1.0	2.00	3.37
100	4	102.0	0.50	11.0	127.0	130.0	240	750	1.0	3.19	4.97
125	5	127.0	0.50	12.0	152.0	155.0	300	930	1.0	4.23	6.81
150	6	151.0	0.50	16.0	180.0	183.0	350	970	0.6	4.92	7.77

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※ The maximum working pressure may vary depending on the design conditions.

※1: Pressure at working temperature of 40° C, safety factor of 3 and weld efficiency of 0.7

# Type WF (Worm Free Flex<sup>®</sup>)

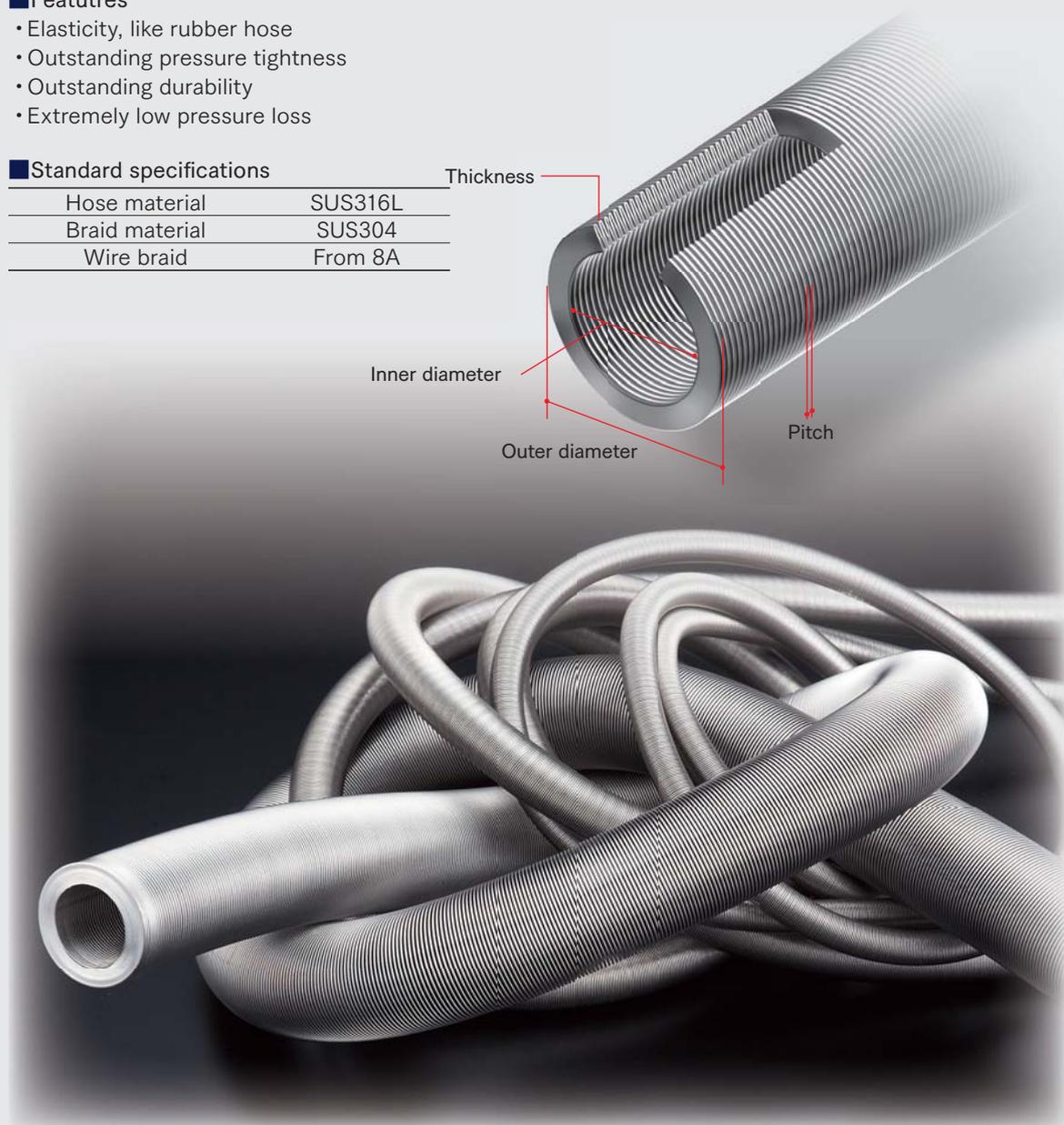
■ Type WF (Worm Free Flex) is formed flexible hose with ultra flexibility, being born out of a different idea to conventional items.

## ■ Features

- Elasticity, like rubber hose
- Outstanding pressure tightness
- Outstanding durability
- Extremely low pressure loss

## ■ Standard specifications

Hose material	SUS316L
Braid material	SUS304
Wire braid	From 8A



## ■ Standard dimensions and performance table

Nominal diameter		Inner diameter (mm)	Thickness (mm)	Pitch (mm)	Outer diameter (mm)		Min. bending radius (mm)		Max. working pressure (MPa) <sup>※1</sup>		Weight (kg/m)	
A	B				No braid	Single braid	Constant bending	Repeated bending	No braid	Single braid	No braid	Single braid
3	1/8	3.2	0.10	0.5	5.1	—	10	55	Vacuum~1.5	—	0.06	—
5	-	4.2	0.15	0.6	7.8	—	25	60	Vacuum~0.7	—	0.15	—
8	1/4	4.8	0.15	0.6	9.0	10.5	30	60	Vacuum~0.5	16	0.18	0.21
10	3/8	9.4	0.15	0.6	14.0	15.5	45	65	Vacuum~0.3	11	0.37	0.40
15	1/2	11.5	0.15	0.7	16.5	18	45	70	Vacuum~0.2	10	0.43	0.47
20	3/4	20.7	0.20	1.0	30.5	32	50	85	Vacuum~ Atmospheric pressure	3.5	1.20	1.51
25	1	25.5	0.20	1.2	37.0	38.5	70	95	Vacuum~ Atmospheric pressure	2.0	1.41	1.73

※ The specifications are subject to change for product improvement without prior notice.

※ The maximum working pressure may vary depending on the design conditions.

※1: Pressure at working temperature of 40° C, safety factor of 3 and weld efficiency of 0.7

## Type HC (equivalent to HASTELLOY C-22)

■ Type HC flexible hoses are made of nickel alloy (equivalent to HASTELLOY C-22). The nickel alloy obtained by adding larger amounts of molybdenum and chromium to nickel base shows higher corrosion resistance than stainless steel.

■ HASTELLOY is a registered trademark of Haynes International, Inc.

### Standard specifications

Hose materials	equivalent to HASTELLOY C-22
Braid material	SUS304
Wire braid	ALL sizes



### Standard dimensions

Nominal diameter		Inner diameter (mm)	Thickness (mm)	Pitch (mm)	Outer diameter (mm)		Min. bending radius (mm)		Max. working pressure (MPa) <sup>※1</sup>	Weight (kg/m)	
A	B				No braid	Single braid	Constant bending	Repeated bending		Single braid	No braid
8	1/4	5.5	0.15	1.75	8.5	10.0	40	130	9.9	0.06	0.14
10	3/8	10.0	0.15	2.2	13.5	15.0	50	190	7.0	0.09	0.22
15	1/2	12.0	0.15	2.5	16.0	17.5	50	200	5.2	0.11	0.28
20	3/4	21.5	0.20	3.5	28.5	30.0	60	240	2.9	0.31	0.58
25	1	26.5	0.20	5.0	35.0	36.5	70	250	1.7	0.35	0.68
32	1·1/4	33.5	0.20	5.5	42.5	44.5	80	330	1.7	0.41	0.96
40	1·1/2	41.2	0.20	6.0	51.5	53.5	80	330	1.1	0.54	1.20
50	2	50.5	0.20	6.0	62.5	64.0	90	390	1.0	0.69	1.50

※ The specifications are subject to change for product improvement without prior notice.

※ The maximum working pressure may vary depending on the design conditions.

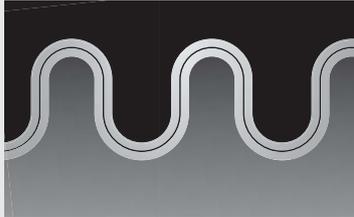
※1: Pressure at working temperature of 40° C, safety factor of 3 and weld efficiency of 0.7

# Type 2PLY (Double layer flexible Hose)

■ Type 2PLY (Double layer flexible Hose) has both flexibility and pressure tightness.

## ■ Standard specifications

Hose material	SUS316L
Braid material	SUS304
Wire braid	all sizes



## ■ Standard dimensions and performance table

Nominal diameter		Inner diameter (mm)	Thickness (mm)	Pitch (mm)	Outer diameter (mm)		Min. bending radius (mm)		Max. working pressure (MPa) <sup>※1</sup>	Weight (kg/m)	
A	B				No braid	Single braid	Constant bending	Repeated bending		Single braid	No braid
25	1	26.0	0.20	5.5	36.0	38.0	55	215	3.0	0.71	1.21
32	1·1/4	33.0	0.20	6.0	44.0	46.0	60	240	2.5	0.89	1.56
40	1·1/2	41.0	0.26	6.5	54.0	56.0	80	310	2.5	1.51	2.28
50	2	50.0	0.26	7.0	65.0	67.5	85	320	2.0	1.95	3.06
65	2·1/2	64.5	0.40	8.0	82.0	85.0	135	520	2.4	3.81	5.09
80	3	77.0	0.40	10.0	98.0	101.0	140	535	2.0	4.46	6.06
100	4	101.0	0.50	11.0	127.0	130.0	165	660	1.6	7.96	9.88
125	5	126.0	0.50	12.0	152.0	155.0	210	840	1.3	9.05	11.32
150	6	151.0	0.50	16.0	180.0	183.0	245	990	1.0	9.45	12.52

※ The specifications are subject to change for product improvement without prior notice.

※ The maximum working pressure may vary depending on the design conditions.

※1: Pressure at working temperature of 40° C, safety factor of 3 and weld efficiency of 0.7

# Thin wall formed bellows

## Standard specifications

Material	bellows SUS316L <sup>*1</sup>
Working pressure	vacuum~atmospheric pressure <sup>*2</sup>

<sup>\*1</sup>. Special material can be fabricated. Please consult us.

<sup>\*2</sup>. Please consult us for allowable pressure at pressure side.

## Standard dimensions

Nominal diameter A	Inner diameter (mm)	Outer diameter (mm)	Thickness (mm)	Pitch (mm)
15A	16.0	22.0	0.15	2.3
20A	20.5	28.5	0.15	2.2
25A	26.0	37.0	0.15	3.0
32A	33.0	46.0	0.15	3.4
40A	41.0	55.0	0.15	4.4
50A	51.0	65.0	0.20	4.4
65A	63.0	83.0	0.25	4.8
80A	80.0	103.0	0.25	5.5
100A	104.0	127.0	0.25	6.6
125A	126.0	151.0	0.3	7.2
150A	150.0	175.0	0.3	7.4
200A	205.0	230.0	0.3	7.6
250A	254.0	290.0	0.3	13.6
300A	305.0	340.0	0.3	14.6



<sup>\*</sup>The specifications are subject to change for product improvement without prior notice.

# Press up Bellows

## Features

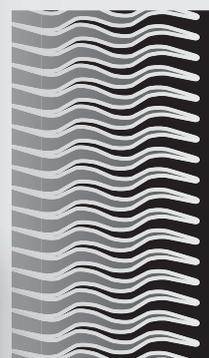
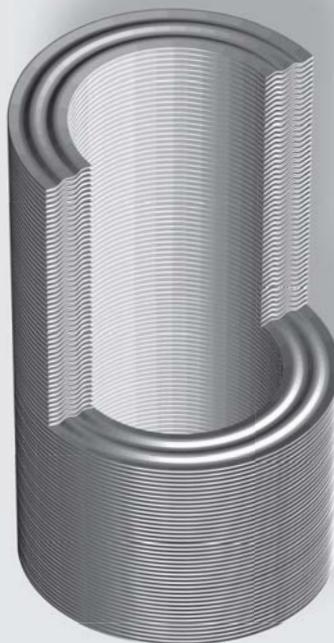
- The shape of conventional welded bellows is realized by forming processing.
- Excellent flexibility

## Standard specifications

Material	bellows SUS316L
Working pressure	vacuum~atmospheric pressure

## Standard dimensions

Nominal diameter A	Inner diameter (mm)	Outer diameter (mm)	Thickness (mm)	Pitch (mm)
16A	17.3	26.8	0.15	0.7
20A	20.5	31.5	0.15	1.0
25A	26.0	37.5	0.15	1.0
32A	33.0	49.0	0.15	1.3
40A	41.0	59.0	0.15	1.3
50A	50.0	70.0	0.20	1.3
80A	78.0	104.0	0.20	1.5
100A	101.0	132.0	0.25	1.75
300A	300.0	340.0	0.30	2.5
340A	340.0	380.0	0.30	2.5
400A	402.0	440.0	0.30	2.5



<sup>\*</sup>The specifications are subject to change for product improvement without prior notice.

## What is braid?

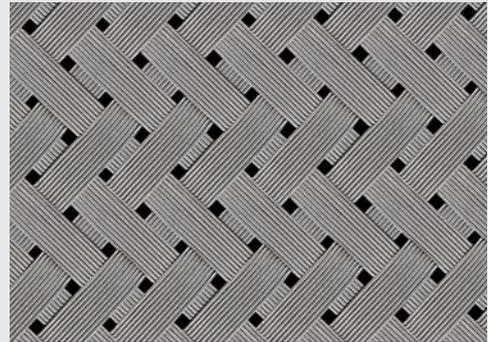
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- The braid is made by weaving stainless steel wires or band plates on the periphery of a flexible hose. The braid is used to prevent elongation of flexible hose under pressure and protect the flexible hose. The braids are classified into three kinds, wire braid, tape braid and twilled braid, according to the material shape.

### Wire braid

---

- Some wires are bundled parallel and braided on a flexible hose. Thus obtained braid is called wire braid. This braid is flexible and suitable to absorb frequent displacement. When the internal pressure is high, a two-layer braid is used. Hoses of sizes of up to 250 A can be provided with this type of braid.



### Tape braid

---

- A braid obtained by weaving band plates on a flexible hose is called a tape braid. Compared to wire braid, tape braid has higher strength against internal pressure but has lower flexibility. It is suitable to absorb displacement when the frequency of displacement is low. When the internal pressure is high, a two-layer braid is used. Hoses of sizes of 50 A or more can be provided with this type of braid.



### Twilled braid

---

- Wires to be used for wire braid are braided into flat plates, and the flat plates are woven on a flexible hose. Thus obtained braid is called a twilled braid. It has high strength and excellent flexibility. Hoses of sizes of 50 A or more can be provided with this type of braid.





# 3

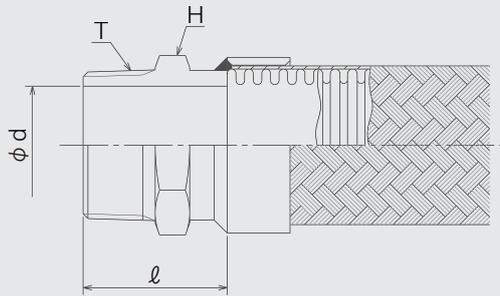
## General purpose

Joints/Accessories/Special models/Guide to order

Flexible hoses are used to transfer a wide range of fluids including gaseous fluids, such as air, steam and gases, and liquids, such as water, oils and chemicals. The hoses function for reciprocation of piping systems, absorption of thermal expansion and vibration and centering of piping.

## Male fixed screw (Type SM joint)

RX-01



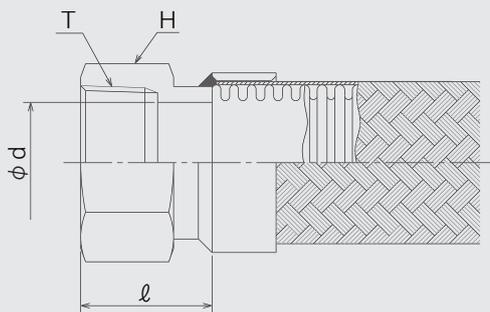
### Standard dimensions

Nominal diameter		T	d	l	H
A	B				
8	1/4	R1/4	6	23	Hexagonal, flat 14
10	3/8	R3/8	10	25	" 19
15	1/2	R1/2	12	31	" 22
20	3/4	R3/4	19	33	" 29
25	1	R1	25	40	" 35
32	1-1/4	R1-1/4	32	43	" 46
40	1-1/2	R1-1/2	38	46	" 50
50	2	R2	50	50	Octagonal, flat 63

※Joint material: SUS304 (For other materials, please consult us.)

## Female fixed screw (Type SF joint)

RX-09



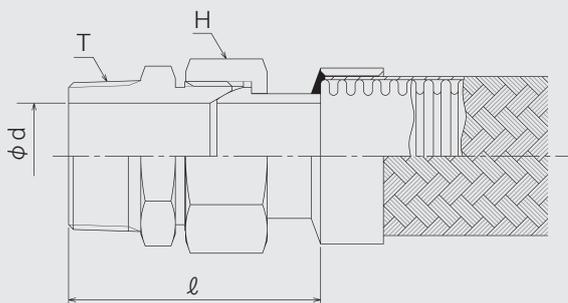
### Standard dimensions

Nominal diameter		T	d	l	H
A	B				
8	1/4	Rc1/4	6	21	Hexagonal, flat 17
10	3/8	Rc3/8	10	22	" 21
15	1/2	Rc1/2	12	28	" 26
20	3/4	Rc3/4	19	30	" 32
25	1	Rc1	25	36	" 38
32	1-1/4	Rc1-1/4	32	39	" 46
40	1-1/2	Rc1-1/2	38	41	" 54
50	2	Rc2	50	48	Octagonal, flat 67

※Joint material: SUS304 (For other materials, please consult us.)

# Male loose screw (Type SNM joint)

RX-07



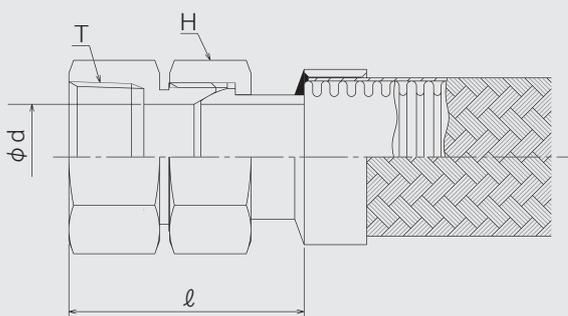
■ Standard dimensions

Nominal diameter		T	d	l	H
A	B				
8	1/4	R1/4	5	39.5	Hexagonal, flat 17
10	3/8	R3/8	8	44.5	" 21
15	1/2	R1/2	11	56	" 26
20	3/4	R3/4	16	61	" 32
25	1	R1	22	70	" 38
32	1·1/4	R1·1/4	29	80	" 46
40	1·1/2	R1·1/2	34	80	" 54
50	2	R2	46	92	Octagonal, flat 67

※Joint material: SUS304 (For other materials, please consult us.)

# Female loose screw (Type SNF joint)

RX-08



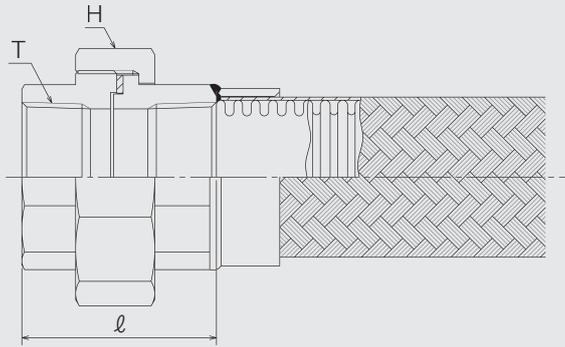
■ Standard dimensions

Nominal diameter		T	d	l	H
A	B				
8	1/4	Rc1/4	5	37.5	Hexagonal, flat 17
10	3/8	Rc3/8	8	41.5	" 21
15	1/2	Rc1/2	11	53	" 26
20	3/4	Rc3/4	16	57	" 32
25	1	Rc1	22	66	" 38
32	1·1/4	Rc1·1/4	29	76	" 46
40	1·1/2	Rc1·1/2	34	76	" 54
50	2	Rc2	46	88	Octagonal, flat 67

※Joint material: SUS304 (For other materials, please consult us.)

## Union joint (Type U joint)

RX-02



### Standard dimensions

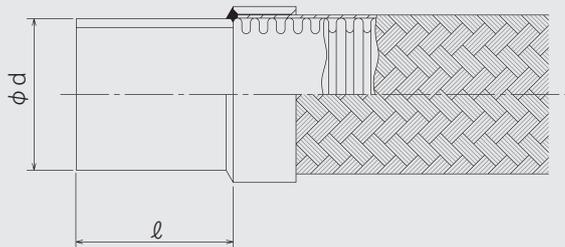
Nominal diameter		T	ℓ	H
A	B			
8	1/4	Rc1/4	34	Octagonal, flat 32
10	3/8	Rc3/8	37	" 38
15	1/2	Rc1/2	40	" 41
20	3/4	Rc3/4	48.5	" 50
25	1	Rc1	52	Decagonal, flat 59
32	1·1/4	Rc1·1/4	56	" 69
40	1·1/2	Rc1·1/2	60	" 78
50	2	Rc2	67	" 93

※Joint material: SUS304 (For other materials, please consult us.)

※Gasket material: Non-asbestos (For other materials, please consult us.)

## Pipe joint (Type P joint)

RX-21



### Standard dimensions

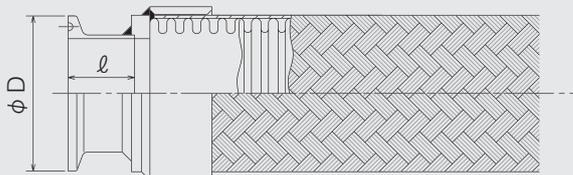
Nominal diameter		d	ℓ	Pipe
A	B			
8	1/4	13.8	30	For the pipe thickness, see the technical document (7-10).
10	3/8	17.3	30	
15	1/2	21.7	30	
20	3/4	27.2	30	
25	1	34.0	50	
32	1·1/4	42.7	50	
40	1·1/2	48.6	50	
50	2	60.5	50	

※The pipe material specified by the user can be used.

※Other than pipe length (ℓ) can be fabricated.

# Ferrule

RX-20



## Standard dimensions

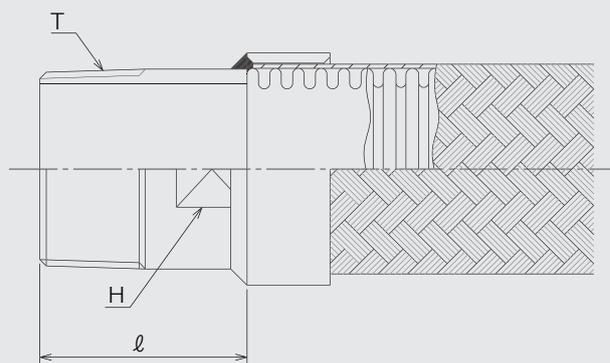
Nominal diameter		D	l
A	B		
8	1/4	34	17.3
10	3/8	34	17.3
15	1/2	34	17.3
20	3/4	50.5	20.5
25	1	50.5	20.5
32	1·1/4	50.5	20.5
40	1·1/2	50.5	20.5
50	2	64	20.5

※The list is for IDF/ISO Ferrule.

※For other ferrule types and materials, please consult us.

# Pipe nipple

RX-22



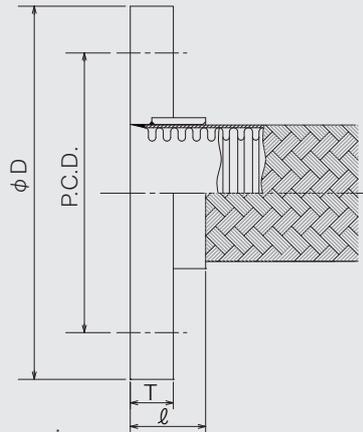
## Standard dimensions

Nominal diameter		T	l	H
A	B			
65	2·1/2	R2·1/2	70	Dihedral flat 74
80	3	R3	78	" 86
100	4	R4	90	" 112

※Joint material SUS304 (For other materials, please consult us)

## Fixed flange (Type R1)

RX-04



### Standard dimensions

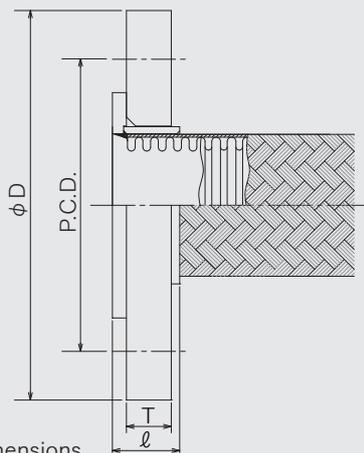
Nominal diameter		$l$	D	P.C.D.	T
A	B				
10	3/8	17.5	90	65	12
15	1/2	17	95	70	12
20	3/4	22	100	75	14
25	1	24	125	90	14
32	1-1/4	28	135	100	16
40	1-1/2	28	140	105	16
50	2	33	155	120	16
65	2-1/2	34	175	140	18

※The list is for the dimensions of JIS10K.

※Other flanges can be responded.

## Loose flange (Type R1)

RX-03



### Standard dimensions

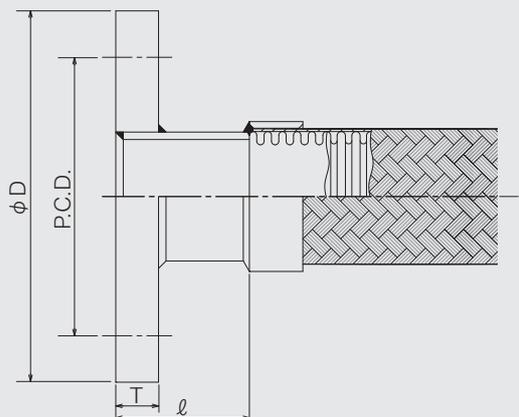
Nominal diameter		$l$	D	P.C.D.	T
A	B				
10	3/8	16	90	65	12
15	1/2	16	95	70	12
20	3/4	18.5	100	75	14
25	1	20.5	125	90	14
32	1-1/4	24	135	100	16
40	1-1/2	24	140	105	16
50	2	29.5	155	120	16
65	2-1/2	29.5	175	140	18

※The list is for the dimensions of JIS10K.

※Other flanges can be responded.

## Fixed flange (Type R2)

RX-06



### Standard dimensions

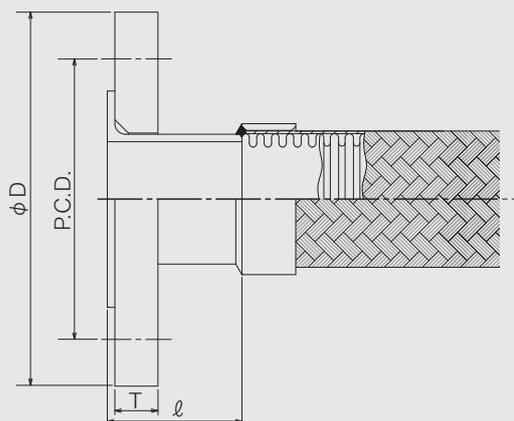
Nominal diameter		$l$	D	P.C.D.	T
A	B				
10	3/8	30	90	65	12
15	1/2	30	95	70	12
20	3/4	30	100	75	14
25	1	50	125	90	14
32	1-1/4	50	135	100	16
40	1-1/2	50	140	105	16
50	2	50	155	120	16
65	2-1/2	50	175	140	18

※The list is for the dimensions of JIS10K.

※Other flanges can be responded.

## Loose flange (Type R2)

RX-05



### Standard dimensions

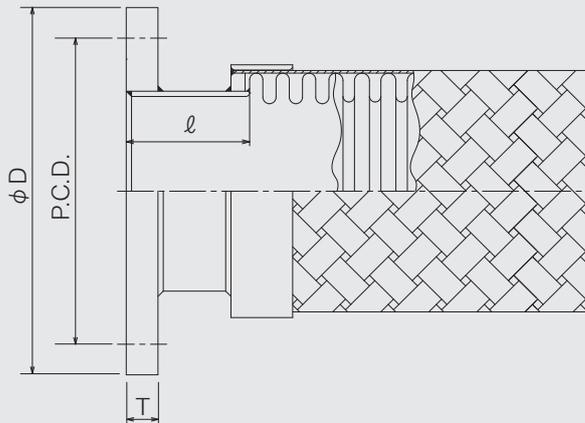
Nominal diameter		$l$	D	P.C.D.	T
A	B				
10	3/8	30	90	65	12
15	1/2	30	95	70	12
20	3/4	30	100	75	14
25	1	50	125	90	14
32	1-1/4	50	135	100	16
40	1-1/2	50	140	105	16
50	2	50	155	120	16
65	2-1/2	50	175	140	18

※The list is for the dimensions of JIS10K.

※Other flanges can be responded.

## Fixed flange (Type R3)

RX-14



### Standard dimensions

Nominal diameter		ℓ	D	P.C.D.	T
A	B				
80	3	65	185	150	18
100	4	70	210	175	18
125	5	75	250	210	20
150	6	85	280	240	22
200	8	90	330	290	22
250	10	100	400	355	24

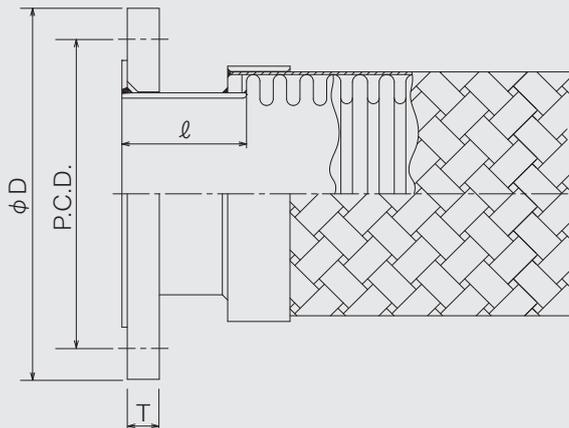
※The list is for the dimensions of JIS10K.

※Other flanges can be responded.

※Up to 500A can be fabricated.

## Loose flange (Type R3)

RX-13



### Standard dimensions

Nominal diameter		ℓ	D	P.C.D.	T
A	B				
80	3	65	185	150	18
100	4	70	210	175	18
125	5	75	250	210	20
150	6	85	280	240	22
200	8	90	330	290	22
250	10	100	400	355	24

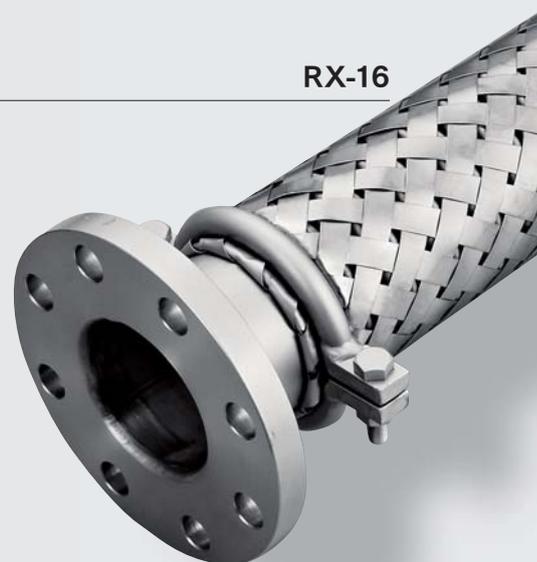
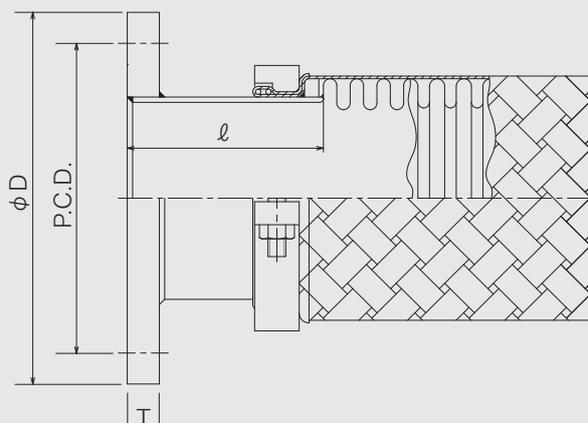
※The list is for the dimensions of JIS10K.

※Other flanges can be responded.

※Up to 500A can be fabricated.

## Fixed flange (Type R4)

RX-16



### Standard dimensions

Nominal diameter		l	D	P.C.D.	T
A	B				
80	3	100	185	150	18
100	4	110	210	175	18
125	5	120	250	210	20
150	6	120	280	240	22
200	8	140	330	290	22
250	10	140	400	355	24

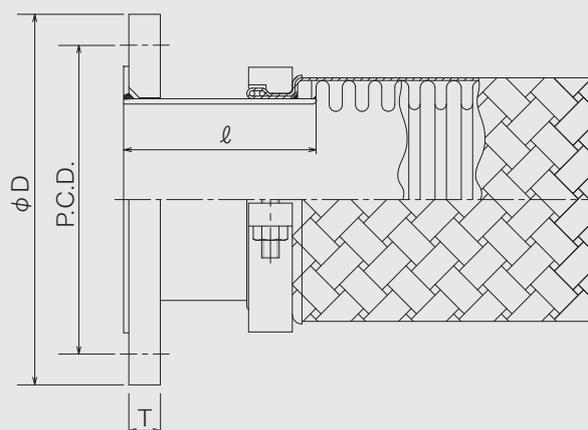
※The list is for the dimensions of JIS10K.

※Other flanges can be responded.

※Up to 500A can be fabricated.

## Loose flange (Type R4)

RX-15



### Standard dimensions

Nominal diameter		l	D	P.C.D.	T
A	B				
80	3	100	185	150	18
100	4	110	210	175	18
125	5	120	250	210	20
150	6	120	280	240	22
200	8	140	330	290	22
250	10	140	400	355	24

※The list is for the dimensions of JIS10K.

※Other flanges can be responded.

※Up to 500A can be fabricated.

Unwelded Male loose screw  
(Type HUM joint) RX-31



Unwelded Female loose screw  
(Type HUF joint) RX-32



Type SM joint +  
Quick coupling RX-55



Type SM joint +  
Lever coupling RX-66



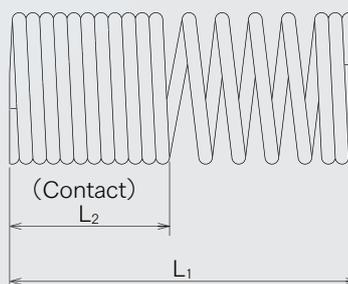
※For the joint type and material, please consult us.

※For the joint type and material, please consult us.

# Accessories

## External protective parts

These parts are designed to protect tubes from local bending and external factors. The parts include springs, helical tubes and hale. These parts may not be applied to tubes depending on the diameter. For the details, please contact us.



### Spring



Standard dimensions

Nominal diameter	L <sub>2</sub>	L <sub>1</sub>
8A	30	100
10A	30	100
15A	30	100
20A	50	150
25A	50	150
32A	50	150
40A	50	150
50A	50	150

### Helical tube



### Hale



## Heat-shrinkable rubber

Flexible hoses can be closely coated with the cylindrical rubber tubes to prevent ingress of water and moisture.



# Vibration absorber

■ These hoses are used to absorb vibration on piping close to a refrigerator compressor. Mainly, they are installed at the inlet and outlet of refrigerant piping compressor and the opposite side is firmly fixed. Then, vibration transmission to the piping beyond the fixed point can be prevented.

- Compatible with new refrigerant
- Standard specifications

Material	Hose, braid SUS304
Tube end	C1220T
Working pressure	Please refer to the list.
Working temperature	100°C
Allowable vibrating amplitude	±200μm

■ JIS B 8607 Refrigerant type and maximum working pressure

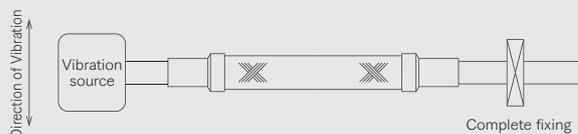
Type	Max. working pressure	Examples of refrigerant
1	3.45MPa	R22, R134a, R404A, R407C, R507A etc.
2	4.30MPa	R410A, R32
3	4.80MPa	Refrigerant which is over 4.30MPa and less than 4.80MPa



## Installation Method

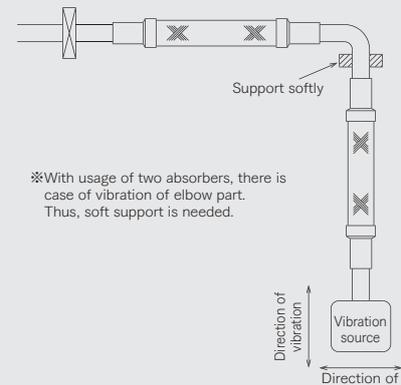
### Usage of one absorber

Please install an absorber at right angle to the direction of vibration.

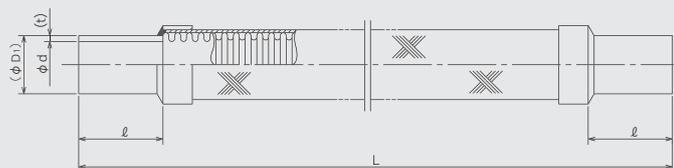


### Usage of two absorbers

When vibration is not in one direction, it is effective to use two absorbers together with 90° elbow part.



## Standard dimensions



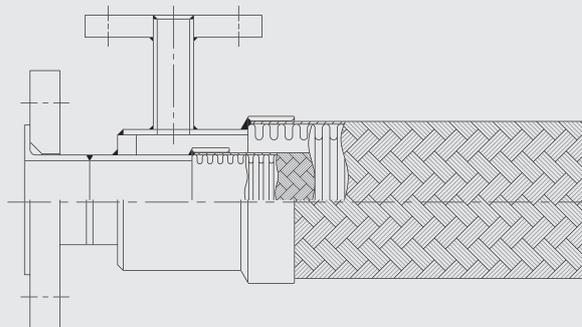
F-No.	Connecting pipe	Tube end				Overall length	Max. working pressure (MPa)
	B	d	(t)	(D <sub>1</sub> )	ℓ	L	
F-3	1/4"	6.46	1.57	9.6	13	191	4.8
F-5	3/8"	9.63	1.585	12.8	16	210	4.8
F-7	1/2"	12.81	1.595	16.0	19	229	4.8
F-9	5/8"	15.99	1.555	19.1	22.5	248	4.8
F-11	3/4"	19.16	1.57	22.3	26	255	4.8
F-13	3/4"	19.16	1.57	22.3	29	287	4.8
F-15	7/8"	22.33	1.585	25.5	32	293	4.3
F-16	1"	25.53	1.835	29.2	35	311	4.3
F-17	1·1/8"	28.64	2.08	32.8	38	330	4.3
F-18	1·1/4"	31.88	2.36	36.6	40	351	4.3
F-19	1·3/4"	34.99	2.505	40.0	42	376	4.3

※For other sizes, please consult us.

※Rubber coating is possible. Please refer to P.24.

## Jacket type

- 2-layer flexible hose consisting of an inner tube and an outer tube between which a heating medium or steam can be fed to heat a high-viscosity fluid, such as heavy oil and asphalt, so that the fluid will not be solidified by lowered temperature during transfer. Both semi-jacket type and full-jacket type can be fabricated.



## For marine use (NK, etc.)

- Classification societies in various countries determine the acceptability of ships and give approval to the ships. According to the international rules, each ship owner shall receive approval of any of the classification societies to secure the safety of human life and property at sea and to prevent marine pollution. The object of approval is equipment related directly to navigation of ship, and the flexible hoses for fuel, lubricant and cooling water are included in the equipment. Our company has supplied flexible hoses approved by the classification societies in various countries to users for many years. (Classification societies from which we have received type approval: ABS, BV, CCS, CR, DNV GL, KR, LR, NK and RINA)



## Flexible hoses for tank trucks

- These flexible hoses are connected to tank trucks to load and unload fluids. They are applicable to a wide range of fluids in tanks, including chemicals, hazardous substances, liquid nitrogen and liquid oxygen.



# Guide to order flexible hose

		Example of entry		Entry field	
Nominal diameter (A)		25			
Overall length (mm)		1000			
Joint model	Upstream side	JIS20k-25RF(loose)			
	Downstream side	NPTI, externally threaded,Fixed			
Quantity (pieces)		5			
		Internal	External	Internal	External
Pressure (MPa)		1.5	—		
Temperature (°C)		100	—		
Fluid		Nitrogen gas	Atmosphere		
Repeated displacement		<input checked="" type="checkbox"/> Will occur	<input type="checkbox"/> Will not occur	<input type="checkbox"/> Will occur	<input type="checkbox"/> Will not occur
Vibration		<input type="checkbox"/> Will occur	<input checked="" type="checkbox"/> Will not occur	<input type="checkbox"/> Will occur	<input type="checkbox"/> Will not occur
Installation condition <sup>※1</sup>		Straight			
Life cycle (times)		10000			
Constant bending radius (mm)		—			
Repeated bending radius (mm)		—			
Lateral displacement (mm)		50			
Frequency (Hz)/amplitude (mm)		/			
Material	hose	SUS304			
	Braid	SUS304			
	Joint 1 on upstream side	SUS304(pipe)			
	Joint 2 on upstream side	SUSF304			
	Joint 1 on downstream side	SUS304			
	Joint 2 on downstream side	—			
	Certificates for materials	<input checked="" type="checkbox"/> Required	<input type="checkbox"/> Not required	<input type="checkbox"/> Required	<input type="checkbox"/> Not required
Applicable standards, laws and regulations		High Pressure Gas Safety Act			
Additional inspections		<input checked="" type="checkbox"/> Dye penetrant test (PT)	<input type="checkbox"/> Radiographic test (RT)	<input type="checkbox"/> Dye penetrant test (PT)	<input type="checkbox"/> Radiographic test (RT)
Other requirements		<ul style="list-style-type: none"> <li>④ Fit a spring for reinforcing the root. Your standard length is acceptable.</li> <li>④ Fit a nameplate showing the serial number and manufacturing date.</li> </ul>			

※In inapplicable fields, enter -.

※1:For the installation condition, see also pages 95 ~ 97 of the catalog.



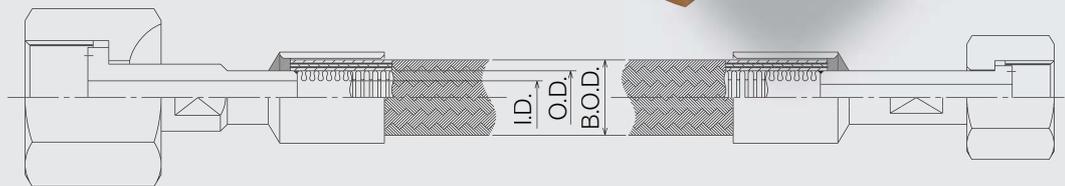
# 4

## High Pressure

Conforming to High Pressure Gas Safety Law  
(inspection by KHK) /Applicable for 88MPa

Flexible hose for high pressure are used in piping in industrial gas, transportation of each liquid with high pressure, filling lines etc. Especially, we have many records to manufacturing facilities for high pressure gas and can deal with items inspected by The High Pressure Safety Institute of Japan (KHKS 0803).

## Sleeve nut type (conforming to High Pressure Gas Safety Low)



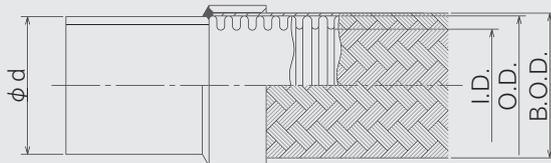
### Standard dimensions

Nominal diameter		I.D.	O.D.	B.O.D.	Max.working pressure MPa (40°C)	Min.bending radius
A	B					
8	1/4	7.2	12.2	16.5	22.0	135
10	3/8	10.0	16.0	22.5	22.0	165
15	1/2	12.0	17.5	22.0	17.0	195

※For joint types and materials, please consult us.

※Design with more pressure shown in the list can be available.

## Pipe type



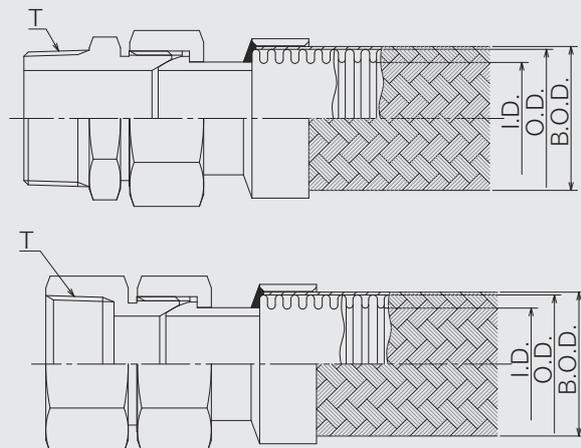
### Standard dimensions

Nominal diameter		Pipe O.D.	Hose dimension			Single braid		Double braid	
A	B		d	I.D.	O.D.	B.O.D.	Max.working pressure MPa (40°C)	B.O.D.	Max.working pressure MPa (40°C)
8	1/4	6.35	7.2	12.2	13.5	7.0	15.0	14.1	
10	3/8	9.52	10.0	16.0	17.5	5.5	19.0	11.1	
15	1/2	12.7	12.0	17.5	19.0	4.9	20.5	9.9	
20	3/4	19.05	19.0	26.0	27.5	2.7	29.0	5.5	
25	1	25.4	25.5	34.0	35.5	1.9	37.0	3.9	

※Other joints, such as UJR and VCR, can be available. For joint types, please specify model no.

※Sizes for Gas piping can be available.

## Screw type



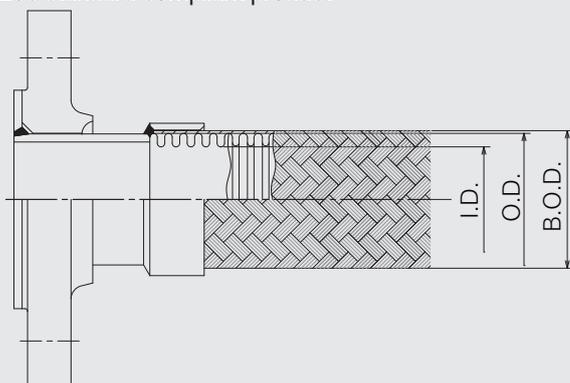
### Standard dimensions

Nominal diameter		Screw specification	Hose dimension			Single braid	Double braid	
A	B	T	I.D.	O.D.	B.O.D.	Max.working pressure MPa (40°C)	B.O.D	Max.working pressure MPa (40°C)
8	1/4	R(Rc)1/4	7.2	12.2	13.5	7.0	15.0	14.1
10	3/8	R(Rc)3/8	10.0	16.0	17.5	5.5	19.0	11.1
15	1/2	R(Rc)1/2	12.0	17.5	19.0	4.9	20.5	9.9
20	3/4	R(Rc)3/4	19.0	26.0	27.5	2.7	29.0	5.5
25	1	R(Rc) 1	25.5	34.0	35.5	1.9	37.0	3.9

※Other screw specifications can be available. ※For joints and materials, please consult us.

## Flange type (JIS20K)

### JLPA209 standard compliant product



### Standard dimensions

Nominal diameter		I.D.	O.D.	B.O.D	Max.working pressure
A	B				
15	1/2	12.0	17.5	19.0	2.12MPa/60°C
20	3/4	19.0	26.0	27.5	
25	1	25.5	34.0	37.0	
32	1·1/4	32.0	42.0	46.0	
40	1·1/2	39.0	49.0	53.0	
50	2	50.0	62.0	66.0	
65	2·1/2	65.0	86.0	90.0	
80	3	77.0	104.0	109.0	
100	4	100.0	129.0	134.0	

※For materials, please consult us.

# Flexible hose for ultra-high pressure

## Usage

- Hydrogen station facilities
- Various testing facilities for on-board tanks etc.

## Features

- No penetration of hydrogen
- High flexibility
- Hoses can be designed to conform to High Pressure Gas Safety Act.
- SUS316・SUS316L  
(Material with more than nickel equivalent 28.5, can be dealt with)

## Specifications

Max. working pressure	90.2MPa
Max. working temperature	+85°C
Min. working temperature	-45°C
Min. burst pressure	360.8MPa
Min. bending radius	200mm

※Flexible hoses for 40MPa and 70MPa can be fabricated.

※For fittings, please consult us.



■ We have a hydraulic test equipment which can apply pressure of up to 700MPa.

## Hydrogen impulse test

<Test condition>

Medium : Hydrogen gas

Pressure : 0⇄85MPaG (repeated pressure)

Temperature : Less than : -45°C (under the condition of precooling)

Pressure cycle : 3 minutes

Installation status : Inverted U-shape

(please refer to the picture of hose piping)

Bending radius : 200mm



Test facility : Iwatani Corporation Iwatani R&D center



Our FCVs (place : Iwatani Hydrogen Refueling Station in Amagasaki)



# 5

## **Vacuum flexible hoses and bellows**

Flexible hoses / Bellows  
Joints and piping parts / Special models

The vacuum technology is widely used in the semiconductor, LCD, LED, space development, accelerator and food industries and is one of the indispensable technologies in these days. Our flexible hoses and bellows for vacuum use are manufactured in a clean environment so that they can be used in these vacuum technology fields.

# Megaflex<sup>®</sup> /Megaflex (with inner surface polished)

Recently, the scale of integration in the semiconductor industry has been remarkably increased, and requirements for cleanliness of semiconductor manufacturing equipment have become considerably strict. Particularly, on process gas piping systems, super clean pipes made of vacuum double-melted materials are used to improve the cleanliness. The flexible hoses with inner surface polished, Megaflex, have been developed to meet the requirements for higher cleanliness and gained absolute confidence and appreciation in the semiconductor field for many years.

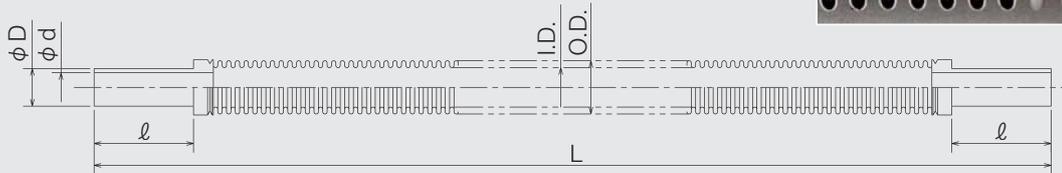
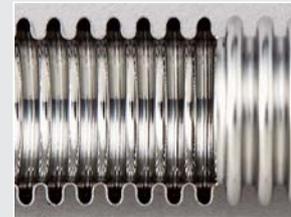


## Features

- Since an ultra-low Mn vacuum double-melted material is used for the tube end, the corrosion resistance of the welded zone is very high.
- Inner surface roughness: Rz 0.7 μm or less
- The remarkably smooth inner surface is hardly covered with particles and generates almost no particles.
- Products exposed to precision cleaning in clean room

## Standard specifications

Material	Hose SUS316L Tube end SUS316L(Vacuum double-melted material)
Working pressure	Vacuum ~0.5MPa
Allowable leak rate	$1.33 \times 10^{-10} \text{Pa} \cdot \text{m}^3/\text{sec}$ or less



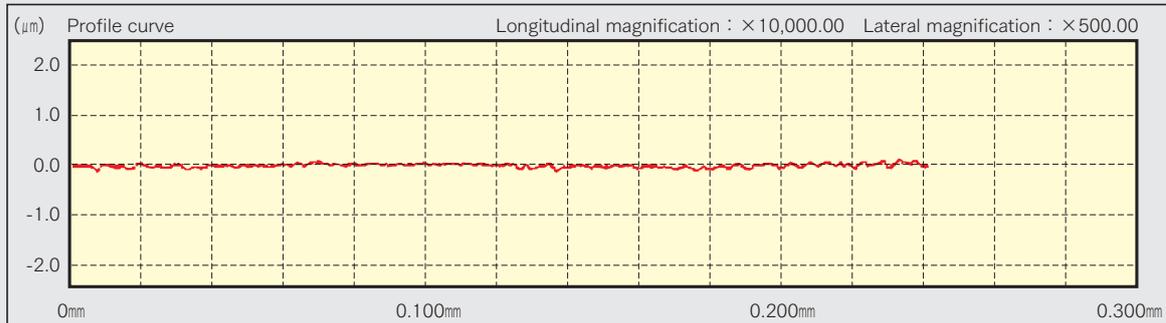
## Standard dimensions

Nominal diameter (A)	Joint standard	Model No.	I.D.	O.D.	D	d	l	L	Min. bending radius (mm)	
									Constant bending	Repeated bending
8	1/4"	ORV-8PM-20	5.5	8.5	6.35	4.5	20	200	30	125
		ORV-8PM-30						300		
		ORV-8PM-40						400		
10	3/8"	ORV-10PM-20	10.0	13.5	9.52	7.4	25	200	45	180
		ORV-10PM-30						300		
		ORV-10PM-40						400		
15	1/2"	ORV-15PM-20	12.0	16.0	12.7	10.3	30	200	45	185
		ORV-15PM-30						300		
		ORV-15PM-40						400		

※Max. length: 2000L

## Hose inner surface roughness (actual measurement)

Ra:0.02 μm Rz:0.2 μm



# Tube end type

## Standard specifications

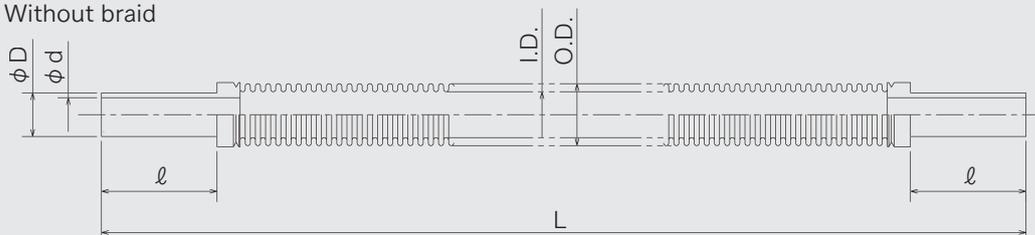
	Hose SUS316L
Material	Tube end SUS316L
	Braid SUS304
Working pressure	See the tables.
Allowable leak rate	$1.33 \times 10^{-10}$ Pa · m <sup>3</sup> /secor less

## Remarks

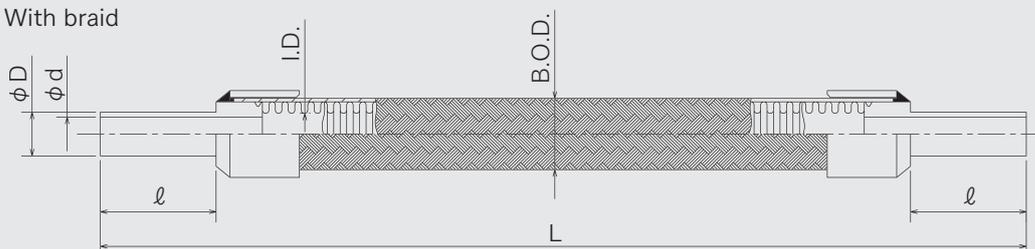
- 3/4" (ORV-20PS) and 1" (ORV-25PS)  
Hose can be fabricated.  
(For the allowable pressure on the pressing side, please consult us.)



Without braid



With braid



## Standard dimensions of hoses without braid

Nominal diameter (A)	Joint standard	Model No.	I.D.	O.D.	D	d	l	L	Working pressure (MPa)	Min. bending radius (mm)	
										Constant bending	Repeated bending
8	1/4"	ORV-8PS-cm	5.5	8.5	6.35	4.5	20	70~3000	Vacuum~0.5	30	125
10	3/8"	ORV-10PS-cm	10.0	13.5	9.52	7.4	25	80~3000	Vacuum~0.5	45	180
15	1/2"	ORV-15PS-cm	12.0	16.0	12.7	10.3	30	90~3000	Vacuum~0.5	45	185

\*Specify the length in the model number in cm. Example : ORV-8PS-20

## Standard dimensions of hoses with braid

Nominal diameter (A)	Joint standard	Model No.	I.D.	O.D.	D	d	l	L	Working pressure (MPa)	Min. bending radius (mm)	
										Constant bending	Repeated bending
8	1/4"	ORVB-8PS-cm	5.5	10.0	6.35	4.5	20	120~3000	Vacuum~4.0	30	125
10	3/8"	ORVB-10PS-cm	10.0	15.0	9.52	7.4	25	120~3000	Vacuum~3.0	45	180
15	1/2"	ORVB-15PS-cm	12.0	17.5	12.7	10.3	30	120~3000	Vacuum~2.0	45	185

\*Specify the length in the model number in cm. Example : ORVB-8PS-20

# Tube end type (metal seal type)

## Standard specifications

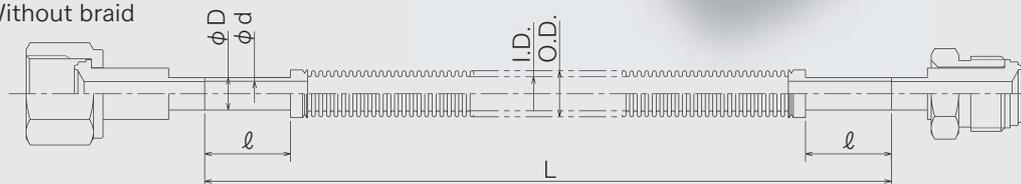
Material	Hose SUS316L
	Tube end SUS316L
	Braid SUS304
Working pressure	See the tables.
Allowable leak rate	$1.33 \times 10^{-10}$ Pa · m <sup>3</sup> /sec or less

## Remarks

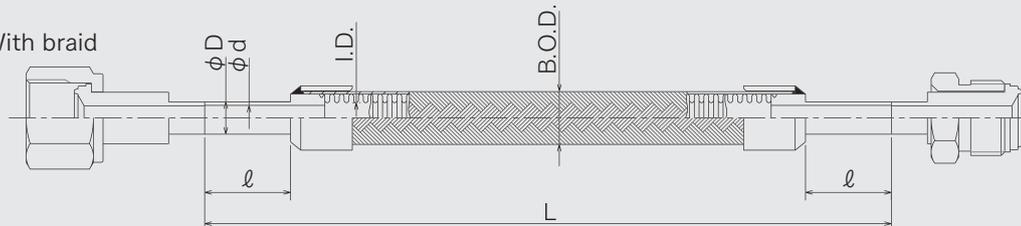
- These models are tube end type provided with metal seal type joints.
- Please specify the joint model.



Without braid



With braid



## Standard dimensions of hoses without braid

Nominal diameter (A)	Joint standard	Model No.	I.D.	O.D.	D	d	l	L	Working pressure (MPa)	Min. bending radius (mm)	
										Constant bending	Repeated bending
8	1/4"	ORV-8PS-cm-joint model	5.5	8.5	6.35	4.5	20	70~3000	Vacuum~0.5	30	125
10	3/8"	ORV-10PS-cm-joint model	10.0	13.5	9.52	7.4	25	80~3000	Vacuum~0.5	45	180
15	1/2"	ORV-15PS-cm-joint model	12.0	16.0	12.7	10.3	30	90~3000	Vacuum~0.5	45	185

※Specify the length in the model number in cm. Example : ORV-8PS-20-joint model

※As the joint model, specify the model number given by the manufacturer.

## Standard dimensions of hoses with braid

Nominal diameter (A)	Joint standard	Model No.	I.D.	O.D.	D	d	l	L	Working pressure (MPa)	Min. bending radius (mm)	
										Constant bending	Repeated bending
8	1/4"	ORVB-8PS-cm-joint model	5.5	10.0	6.35	4.5	20	120~3000	Vacuum~4.0	30	125
10	3/8"	ORVB-10PS-cm-joint model	10.0	15.0	9.52	7.4	25	120~3000	Vacuum~3.0	45	180
15	1/2"	ORVB-15PS-cm-joint model	12.0	17.5	12.7	10.3	30	120~3000	Vacuum~2.0	45	185

※Specify the length in the model number in cm. Example : ORVB-8PS-20-joint model

※As the joint model, specify the model number given by the manufacturer.

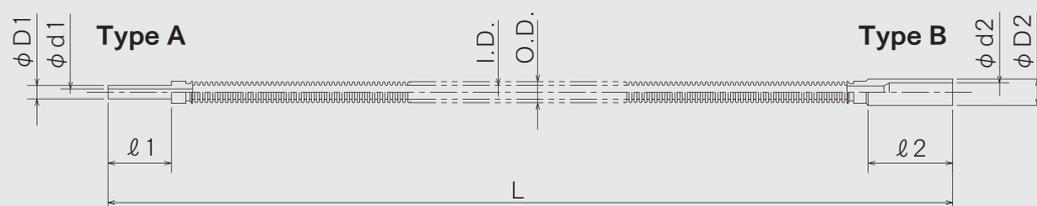
# 3A Super Mini Flex

## Standard specifications

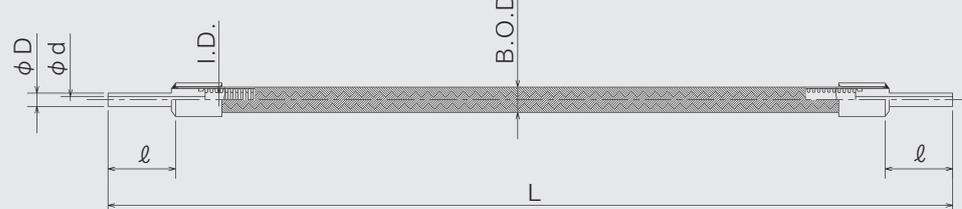
Material	Hose SUS316L
	Tube end SUS316L
	Braid SUS304
Working pressure	See the tables.
Allowable leak rate	$1.33 \times 10^{-10}$ Pa · m <sup>3</sup> /sec or less



Without braid



With braid



## Standard dimensions of hoses without braid

Nominal diameter (A)	Joint standard	Model No.	I.D.	O.D.	D <sub>1</sub>	d <sub>1</sub>	l <sub>1</sub>	D <sub>2</sub>	d <sub>2</sub>	l <sub>2</sub>	L	Working pressure (MPa)	Min. bending radius (mm)	
													Constant bending	Repeated bending
3	1/8"	ORV-3PS-cm-A(B)	3.3	5.0	3.18	1.6	15	6.35	4.5	20	100~2000	Vacuum~0.5	10	75

※Specify the length in the model number in cm. Example : ORV-3PS-20-A

※Specify type A or B joint. Joints having other shapes can be fabricated.

## Standard dimensions of hoses with braid

Nominal diameter (A)	Joint standard	Model No.	I.D.	B.O.D.	D	d	l	L	Working pressure (MPa)	Min. bending radius (mm)	
										Constant bending	Repeated bending
3	1/8"	ORVB-3PS-cm-A	3.3	6.0	3.18	1.6	15	100~2000	Vacuum~6.1	10	75

※Specify the length in the model number in cm. Example : ORVB-3PS-20-A

※Only type A is available.

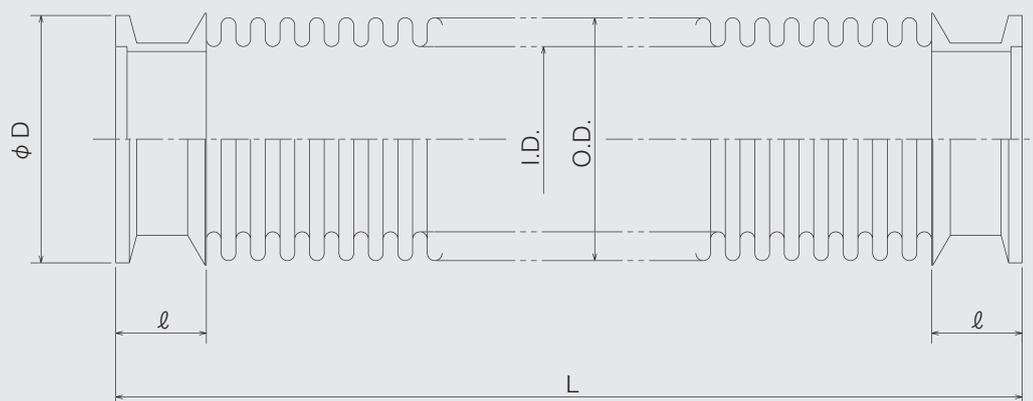
## NW flange type

### Standard specifications

Material	Hose SUS304, SUS316L
	NW flange SUS304, SUS316L
Working pressure	Vacuum~atmospheric pressure
Allowable leak rate	$1.33 \times 10^{-10}$ Pa · m <sup>3</sup> /sec or less

### Remarks

- Hoses of sizes of NW125 or more can be fabricated.
- Hoses with braid can be fabricated.  
(Model No. ORVB-)
- For the allowable pressure on the pressing side, please consult us.
- Hoses having length not shown in the L column can be fabricated.



### Standard dimensions

Nominal diameter (A)	Joint standard	Model No.	I.D.	O.D.	D	ℓ	L	Min. bending radius (mm)	
								Constant bending	Repeated bending
15	NW10	ORV-10C-cm	12.0	16.0	30	20	100~2000	45	185
20	NW16	ORV-16C-cm	21.5	29.5	30	20	100~2000	50	210
25	NW25	ORV-25C-cm	26.5	36.0	40	20	100~2000	70	240
40	NW40	ORV-40C-cm	41.2	54.0	55	20	100~2000	100	330
50	NW50	ORV-50C-cm	50.5	65.0	75	20	100~2000	130	365
65	NW63	ORV-63C-cm	65.0	82.0	87	20	100~2000	170	545
80	NW80	ORV-80C-cm	77.5	98.0	114	25	100~2000	200	600
100	NW100	ORV-100C-cm	102.0	127.0	134	25	100~2000	240	750

※Specify the length in the model number in cm. Example : ORV-80C-20

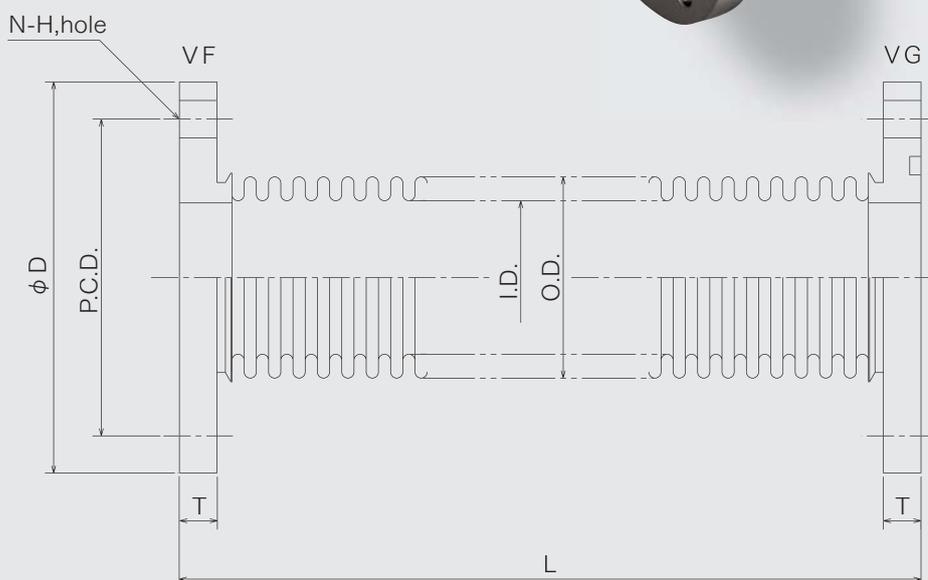
# JIS flange type

## Standard specifications

Material	Hose SUS304, SUS316L
	Flange SUS304, SUS316L
Working pressure	Vacuum~atmospheric pressure
Allowable leak rate	$1.33 \times 10^{-10}$ Pa · m <sup>3</sup> /sec or less

## Remarks

- Hoses with braid can be fabricated.  
(Model No. ORVB-)
- For the allowable pressure on the pressing side, please consult us.
- Hoses having length not shown in the L column can be fabricated.



## Standard dimensions

Nominal diameter (A)	Joint standard	Model No.	I.D.	O.D.	D	T	P.C.D.	N-H	L	Min. bending radius (mm)	
										Constant bending	Repeated bending
20	VG20/VF20	ORV-20F-cm	21.5	29.5	80	8	60	4-10	100~2000	50	210
25	VG25/VF25	ORV-25F-cm	26.5	36.0	90	8	70	4-10	100~2000	70	240
40	VG40/VF40	ORV-40F-cm	41.2	54.0	105	10	85	4-10	100~2000	100	330
50	VG50/VF50	ORV-50F-cm	50.5	65.0	120	10	100	4-10	100~2000	130	365

\*Specify the length in the model number in cm. Example : ORV-20F-20

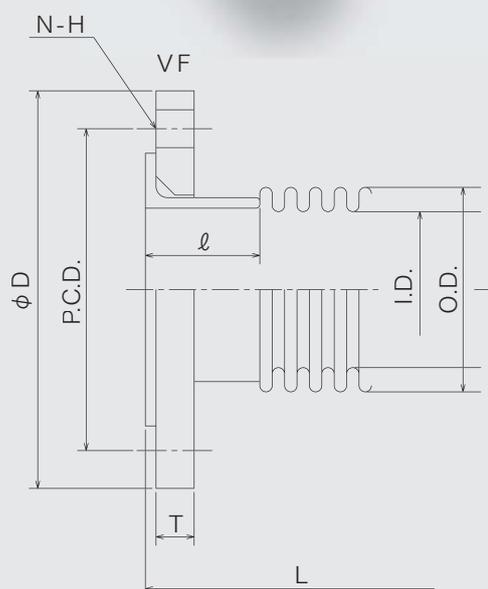
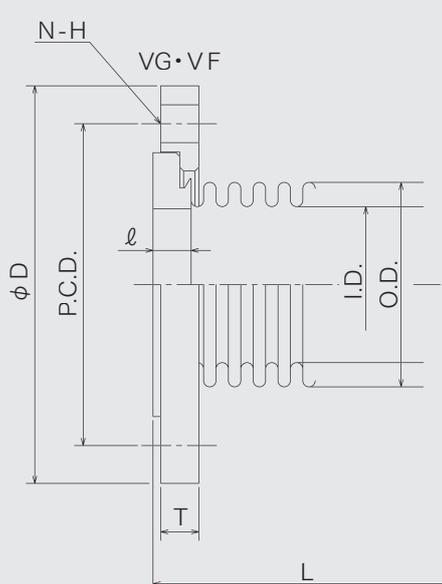
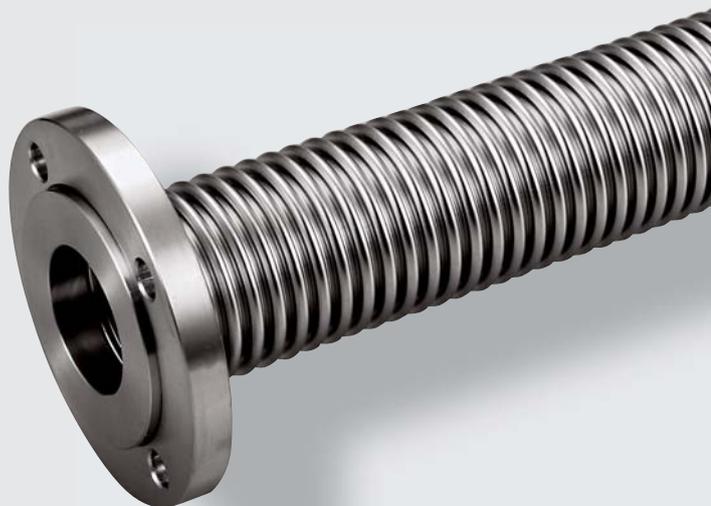
# JIS flange(VF loose) type

## Standard specifications

Material	Hose SUS304, SUS316L
	Flange SUS304, SUS316L
Working pressure	Vacuum~atmospheric pressure
Allowable leak rate	$1.33 \times 10^{-10}$ Pa · m <sup>3</sup> /sec or less

## Remarks

- Hoses with braid can be fabricated.  
(Model No. ORVB-)
- For the allowable pressure on the pressing side, please consult us.
- Hoses having length not shown in the L column can be fabricated.



## Standard dimensions

Nominal diameter (A)	Joint standard	Model No.	I.D.	O.D.	D	T	P.C.D.	N-H	ℓ	L	Min. bending radius (mm)	
											Constant bending	Repeated bending
20	VG20/VF20	ORV-20FL-cm	21.5	29.5	80	8	60	4-10	9	100~2000	50	210
25	VG25/VF25	ORV-25FL-cm	26.5	36.0	90	8	70	4-10	9	100~2000	70	240
40	VG40/VF40	ORV-40FL-cm	41.2	54.0	105	10	85	4-10	10	100~2000	100	330
50	VG50/VF50	ORV-50FL-cm	50.5	65.0	120	10	100	4-10	10	100~2000	130	365
65	VG65/VF65	ORV-65FL-cm	65.0	82.0	145	10	120	4-12	50	200~2000	170	545
80	VG80/VF80	ORV-80FL-cm	77.5	98.0	160	12	135	4-12	50	200~2000	200	600
100	VG100/VF100	ORV-100FL-cm	102.0	127.0	185	12	160	8-12	50	200~2000	240	750
125	VG125/VF125	ORV-125FL-cm	127.0	152.0	210	12	185	8-12	50	200~2000	300	930
150	VG150/VF150	ORV-150FL-cm	151.0	180.0	235	12	210	8-12	50	200~2000	350	970

※Specify the length in the model number in cm. Example : ORV-20FL-20

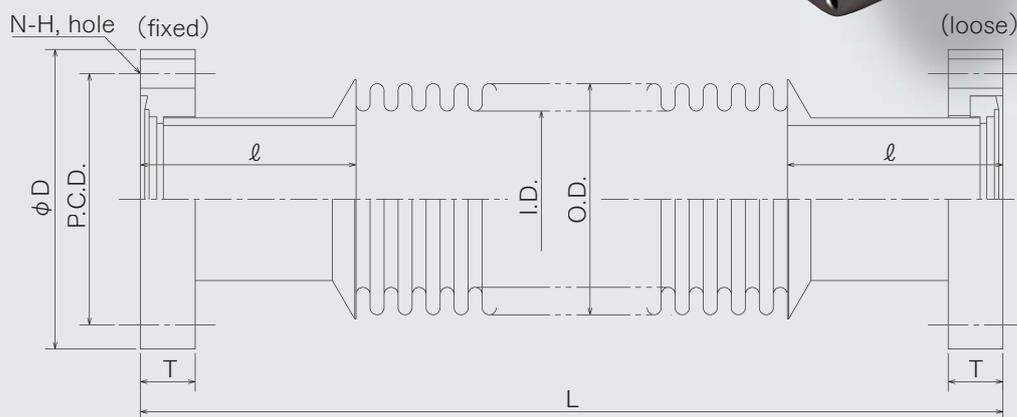
# Conflat flange type

## Standard specifications

Material	Hose SUS304, SUS316L
	Flange SUS304, SUS316L
Working pressure	Vacuum~atmospheric pressure
Allowable leak rate	$1.33 \times 10^{-10}$ Pa · m <sup>3</sup> /sec or less

## Remarks

- Hoses with braid can be fabricated.  
(Model No. ORVB-)
- For the allowable pressure on the pressing side, please consult us.
- Hoses having length not shown in the L column can be fabricated.



## Standard dimensions

Nominal diameter (A)	Joint standard	Model No.	I.D.	O.D.	D	T	P.C.D.	N-H	l	L	Min. bending radius (mm)	
											Constant bending	Repeated bending
20	ICF34	ORV-20CF-cm	21.5	29.5	34	7.5	27.0	6-4.5	25	200~2000	50	210
25	ICF70	ORV-25CF-cm	26.5	36.0	70	12.7	58.7	6-6.8	30	200~2000	70	240
32	ICF70	ORV-32CF-cm	33.5	44.0	70	12.7	58.7	6-6.8	30	200~2000	80	280
40	ICF70	ORV-40CF-cm	41.2	54.0	70	12.7	58.7	6-6.8	50	200~2000	100	330
50	ICF114	ORV-50CF-cm	50.5	65.0	114	17.5	92.1	8-8.5	50	200~2000	130	365

※Specify the length in the model number in cm. Example : ORV-20CF-20

※Specify the flange type, fixed or loose.

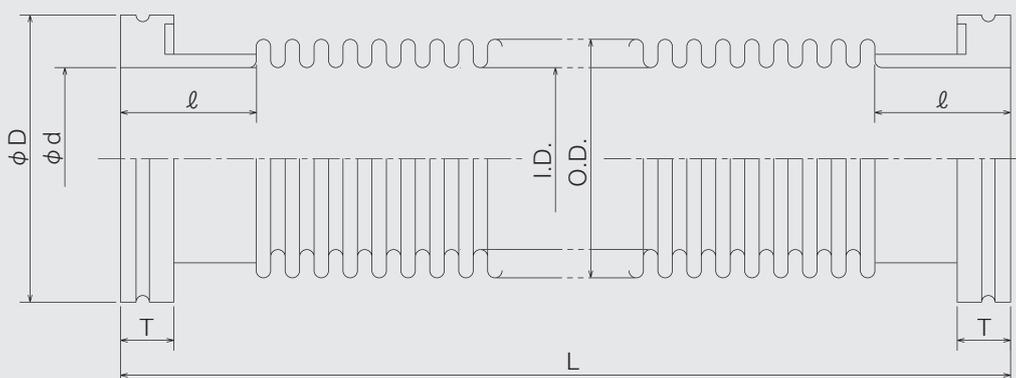
# ISO-MF flange type

## Standard specifications

Material	Hose SUS304, SUS316L
	Flange SUS304, SUS316L
Working pressure	Vacuum~atmospheric pressure
Allowable leak rate	$1.33 \times 10^{-10}$ Pa · m <sup>3</sup> /sec or less

## Remarks

- Hoses with braid can be fabricated.  
(Model No. ORVB-)
- For the allowable pressure on the pressing side, please consult us.
- Hoses having length not shown in the L column can be fabricated.



## Standard dimensions

Nominal diameter (A)	Joint standard	Model No.	I.D.	O.D.	D	T	d	l	L	Min. bending radius (mm)	
										Constant bending	Repeated bending
65	ISO-MF63	ORV-63MF-cm	65.0	82.0	95	12	70.2	25	200~2000	170	545
80	ISO-MF80	ORV-80MF-cm	77.5	98.0	110	12	83.2	25	200~2000	200	600
100	ISO-MF100	ORV-100MF-cm	102.0	127.0	130	12	102.2	25	200~2000	240	750
125	ISO-MF125	ORV-125MF-cm	127.0	152.0	155	12	127.2	25	200~2000	300	930
150	ISO-MF160	ORV-160MF-cm	151.0	180.0	180	12	153.2	30	200~2000	350	970

※Specify the length in the model number in cm. Example : ORV-63MF-20

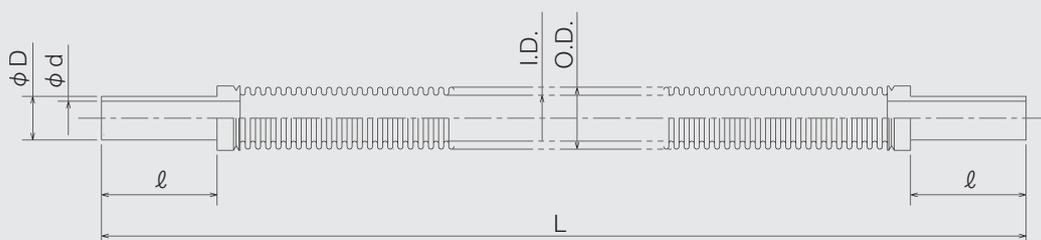
# Tube end type (equivalent to HASTELLOY C-22)

## ■ Features

- Nickel alloy (equivalent to HASTELLOY C-22) excelling in corrosion resistance is used for the thin-walled flexible hoses.

## ■ Standard specifications

Material	Hose Nickel alloy
	(equivalent to HASTELLOY C-22)
Tube end SUS316L, Nickel alloy	
Working pressure	Vacuum~0.5MPa
Allowable leak rate	$1.33 \times 10^{-10}$ Pa · m <sup>3</sup> /sec or less



## ■ Standard dimensions

Nominal diameter (A)	Joint standard	Model No.	I.D.	O.D.	D	d	ℓ	L	Min. bending radius (mm)	
									Constant bending	Repeated bending
8	1/4"	ORV-8PH-cm	5.5	8.5	6.35	4.5	20	70~3000	40	130
10	3/8"	ORV-10PH-cm	10.0	13.5	9.52	7.4	25	80~3000	50	190
15	1/2"	ORV-15PH-cm	12.0	16.0	12.7	10.3	30	90~3000	50	200

※Specify the length in the model number in cm. Example : ORV-8PH-20

## NW flange type (equivalent to HASTELLOY C-22)

### ■ Features

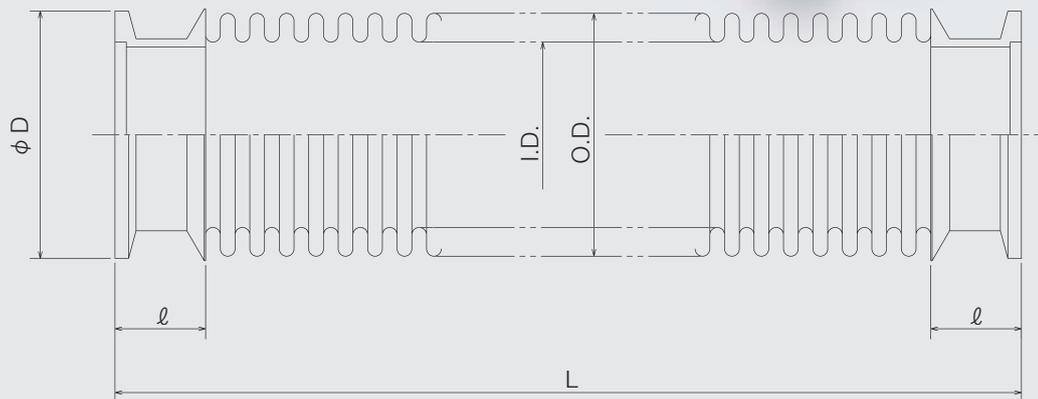
- Nickel alloy (equivalent to HASTELLOY C-22) excelling in corrosion resistance is used for the thin-walled flexible hoses.

### ■ Standard specifications

Material	Hose Nickel alloy (equivalent to HASTELLOY C-22) NW flange SUS316L, Nickel alloy
Working pressure	Vacuum~atmospheric pressure
Allowable leak rate	$1.33 \times 10^{-10}$ Pa · m <sup>3</sup> /sec or less

### ■ Remarks

- For the allowable pressure on the pressing side, please consult us.



### ■ Standard dimensions

Nominal diameter (A)	Joint standard	Model No.	I.D.	O.D.	D	ℓ	L	Min. bending radius (mm)	
								Constant bending	Repeated bending
15	NW10	ORV-10C-cm-C22	12.0	16.0	30	20	100~2000	50	200
20	NW16	ORV-16C-cm-C22	21.5	28.5	30	20	100~2000	60	240
25	NW25	ORV-25C-cm-C22	26.5	35.0	40	20	100~2000	70	250
40	NW40	ORV-40C-cm-C22	41.2	51.5	55	20	100~2000	80	330
50	NW50	ORV-50C-cm-C22	50.5	62.5	75	20	100~2000	90	390

※Specify the length in the model number in cm. Example : ORV-10C-20-C22

# NW flange type (coated models)

## Features

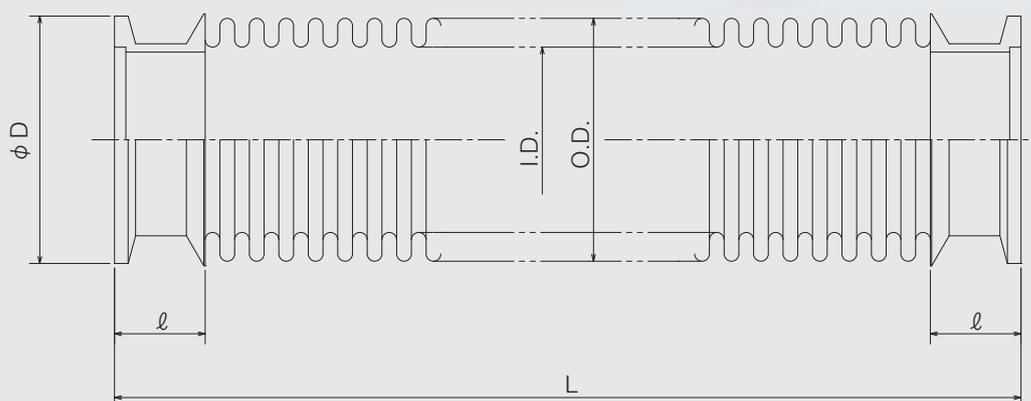
- Since the surface is coated with a special material, the surface excels in corrosion resistance. The coating is effective particularly against chlorine corrosive gas.
- The coating is performed by Clean S treatment (Showa Denko).

## Standard specifications

Material	Hose SUS304, SUS316L NW flange SUS304
Working pressure	Vacuum~atmospheric pressure
Allowable leak rate	$1.33 \times 10^{-10}$ Pa · m <sup>3</sup> /sec or less

## Remarks

- For the allowable pressure on the pressing side, please consult us.



## Standard dimensions

Nominal diameter (A)	Joint standard	Model No.	I.D.	O.D.	D	l	L	Min. bending radius (mm)	
								Constant bending	Repeated bending
15	NW10	ORV-10C-cmCS	12.0	16.0	30	20	100~1000	45	185
20	NW16	ORV-16C-cmCS	21.5	29.5	30	20	100~1000	50	210
25	NW25	ORV-25C-cmCS	26.5	36.0	40	20	100~1000	70	240
40	NW40	ORV-40C-cmCS	41.2	54.0	55	20	100~1000	100	330
50	NW50	ORV-50C-cmCS	50.5	65.0	75	20	100~1000	130	365

\*Specify the length in the model number in cm. Example : ORV-10C-20CS

# Clear Flow Flex<sup>®</sup>

## (Turbulence Suppressive Low-Vibration Flexible Hose)

### Features

『Clear Flow Flex<sup>®</sup>』 is a flexible tube equipped internally with a specially designed flexible sleeve. The new product suppresses turbulent flow to reduce the vibration and hissing noise caused by a fluid running through the hose without compromising the performances such as flexibility which the conventional series of products have.

『Clear Flow Flex』 suits best to the piping for precision apparatus such as spectrometers, electronic microscopes and medical equipments that should be free from vibration and passing hiss.

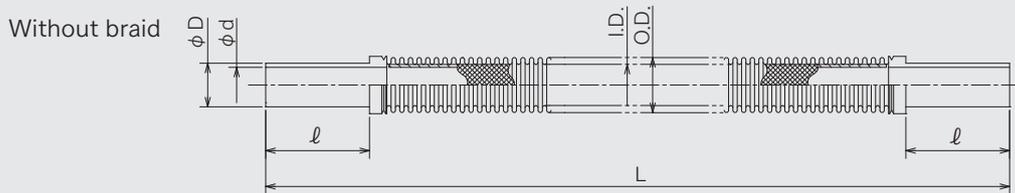
### Standard specifications

	Hose	SUS316L
Material	Tube end	SUS316L
	Sleeve	Alumina fiber
specifications	Working pressure.	See the table
	Working temperature	-196°C~40°C
	Allowable leak rate	$1.33 \times 10^{-10} \text{Pa} \cdot \text{m}^3/\text{sec}$ of less



RIKEN

Japan Synchrotron Radiation Research Institute (JASRI)  
Osaka Rasenkan Kogyo Co., Ltd.  
Co-patented.



### Standard dimensions-without braid

Nominal diameter (A)	Joint standard	Model No.	I.D.	O.D.	D	d	l	L	Working pressure (MPa)	Min. bending radius (mm)	
										Constant bending	Repeated bending
8	1/4"	ORV-8CFF-cm	5.5	8.5	6.35	4.5	20	70~2000	Vacuum-0.5	30	115
10	3/8"	ORV-10CFF-cm	10.0	13.5	9.52	7.4	25	80~2000	Vacuum-0.5	45	180
15	1/2"	ORV-15CFF-cm	12.0	16.0	12.7	10.3	30	90~2000	Vacuum-0.5	45	185

※Specify the length in the model number in cm. Example : ORV-8CFF-20

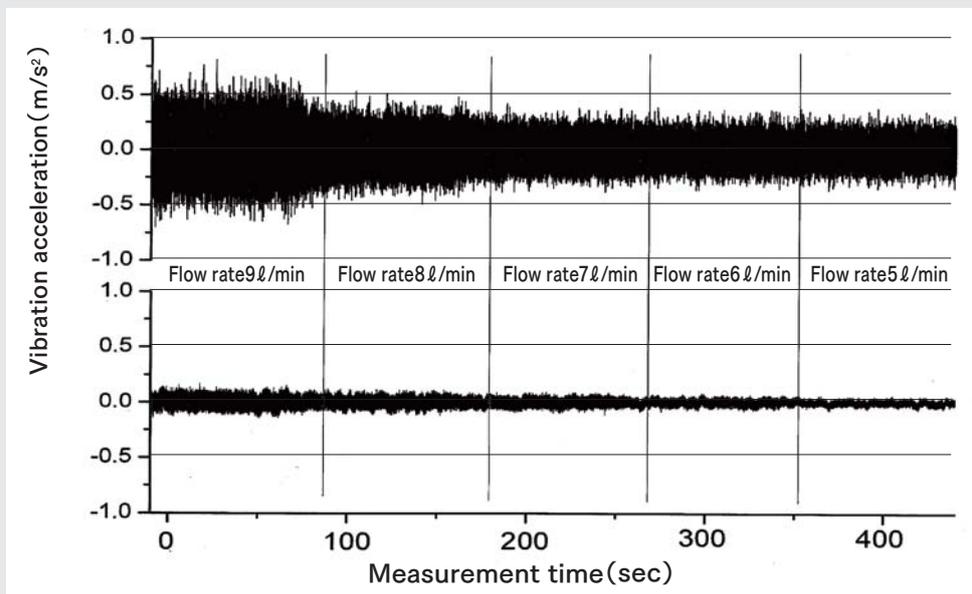
※With braid can be fabricated.

### Experimental Data

#### Results of measuring vibration accelerations by water flow (at room temperature)

Measured at the center of 15A-600L flexible hose

Data provided by courtesy of Japan Synchrotron Radiation Research Institute (JASRI)



Conventional products

Clear Flow Flex<sup>®</sup>

# Heat Flex

## Features

- The uniform temperature distribution ensures stable insulation and heating.
- The inner hose and tube end made of SUS316L realize excellent heat resistance and corrosion resistance and ensure complete airtightness (He test:  $1.33 \times 10^{-10}$  Pa · m<sup>3</sup>/sec). The hoses are suitable for feeding H<sub>2</sub> and He gas.
- The bending radius is small, and the flexibility is high.
- The hoses are provided with built-in thermal fuses to prevent overheating.

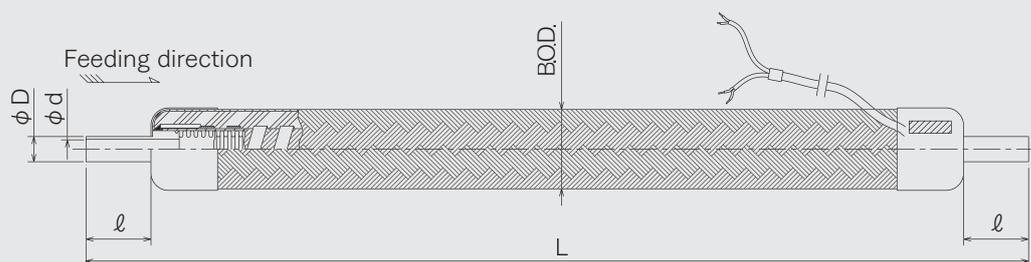


## Standard specifications

Supply voltage	AC100V
Working pressure	See the table
Working temperature	MAX 200°C
Temperature sensor	CA (K) type thermocouple
Lead wire length	2000mm

## Remarks

- Hoses for supply voltage other than 100 V can be fabricated.
- Hoses for working temperature of higher than 200° C can be fabricated.
- Hoses using CC (T) type thermocouples as temperature sensors can be fabricated.
- Lead wire length is changeable.



## Standard dimensions

Nominal diameter (A)	Joint standard	Model No.	D	d	(B.O.D.)	l	L	Working pressure (MPa)	Min. bending radius (mm)	Power consumption per m
3	1/8"	HFB-3PS-cm	3.18	1.6	23	15	500~2000	Vacuum~4.2	20	110W
8	1/4"	HFB-8PS-cm	6.35	4.5	23	20	500~2000	Vacuum~2.8	60	120W
10	3/8"	HFB-10PS-cm	9.52	7.4	33	25	500~2000	Vacuum~2.1	90	130W
15	1/2"	HFB-15PS-cm	12.7	10.3	45	30	500~2000	Vacuum~1.4	90	150W
20	3/4"	HFB-20PS-cm	19.05	15.7	53	40	500~2000	Vacuum~1.0	100	250W

\*Specify the length in the model number in cm. Example : HFB-8PS-75

## Transfer tubes (vacuum insulation double-layer flexible hoses)

### ■ Features

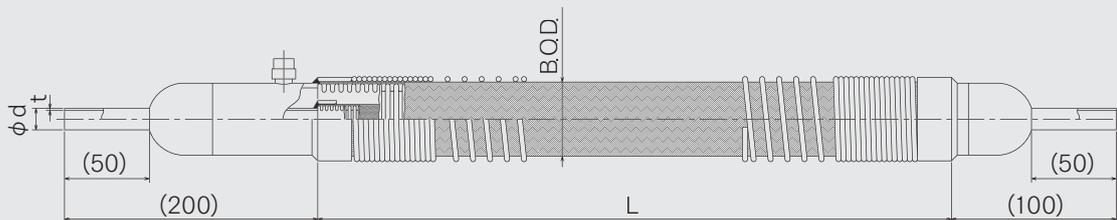
- Remarkably high flexibility
- The excellent heat insulating performance minimizes evaporation of the internal fluid.

### ■ Standard specifications

Material	Inner hose SUS316L
	Outer hose SUS304
Working pressure	MAX 1.0MPa
Working temperature	MIN -200°C
Allowable leak rate	$1.33 \times 10^{-10}$ Pa · m <sup>3</sup> /sec or less

### ■ Remarks

- Hoses for working pressure of higher than 1 MPa can be designed and fabricated.
- Hoses having length not shown in the L column can be fabricated.



### ■ Standard dimensions

Nominal diameter (A)	Joint standard	Model No.	d	t	(B.O.D.)	L	Min. bending radius (mm)
8	1/4"	ORV-8TR-cm	6.35	1.0	35.5	1000~3000	250
10	3/8"	ORV-10TR-cm	9.52	1.0	44.0	1000~3000	300
15	1/2"	ORV-15TR-cm	12.7	1.2	44.0	1000~3000	300

※Specify the length in the model number in cm. Example : ORV-10TR-200

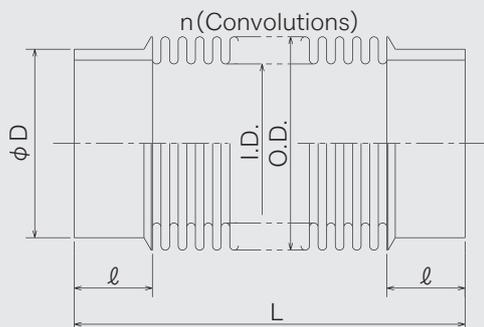
# Tube end type

## Standard specifications

Material	Bellows SUS316L Tube end SUS316L
Working pressure	Vacuum~atmospheric pressure
Allowable leak rate	$1.33 \times 10^{-10}$ Pa · m <sup>3</sup> /sec or less

## Remarks

- For the allowable pressure on the pressing side, please consult us.
- Bellows having length not shown in the L column can be fabricated.



## Standard dimensions

Nominal diameter (A)	Joint standard	Model No.	I.D.	O.D.	t	n (Convolutions)	D	ℓ	L
20	15A	ORV-15PB-8	20.5	28.5	0.15	18	21.7	20	80
20	20A	ORV-20PB-8	20.5	28.5	0.15	18	27.2	20	80
25	25A	ORV-25PB-8	26.0	37.0	0.15	13	34.0	20	80
40	32A	ORV-32PB-10	41.0	55.0	0.15	13	42.7	20	100
40	40A	ORV-40PB-10	41.0	55.0	0.15	13	48.6	20	100
50	50A	ORV-50PB-10	51.0	65.0	0.2	13	60.5	20	100
65	65A	ORV-65PB-12	63.0	83.0	0.25	16	76.3	20	120
80	80A	ORV-80PB-15	80.0	103.0	0.25	18	89.1	25	150
100	100A	ORV-100PB-15	104.0	127.0	0.25	15	114.3	25	150
150	150A	ORV-150PB-15	150.0	175.0	0.3	13	165.2	25	150
200	200A	ORV-200PB-15	205.0	230.0	0.3	13	216.3	25	150

t is the bellows wall thickness.

## Performance table

Nominal diameter (A)	Joint standard	Model No.	Displacement(mm)		Spring rate(N/mm)	
			Axial direction	Lateral direction	Axial direction	Lateral direction
20	15A	ORV-15PB-8	±4.5	±2.5	19.3	10.8
20	20A	ORV-20PB-8	±4.5	±2.5	19.3	10.8
25	25A	ORV-25PB-8	±6.5	±2.5	13.2	13.1
40	32A	ORV-32PB-10	±10.5	±4.0	9.0	9.5
40	40A	ORV-40PB-10	±10.5	±4.0	9.0	9.5
50	50A	ORV-50PB-10	±8.5	±2.5	26.1	40.4
65	65A	ORV-65PB-12	±14.5	±5.0	20.3	27.6
80	80A	ORV-80PB-15	±21.0	±7.5	14.8	19.0
100	100A	ORV-100PB-15	±19.0	±5.5	20.4	41.7
150	150A	ORV-150PB-15	±17.0	±3.0	44.0	188.9
200	200A	ORV-200PB-15	±17.0	±2.5	58.0	423.1

The displacement values in each of the axial direction and lateral direction are shown.

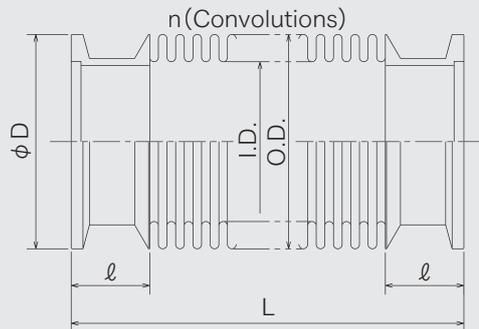
# NW flange type

## Standard specifications

Material	Bellows SUS316L NW flange SUS316L
Working pressure	Vacuum~atmospheric pressure
Allowable leak rate	$1.33 \times 10^{-10}$ Pa · m <sup>3</sup> /sec or less

## Remarks

- For the allowable pressure on the pressing side, please consult us.
- Bellows having length not shown in the L column can be fabricated.



## Standard dimensions

Nominal diameter (A)	Joint standard	Model No.	I.D.	O.D.	t	n (Convolutions)	D	ℓ	L
20	NW16	ORV-16CB-8	20.5	28.5	0.15	18	30	20	80
25	NW25	ORV-25CB-8	26.0	37.0	0.15	13	40	20	80
40	NW40	ORV-40CB-10	41.0	55.0	0.15	13	55	20	100
50	NW50	ORV-50CB-10	51.0	65.0	0.2	13	75	20	100
65	NW63	ORV-63CB-12	63.0	83.0	0.25	16	87	20	120
80	NW80	ORV-80CB-15	80.0	103.0	0.25	18	114	25	150
100	NW100	ORV-100CB-15	104.0	127.0	0.25	15	134	25	150
150	NW160	ORV-160CB-15	150.0	175.0	0.3	13	190	25	150
200	NW200	ORV-200CB-15	205.0	230.0	0.3	13	252	25	150

t is the bellows wall thickness.

## Performance table

Nominal diameter (A)	Joint standard	Model No.	Displacement(mm)		Spring rate(N/mm)	
			Axial direction	Lateral direction	Axial direction	Lateral direction
20	NW16	ORV-16CB-8	±4.5	±2.5	19.3	10.8
25	NW25	ORV-25CB-8	±6.5	±2.5	13.2	13.1
40	NW40	ORV-40CB-10	±10.5	±4.0	9.0	9.5
50	NW50	ORV-50CB-10	±8.5	±2.5	26.1	40.4
65	NW63	ORV-63CB-12	±14.5	±5.0	20.3	27.6
80	NW80	ORV-80CB-15	±21.0	±7.5	14.8	19.0
100	NW100	ORV-100CB-15	±19.0	±5.5	20.4	41.7
150	NW160	ORV-160CB-15	±17.0	±3.0	44.0	188.9
200	NW200	ORV-200CB-15	±17.0	±2.5	58.0	423.1

The displacement values in each of the axial direction and lateral direction are shown.

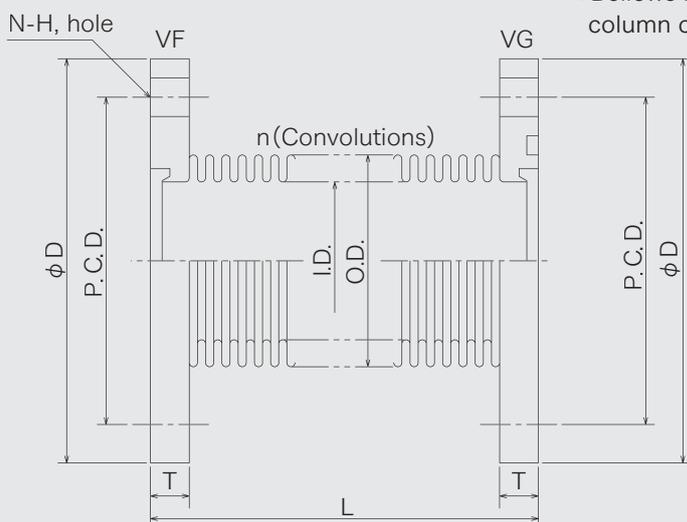
# JIS flange type

## Standard specifications

Material	Bellows SUS316L Flange SUS304, SUS316L
Working pressure	Vacuum~atmospheric pressure
Allowable leak rate	$1.33 \times 10^{-10}$ Pa · m <sup>3</sup> /sec or less

## Remarks

- Bellows with stud bolt for preventing looseness can be fabricated.
- Bellows of 350 A or more can be fabricated.
- For the allowable pressure on the pressing side, please consult us.
- Bellows having length not shown in the L column can be fabricated.



## Standard dimensions

Nominal diameter (A)	Joint standard	Model No.	I.D.	O.D.	t	n (Convolutions)	D	T	P.C.D.	N-H	L
25	VG25/VF25	ORV-25B-8	26.0	37.0	0.15	22	90	8	70	4-10	80
40	VG40/VF40	ORV-40B-10	41.0	55.0	0.15	19	105	10	85	4-10	100
50	VG50/VF50	ORV-50B-10	51.0	65.0	0.2	19	120	10	100	4-10	100
65	VG65/VF65	ORV-65B-10	63.0	83.0	0.25	17	145	10	120	4-12	100
80	VG80/VF80	ORV-80B-12	80.0	103.0	0.25	18	160	12	135	4-12	120
100	VG100/VF100	ORV-100B-12	104.0	127.0	0.25	15	185	12	160	8-12	120
125	VG125/VF125	ORV-125B-12	126.0	151.0	0.3	14	210	12	185	8-12	120
150	VG150/VF150	ORV-150B-15	150.0	175.0	0.3	18	235	12	210	8-12	150
200	VG200/VF200	ORV-200B-15	205.0	230.0	0.3	16	300	16	270	8-15	150
250	VG250/VF250	ORV-250B-15	254.0	290.0	0.3	9	350	16	320	12-15	150
300	VG300/VF300	ORV-300B-20	305.0	340.0	0.3	12	400	16	370	12-15	200

t is the bellows wall thickness.

## Performance table

Nominal diameter (A)	Joint standard	Model No.	Displacement(mm)		Spring rate(N/mm)	
			Axial direction	Lateral direction	Axial direction	Lateral direction
25	VG25/VF25	ORV-25B-8	±11.0	±7.5	7.8	2.7
40	VG40/VF40	ORV-40B-10	±15.5	±9.0	6.1	3.1
50	VG50/VF50	ORV-50B-10	±12.5	±6.0	17.9	13.0
65	VG65/VF65	ORV-65B-10	±15.5	±5.5	19.1	23.1
80	VG80/VF80	ORV-80B-12	±21.0	±7.5	14.8	19.0
100	VG100/VF100	ORV-100B-12	±19.0	±5.5	20.4	41.7
125	VG125/VF125	ORV-125B-12	±18.0	±4.0	35.3	100.4
150	VG150/VF150	ORV-150B-15	±23.0	±6.5	31.8	71.2
200	VG200/VF200	ORV-200B-15	±21.5	±4.0	47.2	226.9
250	VG250/VF250	ORV-250B-15	±24.5	±3.5	30.9	229.5
300	VG300/VF300	ORV-300B-20	±33.0	±5.5	28.5	145.1

The displacement values in each of the axial direction and lateral direction are shown.

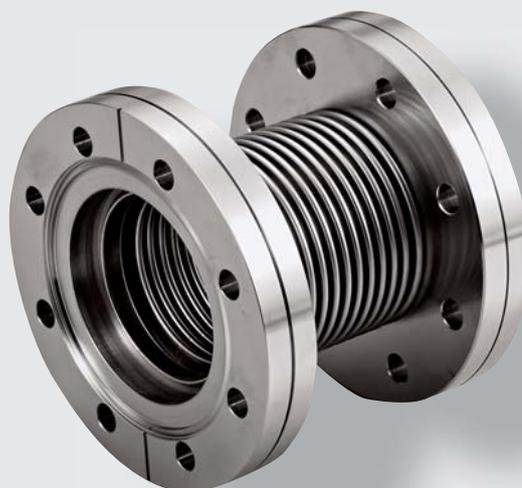
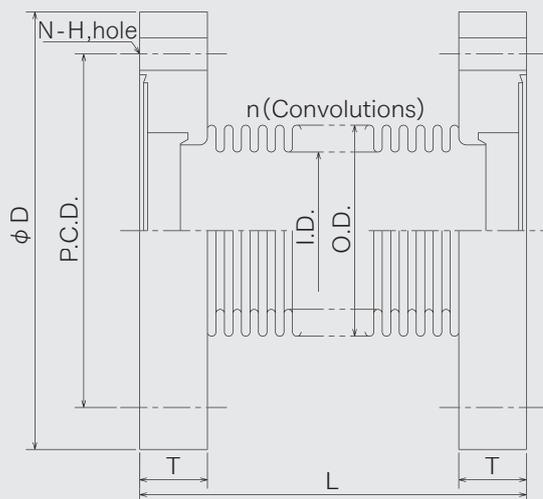
# Conflat flange type

### Standard specifications

Material	Bellows SUS316L Flange SUS304L, SUS316L
Working pressure	Vacuum~atmospheric pressure
Allowable leak rate	$1.33 \times 10^{-10}$ Pa · m <sup>3</sup> /sec or less

### Remarks

- Bellows of 150 A or more can be fabricated.
- For the allowable pressure on the pressing side, please consult us.
- Bellows having length not shown in the L column can be fabricated.



### Standard dimensions

Nominal diameter (A)	Joint standard	Model No.	I.D.	O.D.	t	n (Convolutions)	D	T	P.C.D.	N-H	L
25	ICF70	ORV-25CFB-8	26.0	37.0	0.15	19	70	12.7	58.7	6-6.8	80
50	ICF114	ORV-50CFB-10	51.0	65.0	0.2	15	114	17.5	92.1	8-8.5	100
80	ICF152	ORV-80CFB-12	80.0	103.0	0.25	15	152	20	130.2	16-8.5	120
125	ICF203	ORV-125CFB-12	126.0	151.0	0.3	11	203	22	181	20-8.5	120

t is the bellows wall thickness.

### Performance table

Nominal diameter (A)	Joint standard	Model No.	Displacement(mm)		Spring rate(N/mm)	
			Axial direction	Lateral direction	Axial direction	Lateral direction
25	ICF70	ORV-25CFB-8	±9.5	±5.5	9.1	4.2
50	ICF114	ORV-50CFB-10	±9.5	±3.5	22.6	26.4
80	ICF152	ORV-80CFB-12	±17.5	±5.0	17.7	32.8
125	ICF203	ORV-125CFB-12	±14.0	±2.5	44.9	206.8

The displacement values in each of the axial direction and lateral direction are shown.

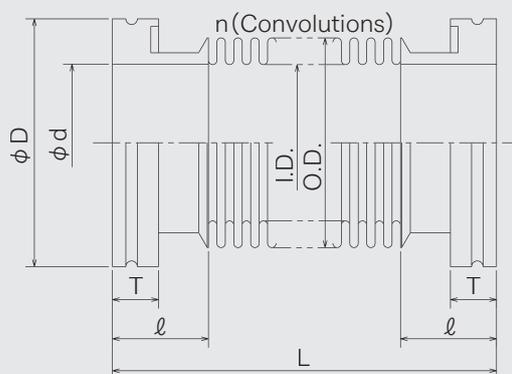
# ISO-MF flange type

## Standard specifications

Material	Bellows SUS316L
	Flange SUS304, SUS316L
Working pressure	Vacuum~atmospheric pressure
Allowable leak rate	$1.33 \times 10^{-10}$ Pa · m <sup>3</sup> /sec or less

## Remarks

- For the allowable pressure on the pressing side, please consult us.
- Bellows having length not shown in the L column can be fabricated.



## Standard dimensions

Nominal diameter (A)	Joint standard	Model No.	I.D.	O.D.	t	n (Convolutions)	D	T	d	ℓ	L
65	ISO-MF63	ORV-63MFB-12	63.0	83.0	0.25	14	95	12	70.2	25	120
80	ISO-MF80	ORV-80MFB-12	80.0	103.0	0.25	12	110	12	83.2	25	120
100	ISO-MF100	ORV-100MFB-12	104.0	127.0	0.25	10	130	12	102.2	25	120
150	ISO-MF160	ORV-160MFB-20	150.0	175.0	0.3	18	180	12	153.2	30	200
200	ISO-MF200	ORV-200MFB-20	205.0	230.0	0.3	18	240	12	213.2	30	200

t is the bellows wall thickness.

## Performance table

Nominal diameter (A)	Joint standard	Model No.	Displacement(mm)		Spring rate(N/mm)	
			Axial direction	Lateral direction	Axial direction	Lateral direction
65	ISO-MF63	ORV-63MFB-12	±12.5	±3.5	23.2	41.2
80	ISO-MF80	ORV-80MFB-12	±14.0	±3.0	22.1	64.0
100	ISO-MF100	ORV-100MFB-12	±12.5	±2.0	30.5	140.7
150	ISO-MF160	ORV-160MFB-20	±23.5	±6.5	31.8	71.2
200	ISO-MF200	ORV-200MFB-20	±24.0	±5.0	41.9	159.3

The displacement values in each of the axial direction and lateral direction are shown.

# Pressup Bellows®

## ■ Features

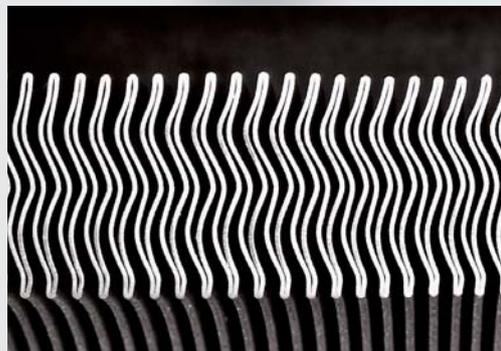
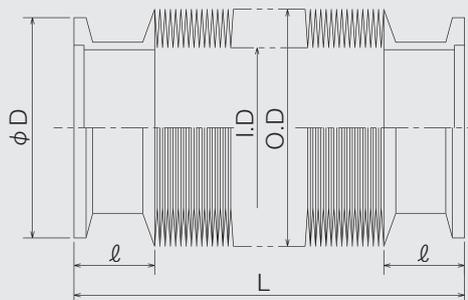
- Excellent flexibility
- The shape of conventional welded bellows is realized by integral forming.

## ■ Standard specifications

Material	Bellows SUS316L NW flanges SUS316L
Working pressure	Vacuum ~0.1MPa
Allowable leak rate	$1.33 \times 10^{-10}$ Pa · m <sup>3</sup> /sec or less

## ■ Remarks

- Flanges other than NW flanges can be fitted.
- Bellows having length not shown in the L column can be fabricated.



Cross-sectional shape

## ■ Standard dimensions

Nominal diameter (A)	Joint standard	Model No.	I.D.	O.D.	t	n (Convolutions)	D	ℓ	L
20	NW16	ORV-16C-PU-10	20.5	31.5	0.15	60	30	20	100
25	NW25	ORV-25C-PU-10	26.0	37.5	0.15	60	40	20	100
32	NW40	ORV-32C-PU-10	33.0	49.0	0.15	46	55	20	100
40	NW40	ORV-40C-PU-10	41.0	59.0	0.15	46	55	20	100
50	NW50	ORV-50C-PU-10	50.0	70.0	0.2	46	75	20	100
80	NW80	ORV-80C-PU-12	78.0	104.0	0.2	46	114	25	120
100	NW100	ORV-100C-PU-12	101.0	132.0	0.25	40	134	25	120

t is the bellows wall thickness.

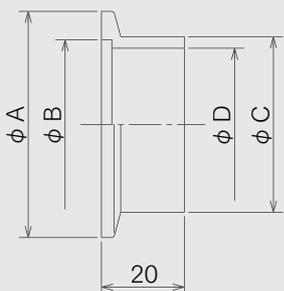
## ■ Performance table

Nominal diameter (A)	Joint standard	Model No.	Axial displacement / Life cycle (mm/times or more)		Axial displacement / Life cycle (mm/times or more)		Spring rate (N/mm)
20	NW16	ORV-16C-PU-10	+0, -30	$1 \times 10^3$	+0, -15	$1 \times 10^5$	2.6
25	NW25	ORV-25C-PU-10	+0, -30	$1 \times 10^3$	+0, -15	$1 \times 10^5$	2.3
32	NW40	ORV-32C-PU-10	+0, -30	$1 \times 10^4$	+0, -15	$1 \times 10^5$	2.0
40	NW40	ORV-40C-PU-10	+0, -30	$1 \times 10^4$	+0, -15	$1 \times 10^5$	1.7
50	NW50	ORV-50C-PU-10	+0, -30	$1 \times 10^4$	+0, -15	$1 \times 10^6$	3.1
80	NW80	ORV-80C-PU-12	+0, -30	$1 \times 10^5$	+0, -15	$1 \times 10^6$	2.1
100	NW100	ORV-100C-PU-12	+0, -30	$1 \times 10^6$	+0, -15	$1 \times 10^6$	3.8

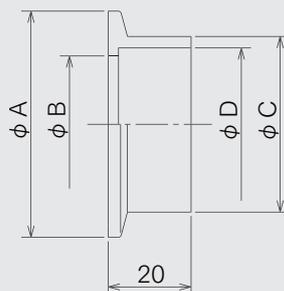
## Set of joints and pipes



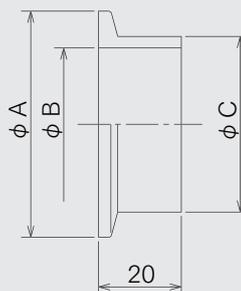
### NW short flange Small-diameter



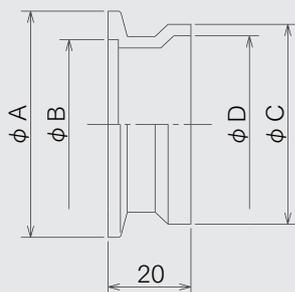
type①



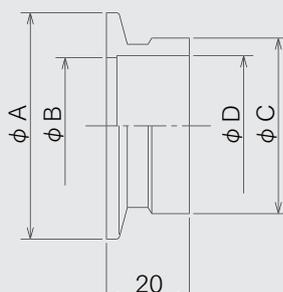
type②



type③



type④



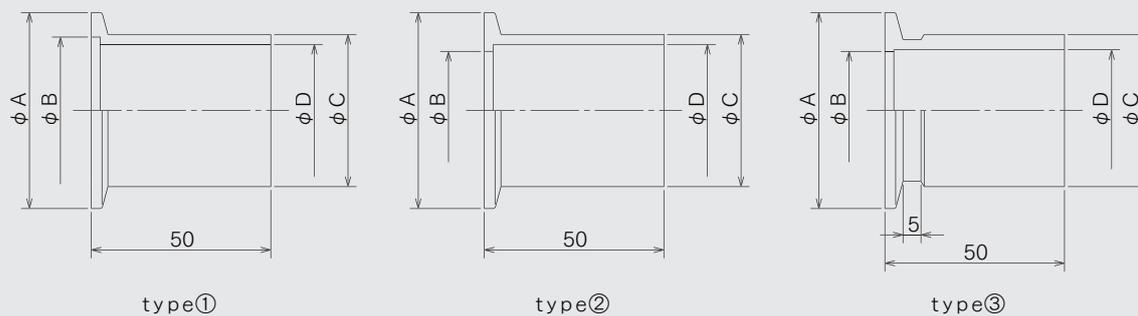
type⑤

Material : SUS304,SUS316L

Standard dimensions

Model No.	A	B	C	D	type
NW 10F	30	12.2	13.8	10.0	①
NW 16F	30	17.2	21.7	17.5	⑤
NW 25F	40	26.2	27.2	23.0	①
NW 25FS	40	26.2	34.0	28.4	④
NW 40F	55	41.2	42.7	37.1	①
NW 40FS	55	41.2	48.6	43.0	④
NW 50F	75	52.2	60.5	54.9	②
NW 63F	87	70.2	76.3	70.2	③

## NW long flange

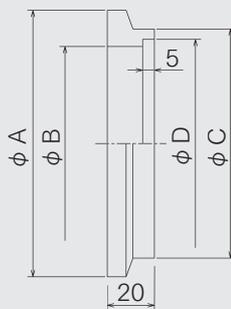


Material : SUS304,SUS316L

Standard dimensions

Model No.	A	B	C	D	type
NW10FL	30	12.2	13.8	10.0	①
NW16FL	30	17.2	21.7	17.5	③
NW25FL	40	26.2	27.2	23.0	①
NW40FL	55	41.2	42.7	37.1	①
NW50FL	75	52.2	60.5	54.9	②

## NW short flange Large-diameter

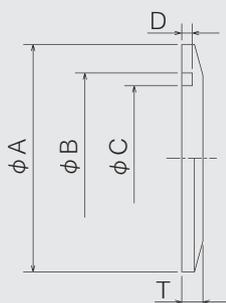


Material : SUS304,SUS316L

Standard dimensions

Model No.	A	B	C	D
NW80F	114	83.2	98	89.8
NW100F	134	102.2	118	114.8

## NW blind flange

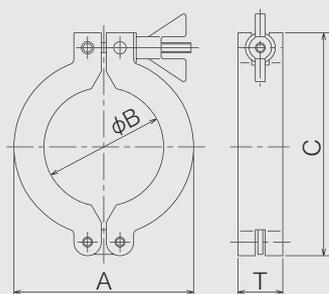


Material : SUS304,SUS316L

Standard dimensions

Model No.	A	B	C	D	T
NW10FB	30	12.2	6	2.5	5
NW16FB	30	17.2	11	2.5	5
NW25FB	40	26.2	20	2.5	5
NW40FB	55	41.2	35	2.5	5
NW50FB	75	52.2	46	2.5	5
NW63FB	87	70.2	64	2.5	5
NW80FB	114	83.2	73	6.5	11
NW100FB	134	102.2	92	6.5	11

## NW clamp

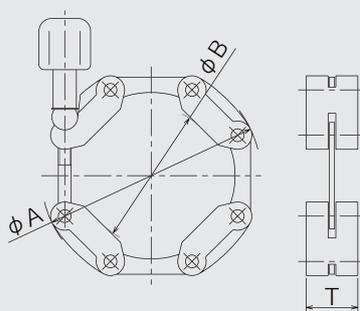


Material : Al+SUS

Standard dimensions

Model No.	A	B	C	T
NW10/16CL	42	20	61	17
NW25CL	52	30	72	17
NW40CL	70	44	90	17
NW50CL	94	62	123	25

## NW chain clamp Small-diameter

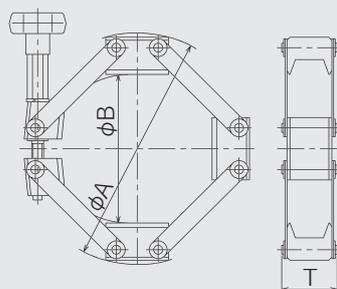


Material : Al+SUS

Standard dimensions

Model No.	A	B	T
NW10/16CLH	60	22	20
NW25CLH	70	32	20
NW40CLH	85	47	20
NW50CLH	105	67	20
NW63CLH	120	79	20

## NW chain clamp Large-diameter

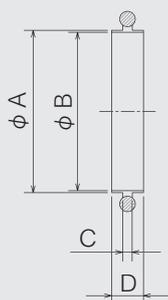


Material : Al+SUS

Standard dimensions

Model No.	A	B	T
NW80CL	156	100	37
NW100CL	177	122	37

## NW center ring



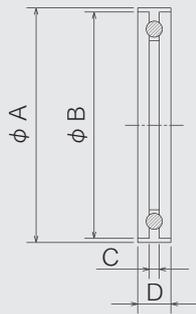
Material : SUS316L

Standard dimensions

Model No.	A	B	C	D
NW10CV	12	10	3.9	8
NW16CV	17	16	3.9	8
NW25CV	26	25	3.9	8
NW40CV	41	40	3.9	8
NW50CV	52	50	3.9	8
NW63CV	70	68	3.9	8
NW80CV	83	80	3.9	8
NW100CV	102	99	3.9	8

※O-ring material: Viton

## NW center ring with outer ring



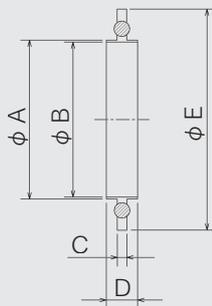
Material : Inner SUS316L, Outer SUS304

Standard dimensions

Model No.	A	B	C	D
NW10/16CVH	32	30	3.9	8
NW25CVH	42	40	3.9	8
NW40CVH	57	55	3.9	8
NW50CVH	77	75	3.9	8

※O-ring material: Viton

## NW center ring with outer ring(ISO)



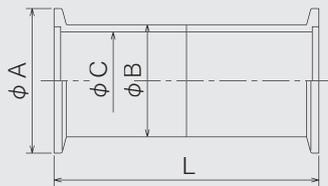
Material : Inner SUS316L, Outer SUS304

Standard dimensions

Model No.	A	B	C	D	E
NW10CVH-ISO	12	10	4	8	30
NW16CVH-ISO	17	16	4	8	30
NW25CVH-ISO	26	25	4	8	41.5
NW40CVH-ISO	41	40	4	8	57
NW50CVH-ISO	52	50	4	8	75
NW63CVH-ISO	70	68	4	8	89
NW80CVH-ISO	83	80	4	8	110
NW100CVH-ISO	102	99	4	8	130

※O-ring material: Viton

## NW nipple

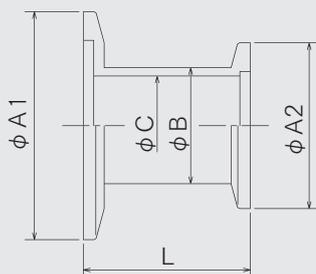


Material : SUS304,SUS316L

Standard dimensions

Model No.	A	B	C	L
NW10N	30	13.8	10	100
NW16N	30	21.7	16	100
NW25N	40	27.2	24	100
NW40N	55	42.7	39	100
NW50N	75	60.5	55	100

## NW reducer

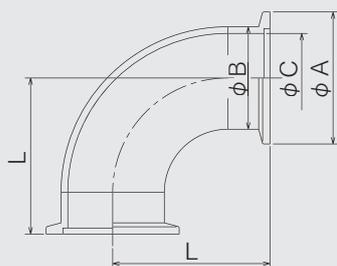


Material : SUS304,SUS316L

Standard dimensions

Model No.	A <sub>1</sub>	A <sub>2</sub>	B	C	L
NW25-10R	40	30	14	10	40
NW25-16R	40	30	20	16	40
NW40-16R	55	30	20	16	40
NW40-25R	55	40	28	24	40
NW50-25R	75	40	28	24	40
NW50-40R	75	55	44	39	40
NW80-50R	114	75	60.5	54.9	40
NW100-80R	134	114	89.1	83.1	40

## NW elbow

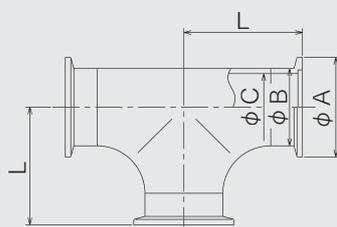


Material : SUS304,SUS316L

Standard dimensions

Model No.	A	B	C	L
NW16E	30	21.7	17.4	50
NW25E	40	27.2	23.0	50
NW40E	55	42.7	37.1	65
NW50E	75	60.5	54.9	80
NW80E	114	89.1	83.1	110
NW100E	134	114.3	108.3	120

## NW tee

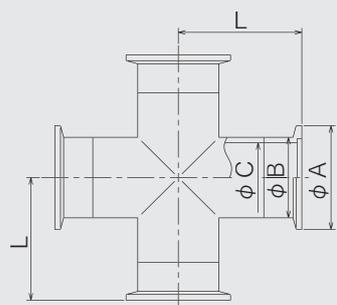


Material : SUS304,SUS316L

Standard dimensions

Model No.	A	B	C	L
NW16T	30	21.7	17.5	40
NW25T	40	27.2	23.0	50
NW40T	55	42.7	37.1	65
NW50T	75	60.5	54.9	80

## NW cross

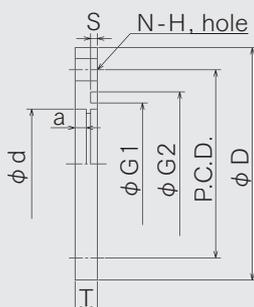


Material : SUS304,SUS316L

Standard dimensions

Model No.	A	B	C	L
NW16X	30	21.7	17.5	40
NW25X	40	27.2	23.0	50
NW40X	55	42.7	37.1	65
NW50X	75	60.5	54.9	80

## VG flange

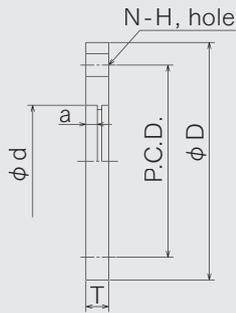


Material : SUS304,SUS316L

Standard dimensions

Model No.	D	T	P.C.D.	N-H	G <sub>1</sub>	G <sub>2</sub>	S	d	a
VG20	80	8	60	4-10	34	44	3	28	4
VG25	90	8	70	4-10	40	50	3	35	4
VG40	105	10	85	4-10	55	65	3	49.5	5
VG50	120	10	100	4-10	70	80	3	61	5
VG65	145	10	120	4-12	85	95	3	77	5
VG80	160	12	135	4-12	100	110	3	90	6
VG100	185	12	160	8-12	120	130	3	115	6

## VF flange

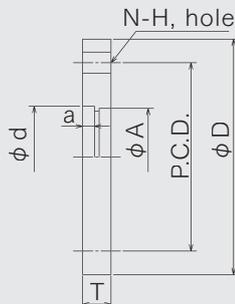


Material : SUS304,SUS316L

Standard dimensions

Model No.	D	T	P.C.D.	N-H	d	a
VF20	80	8	60	4-10	28	4
VF25	90	8	70	4-10	35	4
VF40	105	10	85	4-10	49.5	5
VF50	120	10	100	4-10	61	5
VF65	145	10	120	4-12	77	5
VF80	160	12	135	4-12	90	6
VF100	185	12	160	8-12	115	6

## ISO-BT flange



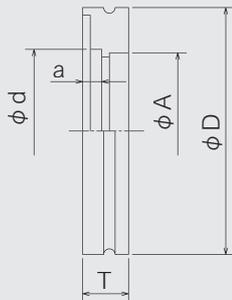
Material : SUS304,SUS316L

Standard dimensions

Model No.	D	T	A	d	a	P.C.D.	N-H
ISO-BT63-50	130	12	70.2	61	5	110	4- 9
ISO-BT80-80	145	12	83.2	90	5	125	8- 9
ISO-BT100-100	165	12	102.2	115	5	145	8- 9
ISO-BT160-153	225	16	153.2	153	9	200	8-11
ISO-BT200-203	285	16	213.2	204	9	260	12-11

Flanges for special pipes can be fabricated.

## ISO-MF flange



Material : SUS304,SUS316L

Standard dimensions

Model No.	D	T	A	d	a
ISO-MF63-50	95	12	70.2	61	5
ISO-MF63-65	95	12	70.2	77	5
ISO-MF80-65	110	12	83.2	77	5
ISO-MF80-80	110	12	83.2	89.5	5
ISO-MF100-90	130	12	102.2	102	5
ISO-MF100-100	130	12	102.2	115	5
ISO-MF160-125	180	12	153.2	141	5
ISO-MF200-203	240	12	213.2	204	5

Flanges for special pipes can be fabricated.

## ISO-MF Blank flange

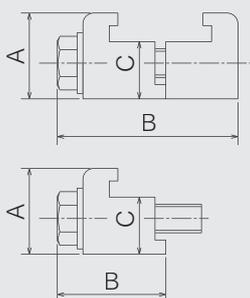


Material : SUS304,SUS316L

Standard dimensions

Model No.	D	T	A
ISO-MF63B	95	12	70.2
ISO-MF80B	110	12	83.2
ISO-MF100B	130	12	102.2
ISO-MF160B	180	12	153.2
ISO-MF200B	240	12	213.2

# Double-claw clamp/single-claw clamp



Material: A $\ell$ +SUS

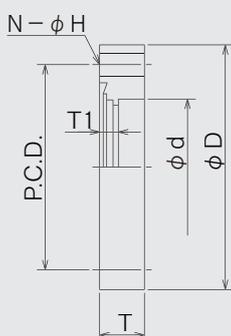
Standard dimensions of double-claw clamp

Model No.	BOLT SIZE	A	B	C
ISO63-WC	M8	24	50	16
ISO80-WC	M8	24	50	16
ISO100-WC	M8	24	50	16
ISO160-WC	M10	28	52	20
ISO200-WC	M10	28	52	20

Standard dimensions of single-claw clamp

Model No.	BOLT SIZE	A	B	C
ISO63-SC	M8	24	30.4	16
ISO80-SC	M8	24	30.4	16
ISO100-SC	M8	24	30.4	16
ISO160-SC	M10	28	31.7	20
ISO200-SC	M10	28	31.7	20

## ICF fixing flange

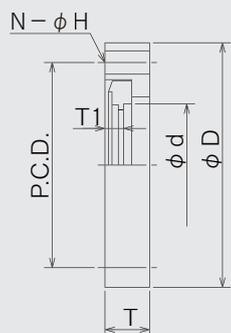


Material: SUS304L, SUS316L

Standard dimensions

Model No.	D	T	T <sub>1</sub>	d	P.C.D.	N-H
ICF34H	34	7.5	blank		27.0	6-4.5
ICF70H	70	12.7	blank		58.7	6-6.8
ICF70-27.2H	70	12.7	5.3	27.5	58.7	6-6.8
ICF70-34H	70	12.7	5.3	34.3	58.7	6-6.8
ICF114H	114	17.5	blank		92.1	8-8.5
ICF114-60.5H	114	17.5	9.5	60.8	92.1	8-8.5

## ICF rotation flange

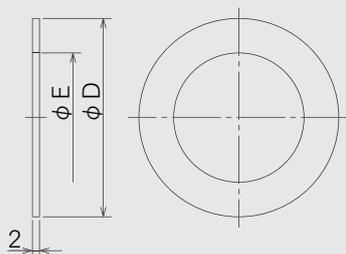


Material: SUS304L, SUS316L

Standard dimensions

Model No.	D	T	T <sub>1</sub>	d	P.C.D.	N-H
ICF34RH	34	7.5	blank		27.0	6-4.5
ICF70RH	70	12.7	blank		58.7	6-6.8
ICF70-27.2RH	70	12.7	5.3	27.5	58.7	6-6.8
ICF70-34RH	70	12.7	5.3	34.3	58.7	6-6.8
ICF114RH	114	17.5	blank		92.1	8-8.5
ICF114-60.5RH	114	17.5	9.5	60.8	92.1	8-8.5

## ICF gasket



Material: Cu

Standard dimensions

Model No.	D	E
ICF34G	21.3	16.3
ICF70G	48.2	39.0
ICF114G	82.4	64.0

## Titanium bellows

- This is made of pure titanium (TR270C, TR340C). Due to light, strong and high corrosion resistance, Titanium is widely used in every field. In addition, it has small Young's modulus and wide elastic region. Thus, it has low spring rate and excels in durability.



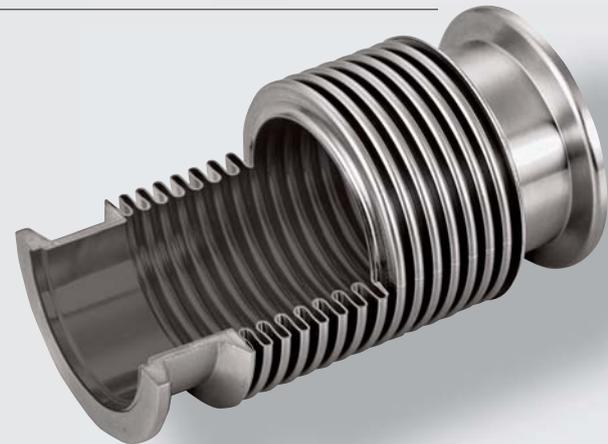
## Bellows with inner surface polished

- Bellows whose inner surface has been polished by the same method as that for Megaflex® (see page 26). Since the surface is polished after the bellows are formed, the surface roughness is uniform.



## Teflon (fluororesin) coating

- The Teflon (fluororesin) coating can form a Teflon film on the base metal surface through a firing process. The coating can be applied to complicated shapes without losing the features of Teflon.



## Leak detectable flexible hose

- The leak detectable flexible hose is a double-layer hose consisting of an inner metallic flexible hose and an outer Teflon pliable hose. When a toxic or harmful fluid is fed into the hose, leaking areas, if any, can be shielded and detected.





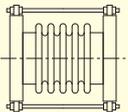
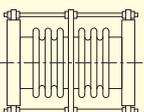
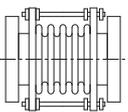
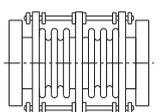
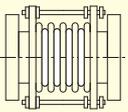
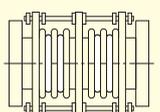
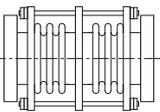
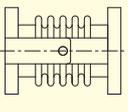
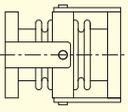
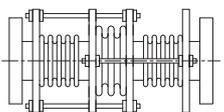
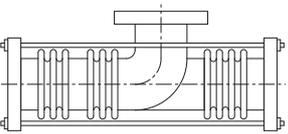
# 6

## Expansion joints

- Types of expansion joints
- Dimension and performance tables
- Earthquake-proof piping system
- Examples of applications
- Guide to order

Expansion joints are joints which absorb axial displacement of piping caused by changes in temperature, lateral displacement and angular displacement. The expansion joints are used in various facilities, such as petrochemical complexes, electric power plants, steel plants and chemical plants. Combinations of expansion joints can be used as earthquake-proof piping for seismic isolated structures.

# Types of bellows expansion joints

Type		Outline drawing	Displacement		
			Axial	Lateral	Angular
Free type	Single		○	△	○
	Double		○	△	×
Guide rod type	Single		○	△	○
	Double		○	×	×
Reinforced type	Single		○	△	○
	Double		○	×	×
Universal type			△	○	×
Hinge type			×	×	○
Gimbal type			×	×	○
Straight pipe pressure balanced type			○	×	×
Bent pipe pressure balanced type			○	○	×

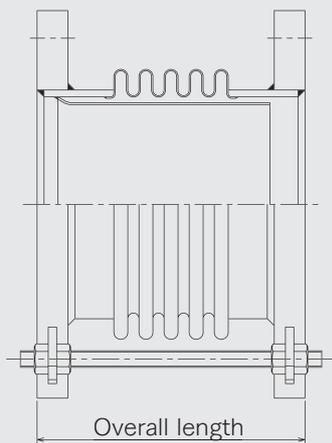
	Pressure	Thrust		Reference
	Low	Occurs	Basic type bellows expansion joints. These joints are used mainly for lowpressure piping. If the displacement is large, double joints are used. The thrust force generated by internal pressure and the displacement reaction force are applied to the fixed point.	P65 »
	Low	Occurs		P66 »
	Medium	Occurs	The displacement is restricted by the guide rod to prevent application of displacement exceeding the design value to the expansion joint. If the displacement is large, double joints are used. The thrust force generated by internal pressure and the displacement reaction force are applied to the fixed point. The guide rod has sufficient strength against thrust force in case of damage to the fixed point.	P67 »
	Medium	Occurs		P68 »
	High	Occurs	Control rings are set in the roots of the bellows to use the bellows for highpressure piping. The displacement is restricted by the guide rod to prevent application of displacement exceeding the design value to the expansion joint. If the displacement is large, double joints are used. The thrust force generated by internal pressure and the displacement reaction force are applied to the fixed point. The guide rod has sufficient strength against thrust force in case of damage to the fixed point.	P69 »
	High	Occurs		P70 »
	High	None	Expansion joints are used to absorb lateral displacement. Larger displacement can be absorbed by increasing the distance between two bellows. Since the thrust force generated by internal pressure is restrained by the tie rod, only the displacement reaction force is applied to the fixed point. Specially designed joints can also absorb the axial displacement. However, in this case, since the thrust force generated by internal pressure cannot be restrained by the tie rod, the thrust force and the displacement reaction force are applied to the fixed point.	P71 »
	High	None	Expansion joints for absorption of angular displacement. The hinge type joints can be used to absorb angular displacement only in one direction. The gimbal type joints can absorb angular displacement in all directions. Since the thrust force generated by internal pressure is restrained by the expansion joint parts, only the displacement reaction force is applied to the fixed point. Normally, some joints are combined to absorb axial displacement and lateral displacement.	P72 »
	High	None		
	High	None	The joints are provided with displacement absorbing bellows and balanced bellows, so that the thrust force generated by internal pressure is countered in the expansion joints. Although only the displacement reaction force is applied to the fixed point, it is larger because the joints have a larger number of bellows. This type of joints is suitable for large-diameter piping with larger thrust force generated by internal pressure. They are used on straight zones (straight pipe pressure balanced type) and corners (bent pipe pressure balanced type) of piping in high places where fixed points with sufficient strength cannot be obtained.	Non-published
	High	None		

## Single free type

■ Standard specifications for bellows

SUS304, SUS316L

※Bellows can be fabricated with other materials.



■ Standard dimensions

Nominal diameter (A)	Model No.	Design pressure (MPa)	Inner diameter (mm)	Outer diameter (mm)	Thickness (mm)	Number of convolution	Overall length (mm)	Axial displacement (mm)	Spring rate Per convolution (N/mm · cov.)
50	1F-50	0.2	50	80	0.8	10	210	±12.6	2260.8
65	1F-65	0.2	64	100	0.8	10	230	±17.3	1697.8
80	1F-80	0.2	78	114	1.0	15	340	±21.4	3864.2
100	1F-100	0.2	100	135	1.0	15	340	±20.5	5086.5
125	1F-125	0.2	128	168	1.0	15	420	±27.6	4103.2
150	1F-150	0.2	152	205	1.0	12	470	±39.4	2010.0
200	1F-200	0.2	201	270	1.2	12	630	±53.0	2145.5
250	1F-250	0.2	251	335	1.5	12	720	±61.7	2959.0
300	1F-300	0.2	301	395	1.5	12	840	±77.1	2455.4
350	1F-350	0.2	340	410	1.5	12	580	±43.9	6566.4
400	1F-400	0.2	385	465	1.5	10	590	±48.0	4863.7
450	1F-450	0.2	435	515	1.5	10	590	±48.0	5433.9
500	1F-500	0.2	485	575	1.5	9	610	±54.5	4178.1
550	1F-550	0.2	535	625	1.5	9	610	±54.5	4571.2
600	1F-600	0.2	585	685	1.5	8	620	±59.3	3593.9

※The overall length is the minimum length of bellows using JIS 10K flanges.

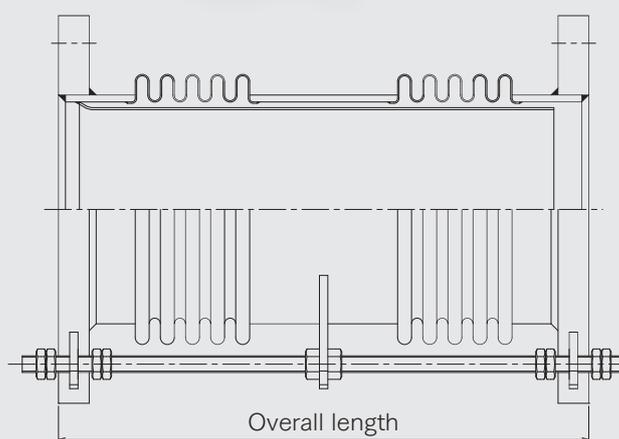
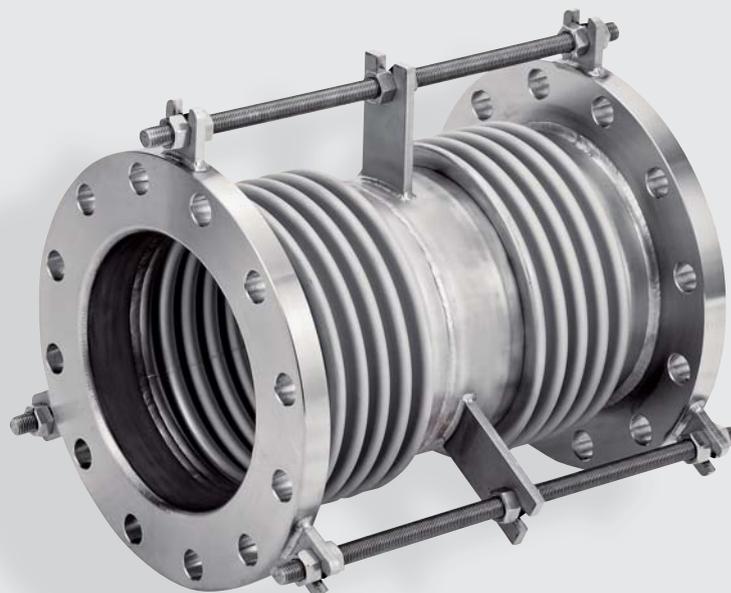
※Design conditions: Bellows material: SUS304, Temperature: 300°C, Life: 3000 times or more

# Double free type

■ Standard specifications for bellows

SUS304, SUS316L

※Bellows can be fabricated with other materials.



■ Standard dimensions

Nominal diameter (A)	Model No.	Design pressure (MPa)	Inner diameter (mm)	Outer diameter (mm)	Thickness (mm)	Number of convolution	Overall length (mm)	Axial displacement (mm)	Spring rate Per convolution (N/mm · cov.)
50	2F-50	0.2	50	80	0.8	10+10	390	±25.3	2260.8
65	2F-65	0.2	64	100	0.8	10+10	430	±34.6	1697.8
80	2F-80	0.2	78	114	1.0	15+15	620	±42.9	3864.2
100	2F-100	0.2	100	135	1.0	15+15	630	±41.1	5086.5
125	2F-125	0.2	128	168	1.0	15+15	760	±55.2	4103.2
150	2F-150	0.2	152	205	1.0	12+12	840	±78.8	2010.0
200	2F-200	0.2	201	270	1.2	12+12	1060	±106.1	2145.5
250	2F-250	0.2	251	335	1.5	12+12	1230	±123.5	2959.0
300	2F-300	0.2	301	395	1.5	12+12	1410	±154.3	2455.4
350	2F-350	0.2	340	410	1.5	12+12	1030	±87.9	6566.4
400	2F-400	0.2	385	465	1.5	10+10	1040	±96.0	4863.7
450	2F-450	0.2	435	515	1.5	10+10	1040	±96.0	5433.9
500	2F-500	0.2	485	575	1.5	9+9	1070	±109.0	4178.1
550	2F-550	0.2	535	625	1.5	9+9	1080	±109.0	4571.2
600	2F-600	0.2	585	685	1.5	8+8	1100	±118.6	3593.9

※The overall length is the minimum length of bellows using JIS 10K flanges.

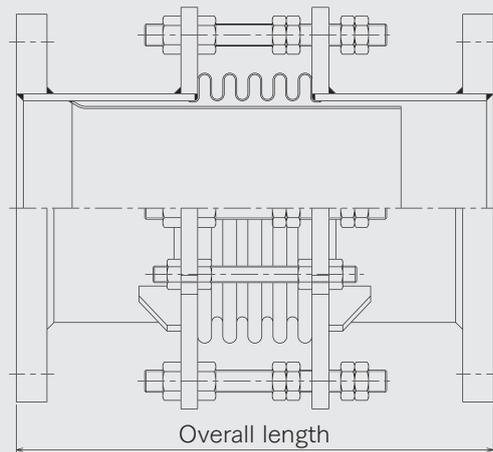
※Design conditions: Bellows material: SUS304, Temperature: 300°C, Life: 3000 times or more

# Single guide rod type

■ Standard specifications for bellows

SUS304, SUS316L

※Bellows can be fabricated with other materials.



■ Standard dimensions

Nominal diameter (A)	Model No.	Design pressure (MPa)	Inner diameter (mm)	Outer diameter (mm)	Thickness (mm)	Number of convolution	Overall length (mm)	Axial displacement (mm)	Spring rate Per convolution (N/mm · cov.)
50	1G-50	0.5	50	80	0.8	10	360	±12.1	2260.8
65	1G-65	0.5	64	100	0.8	10	390	±16.2	1697.8
80	1G-80	0.5	78	114	1.0	15	500	±20.6	3864.2
100	1G-100	0.5	100	135	1.0	15	500	±19.8	5086.5
125	1G-125	0.5	128	168	1.0	15	610	±26.2	4103.2
150	1G-150	0.5	152	205	1.2	12	610	±31.0	3546.3
200	1G-200	0.5	201	270	1.5	12	690	±40.1	4291.8
250	1G-250	0.5	251	335	2.0	13	850	±47.9	7247.5
300	1G-300	0.5	301	395	2.0	12	930	±55.0	5991.8
350	1G-350	0.5	340	410	1.5	12	820	±40.8	6566.4
400	1G-400	0.5	385	465	2.0	10	840	±34.4	11925.7
450	1G-450	0.5	435	515	2.0	10	840	±34.4	13322.1
500	1G-500	0.5	485	575	2.0	9	900	±38.9	10203.7
550	1G-550	0.5	535	625	2.0	9	910	±38.9	11162.7
600	1G-600	0.44	585	685	2.0	8	930	±42.8	8749.4

※The overall length is the minimum length of bellows using JIS 10K flanges.

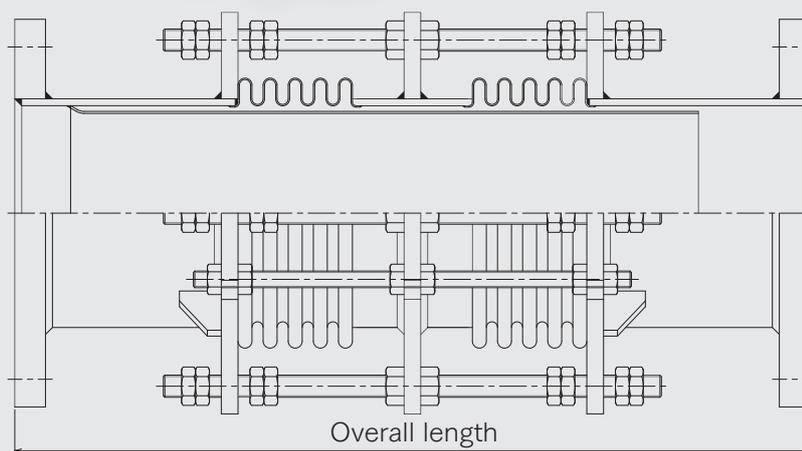
※Design conditions: Bellows material: SUS304, Temperature: 300°C, Life: 3000 times or more

# Double guide rod type

■ Standard specifications for bellows

SUS304, SUS316L

※Bellows can be fabricated with other materials.



■ Standard dimensions

Nominal diameter (A)	Model No.	Design pressure (MPa)	Inner diameter (mm)	Outer diameter (mm)	Thickness (mm)	Number of convolution	Overall length (mm)	Axial displacement (mm)	Spring rate Per convolution (N/mm · cov.)
50	2G-50	0.5	50	80	0.8	10+10	570	±24.2	2260.8
65	2G-65	0.5	64	100	0.8	10+10	610	±32.4	1697.8
80	2G-80	0.5	78	114	1.0	15+15	850	±41.2	3864.2
100	2G-100	0.5	100	135	1.0	15+15	850	±39.6	5086.5
125	2G-125	0.5	128	168	1.0	15+15	1030	±52.4	4103.2
150	2G-150	0.5	152	205	1.2	12+12	1050	±62.0	3546.3
200	2G-200	0.5	201	270	1.5	12+12	1190	±80.2	4291.8
250	2G-250	0.5	251	335	2.0	13+13	1480	±95.9	7247.5
300	2G-300	0.5	301	395	2.0	12+12	1620	±110.0	5991.8
350	2G-350	0.5	340	410	1.5	12+12	1390	±81.7	6566.4
400	2G-400	0.5	385	465	2.0	10+10	1390	±68.9	11925.7
450	2G-450	0.5	435	515	2.0	10+10	1390	±68.9	13322.1
500	2G-500	0.5	485	575	2.0	9+9	1490	±77.9	10203.7
550	2G-550	0.5	535	625	2.0	9+9	1520	±77.9	11162.7
600	2G-600	0.44	585	685	2.0	8+8	1550	±85.7	8749.4

※The overall length is the minimum length of bellows using JIS 10K flanges.

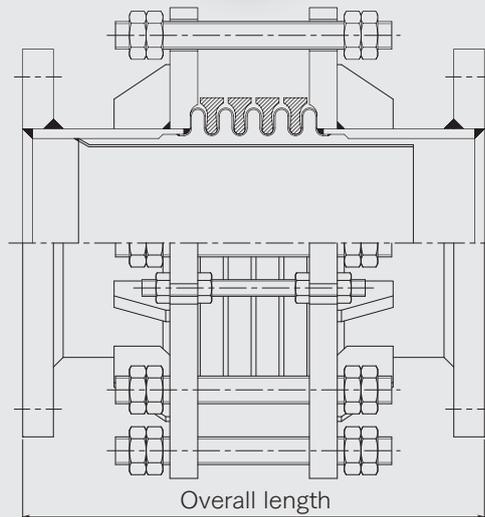
※Design conditions: Bellows material: SUS304, Temperature: 300°C, Life: 3000 times or more

## Single reinforced type

■ Standard specifications for bellows

SUS304, SUS316L

※Bellows can be fabricated with other materials.



■ Standard dimensions

Nominal diameter (A)	Model No.	Design pressure (MPa)	Inner diameter (mm)	Outer diameter (mm)	Thickness (mm)	Number of convolution	Overall length (mm)	Axial displacement (mm)	Spring rate Per convolution (N/mm · cov.)
50	1C-50	1.0	50	80	0.8	10	390	±13.3	2178.6
65	1C-65	1.0	64	100	0.8	10	400	±18.3	1640.2
80	1C-80	1.0	78	114	1.0	15	540	±23.4	3577.6
100	1C-100	1.0	100	135	1.0	15	550	±22.1	4778.0
125	1C-125	1.0	128	168	1.0	15	650	±29.5	3892.7
150	1C-150	1.0	152	205	1.0	12	690	±40.8	2010.0
200	1C-200	1.0	201	270	1.2	11	790	±50.9	2145.5
250	1C-250	1.0	251	335	1.5	11	900	±59.0	2959.0
300	1C-300	1.0	301	395	1.5	10	1010	±68.1	2455.4
350	1C-350	1.0	340	410	1.5	12	910	±48.7	6079.3
400	1C-400	1.0	385	465	1.5	10	910	±53.2	4549.6
450	1C-450	1.0	435	515	1.5	10	920	±53.2	5082.9
500	1C-500	1.0	485	575	1.5	9	940	±60.9	3939.2
550	1C-550	1.0	535	625	1.5	9	950	±60.9	4309.8
600	1C-600	1.0	585	685	1.5	8	980	±66.9	3409.5

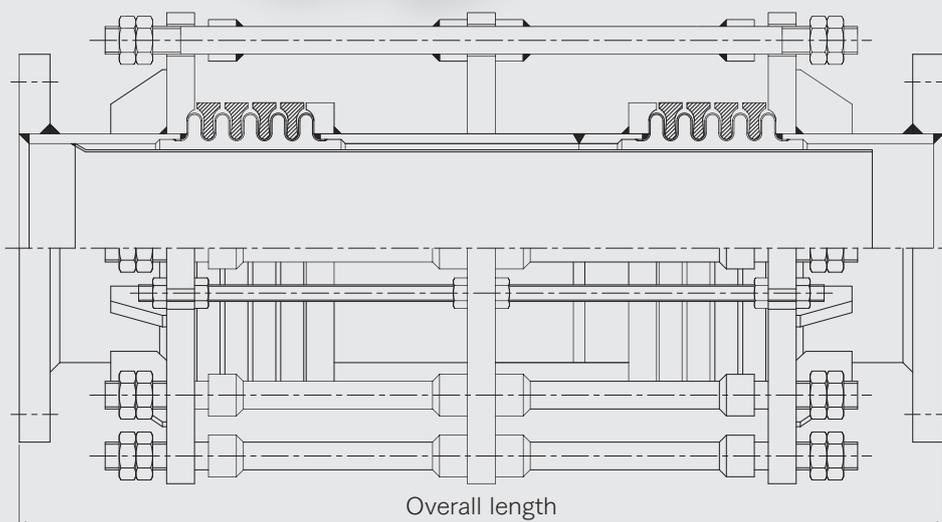
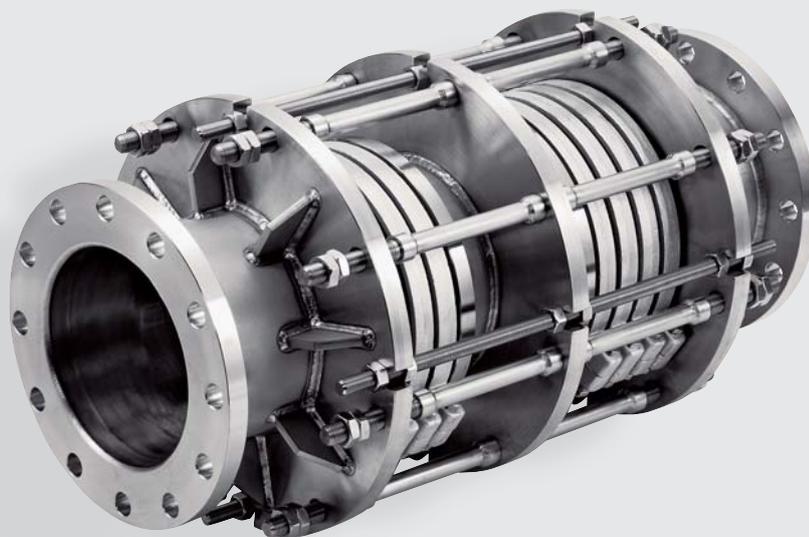
※The overall length is the minimum length of bellows using JIS 10K flanges.

※Design conditions: Bellows material: SUS304, Temperature: 300°C, Life: 3000 times or more

# Double reinforced type

■ Standard specifications for bellows  
SUS304, SUS316L

※Bellows can be fabricated with other materials.



■ Standard dimensions

Nominal diameter (A)	Model No.	Design pressure (MPa)	Inner diameter (mm)	Outer diameter (mm)	Thickness (mm)	Number of convolution	Overall length (mm)	Axial displacement (mm)	Spring rate Per convolution (N/mm · cov.)
50	2C-50	1.0	50	80	0.8	10+10	650	±26.6	2178.6
65	2C-65	1.0	64	100	0.8	10+10	700	±36.6	1640.2
80	2C-80	1.0	78	114	1.0	15+15	990	±46.9	3577.6
100	2C-100	1.0	100	135	1.0	15+15	990	±44.2	4778.0
125	2C-125	1.0	128	168	1.0	15+15	1160	±59.1	3892.7
150	2C-150	1.0	152	205	1.0	12+12	1160	±81.7	2010.0
200	2C-200	1.0	201	270	1.2	11+11	1330	±101.9	2145.5
250	2C-250	1.0	251	335	1.5	11+11	1530	±118.1	2959.0
300	2C-300	1.0	301	395	1.5	10+10	1700	±136.3	2455.4
350	2C-350	1.0	340	410	1.5	12+12	1600	±97.4	6079.3
400	2C-400	1.0	385	465	1.5	10+10	1580	±106.5	4549.6
450	2C-450	1.0	435	515	1.5	10+10	1590	±106.5	5082.9
500	2C-500	1.0	485	575	1.5	9+9	1650	±121.8	3939.2
550	2C-550	1.0	535	625	1.5	9+9	1670	±121.8	4309.8
600	2C-600	1.0	585	685	1.5	8+8	1700	±133.9	3409.5

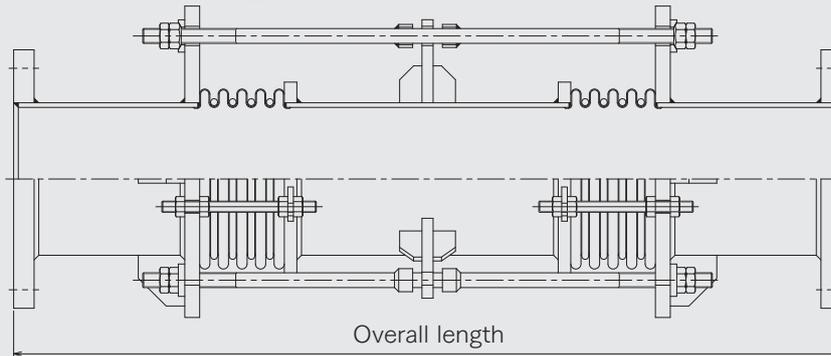
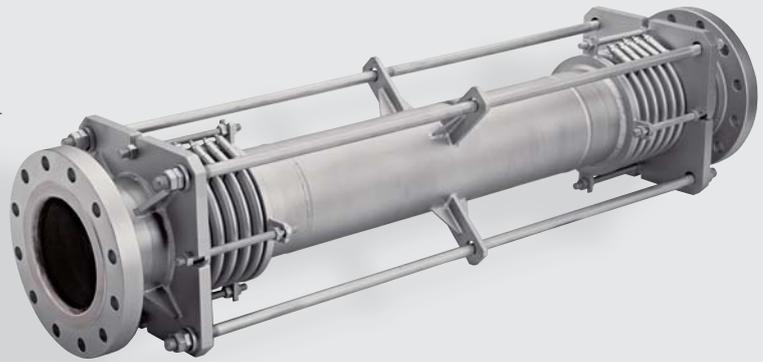
※The overall length is the minimum length of bellows using JIS 10K flanges.

※Design conditions: Bellows material: SUS304, Temperature: 300°C, Life: 3000 times or more

# Universal type

■ Standard specifications for bellows  
SUS304, SUS316L

※Bellows can be fabricated with other materials.



■ Standard dimensions

Nominal diameter (A)	Model No.	Design pressure (MPa)	Inner diameter (mm)	Outer diameter (mm)	Thickness (mm)	Lateral displacement (mm)	Overall length (mm)	Spring rate to lateral direction (N)
50	3C-50	1.0	50	80	0.8	50	890	71.3
						100	1470	35.4
						200	2620	17.8
65	3C-65	1.0	64	100	0.8	50	900	83.6
						100	1470	42.6
						200	2620	21.3
80	3C-80	1.0	78	114	1.0	50	930	248.5
						100	1500	127.1
						200	2650	63.6
100	3C-100	1.0	100	135	1.0	50	970	499.3
						100	1540	254.3
						200	2690	127.1
125	3C-125	1.0	128	168	1.0	50	1030	592.7
						100	1600	314.4
						200	2750	160.3
150	3C-150	1.0	152	205	1.0	50	1030	468.4
						100	1600	242.4
						200	2750	121.9
200	3C-200	1.0	201	270	1.2	50	1090	885.2
						100	1670	447.1
						200	2810	227.7
250	3C-250	1.0	251	335	1.5	50	1170	1857.3
						100	1740	964.5
						200	2890	484.6
300	3C-300	1.0	301	395	1.5	50	1260	2133.3
						100	1830	1119.7
						200	2980	564.8
350	3C-350	1.0	340	410	1.5	50	1260	6032.5
						100	1830	3183.4
						200	2980	1613.3
400	3C-400	1.0	385	465	1.5	50	1280	5886.4
						100	1850	3089.6
						200	3000	1558.5
450	3C-450	1.0	435	515	1.5	50	1280	8208.9
						100	1850	4308.6
						200	3000	2173.3
500	3C-500	1.0	485	575	1.5	50	1290	8032.2
						100	1870	4125.7
						200	3020	2089.6
550	3C-550	1.0	535	625	1.5	50	1310	10519.0
						100	1890	5403.1
						200	3040	2736.6
600	3C-600	1.0	585	685	1.5	50	1360	9777.4
						100	1940	5084.6
						200	3080	2608.8

※The overall length is the minimum length of bellows using JIS 10K flanges.

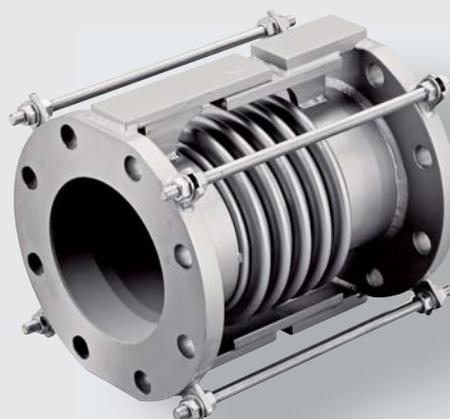
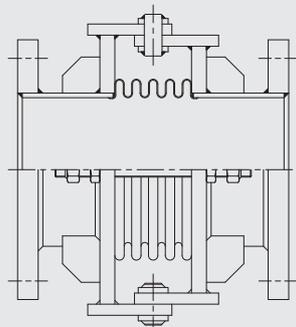
※Design conditions: Bellows material: SUS304, Temperature: 300°C, Life: 3000 times or more, Number of convolutions: 5 conv. + 5 conv.

## Hinge type

■ Standard specifications for bellows

SUS304, SUS316L

※Bellows can be fabricated with other materials.

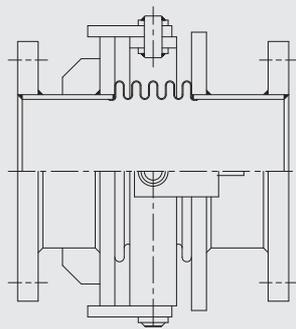


## Gimbal type

■ Standard specifications for bellows

SUS304, SUS316L

※Bellows can be fabricated with other materials.



■ Standard dimensions

Nominal diameter (A)	Design pressure (MPa)	Inner diameter (mm)	Outer diameter (mm)	Thickness (mm)	Number of convolution	Overall length (mm)	Angular displacement (°)	Moment (N·m)
50	1.0	50	80	0.8	5	250	±5	20.6
65	1.0	64	100	0.8	5	250	±5	24.6
80	1.0	78	114	1.0	5	300	±5	73.5
100	1.0	100	135	1.0	5	250	±5	146.5
125	1.0	128	168	1.0	5	300	±5	188.7
150	1.0	155	195	1.0	5	300	±5	310.8
200	1.0	200	250	1.2	5	400	±5	580.9
250	1.0	250	310	1.5	5	450	±5	1271.6
300	1.0	300	370	1.5	5	500	±5	1342.9
350	1.0	340	410	1.5	5	500	±5	1880.9
400	1.0	385	465	1.5	5	580	±5	1806.0
450	1.0	435	515	1.5	5	580	±5	2518.9
500	1.0	485	575	1.5	5	620	±5	2428.7
550	1.0	535	625	1.5	5	620	±5	3180.3
600	1.0	585	685	1.5	5	670	±5	3014.9

※The overall length is the minimum length of bellows using JIS 10K flanges.

※Design conditions: Bellows material: SUS304, Temperature: 300°C, Life: 3000 times or more

# Dodge<sup>3</sup> Joint<sup>®</sup>

Dodge<sup>3</sup>Joint is a revolutionary earthquake-proof piping system which has three kinds of bellows, i.e. the hinge, gimbal and self-propelled gimbal bellows, at three points on L-shaped piping and absorbs three-dimensional relative displacement caused in a seismic isolation layer.



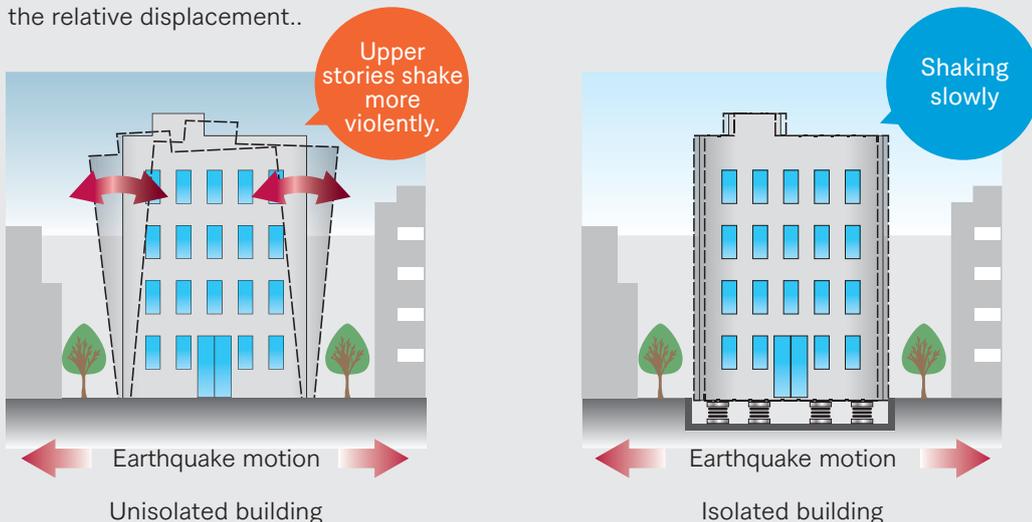
## Standard specifications

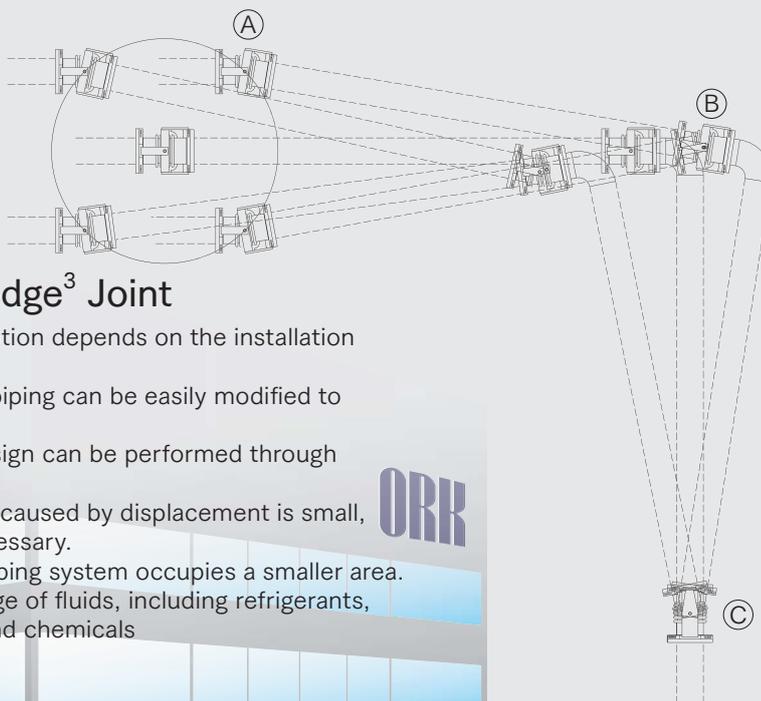
Bellows material	SUS316L
Connecting joint	JIS 10K-FF flange
Joint material	SUS304, SS400
Design pressure	1MPa
Design temperature	100°C
Level of seismic isolation	300mm~1000mm

※Piping systems with self-propelled gimbal bellows suspended from ceiling can be fabricated depending on the building structure. For more information, please contact us

## Seismic isolated structure

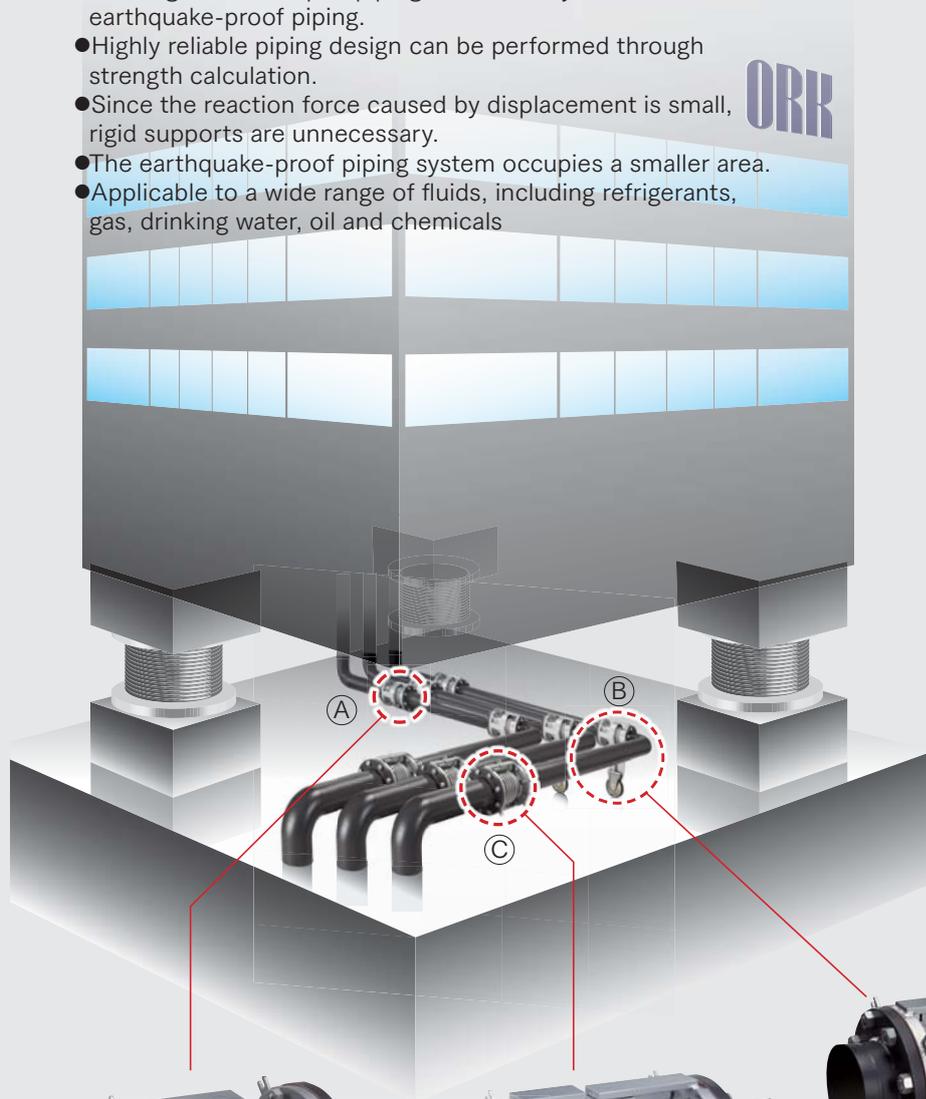
The seismic isolated structure refers to a construction method which isolates the building from the ground through seismic isolation devices to prevent transmission of ground vibrations caused by earthquake energy directly to the building. In buildings constructed by the seismic isolation method, significant relative displacement is generated in the seismic isolation layer between the building and the ground by the earthquake energy. Therefore, the lifeline utilities of the buildings must be provided with piping systems which can absorb the relative displacement..





### Features of Dodge<sup>3</sup> Joint

- The level of seismic isolation depends on the installation positions of the bellows.
- Existing fixed L-shaped piping can be easily modified to earthquake-proof piping.
- Highly reliable piping design can be performed through strength calculation.
- Since the reaction force caused by displacement is small, rigid supports are unnecessary.
- The earthquake-proof piping system occupies a smaller area.
- Applicable to a wide range of fluids, including refrigerants, gas, drinking water, oil and chemicals



Gimbal type



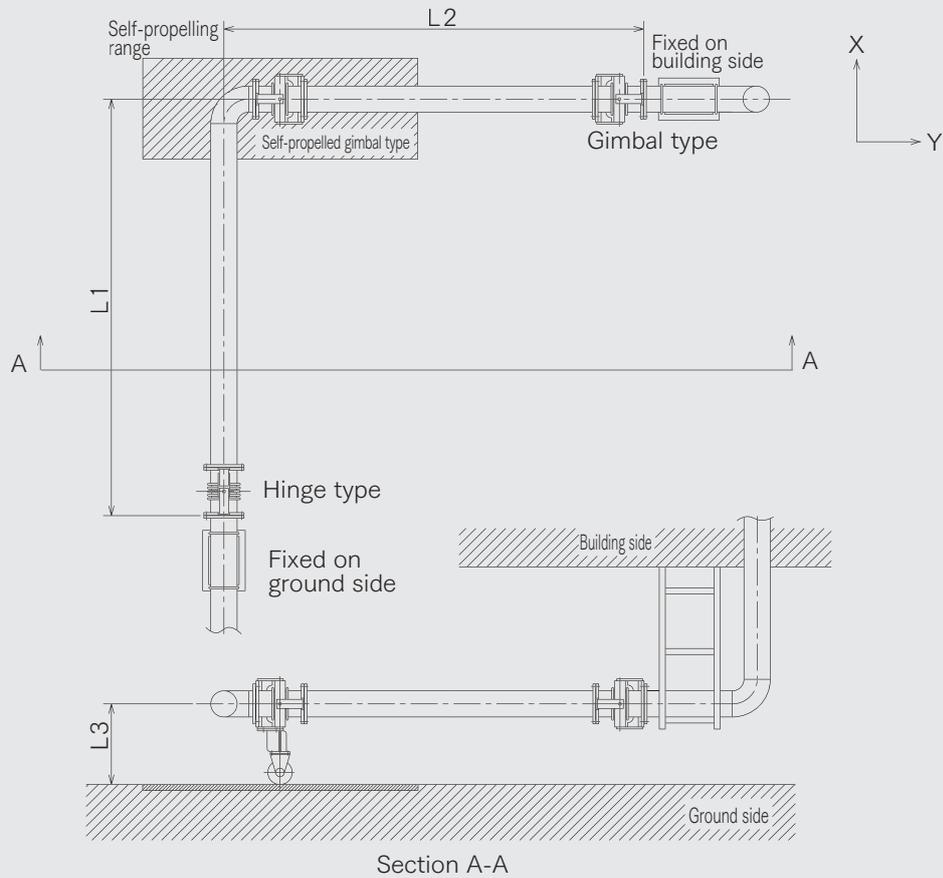
Hinge type



Self-propelled gimbal type

# Dodge<sup>3</sup> Joint<sup>®</sup>

## Basic configuration of Dodge<sup>3</sup> Joint



## Basic configuration of Dodge<sup>3</sup> Joint

	Nominal diameter	L1/L2 (mm)	L3 (mm)	reaction force $F_x^{*1}$ (N)	reaction force $F_y^{*1}$ (N)	weight of system <sup>*2</sup> (kg)
Seismic isolation of 500 mm	50A	2675	330	37.3	36.3	73
	65A	2685	338	45.1	43.1	101
	80A	2715	349	137.3	130.4	126
	100A	2750	368	141.2	133.4	174
	125A	2820	397	311.9	293.2	270
	150A	2850	416	469.7	439.3	350
	200A	2990	667	1216.0	1123.8	576
	250A	3185	709	2408.5	2211.4	898
Seismic isolation of 700 mm	300A	3290	740	2811.6	2563.5	1214
	50A	3585	330	26.5	25.5	85
	65A	3595	338	32.4	31.4	118
	80A	3625	349	98.1	94.1	147
	100A	3660	368	101.0	96.1	206
	125A	3730	397	221.6	210.8	316
	150A	3770	416	334.4	316.8	412
	200A	3910	667	863.0	811.0	678
	250A	4135	709	1708.3	1596.5	1048
	300A	4240	740	1992.7	1850.5	1424

\*1 The maximum reaction force is shown.

\*2 The weight of system is the own weight of Dodge<sup>3</sup> Joint (including three bellows and intermediate pipes connecting the bellows).

\*For other system specifications, please consult us.

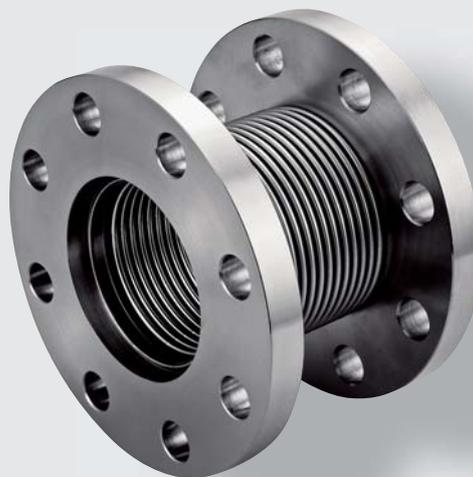
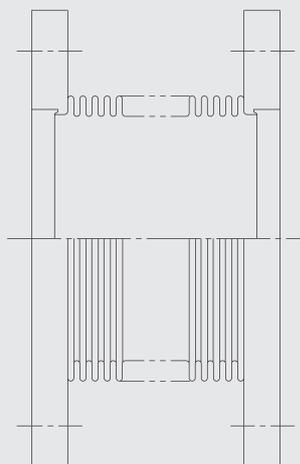
\*Detailed design materials and description on seismic isolation level are available. Please consult us.

# Low-reaction type bellows

## Standard specifications for bellows

SUS304, SUS316L

※Bellows can be fabricated with other materials.



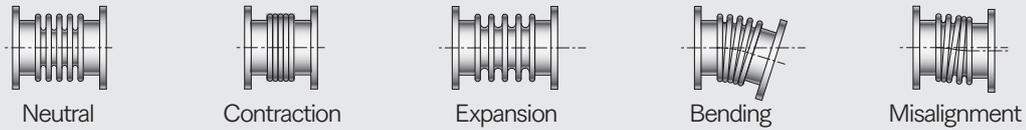
## Standard dimensions

Nominal diameter (A)	Model No.	Design pressure (MPa)	Inner diameter (mm)	Outer diameter (mm)	Thickness (mm)	Spring rate Per convolution (N/mm · cov.)
50	1S-50	0.1	51	65	0.20	338.4
65	1S-65	0.1	63	83	0.25	323.6
80	1S-80	0.1	80	103	0.25	264.7
100	1S-100	0.1	104	127	0.25	304.9
125	1S-125	0.1	126	151	0.30	493.9
150	1S-150	0.1	150	175	0.30	571.4
200	1S-200	0.1	205	230	0.30	754.4
250	1S-250	0.06	254	290	0.30	278.1
300	1S-300	0.06	305	340	0.30	341.8

※Design conditions: Bellows material: SUS316L, Temperature: 300°C

# Examples of application

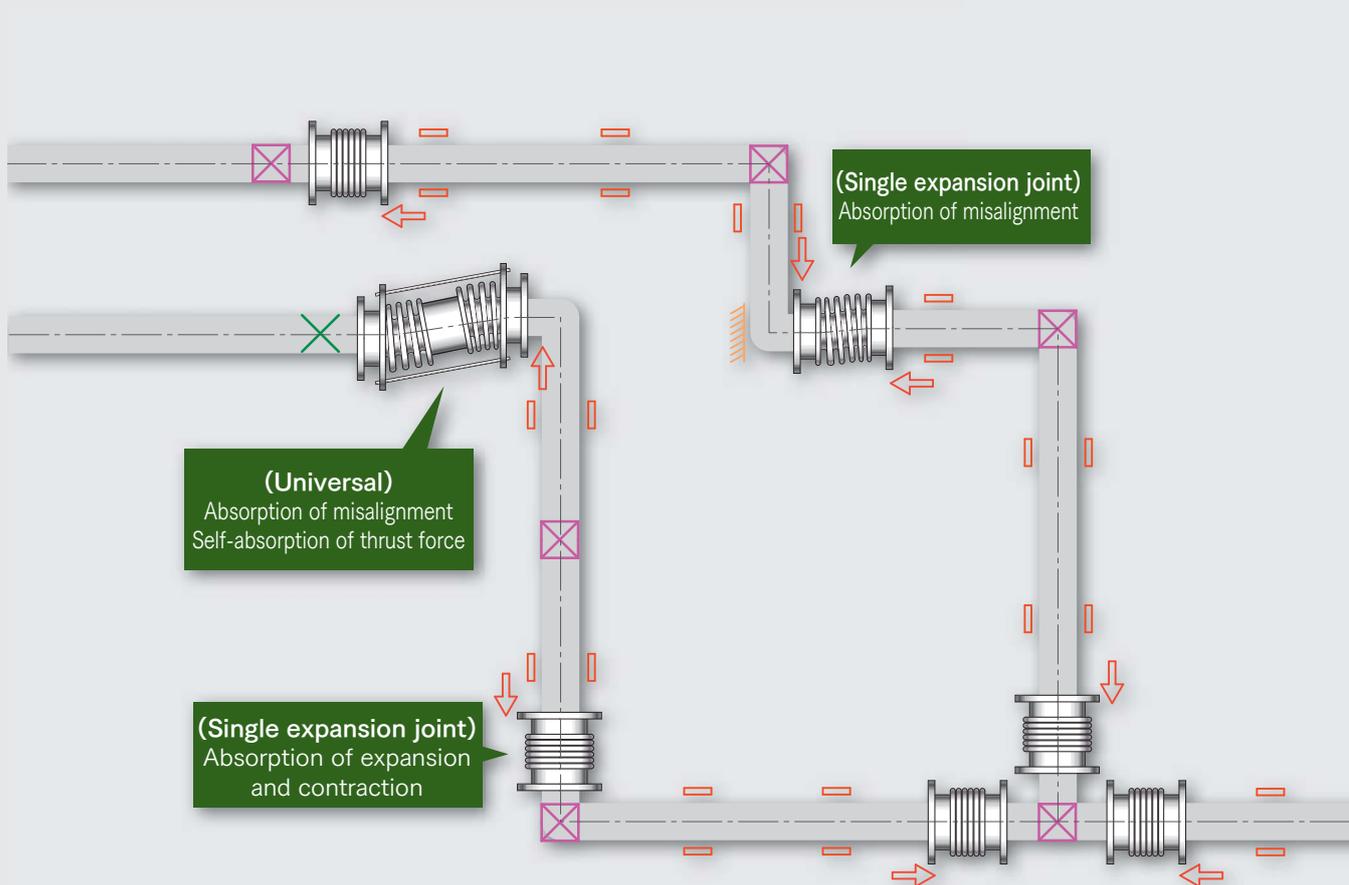
## Basic motions of bellows expansion joints

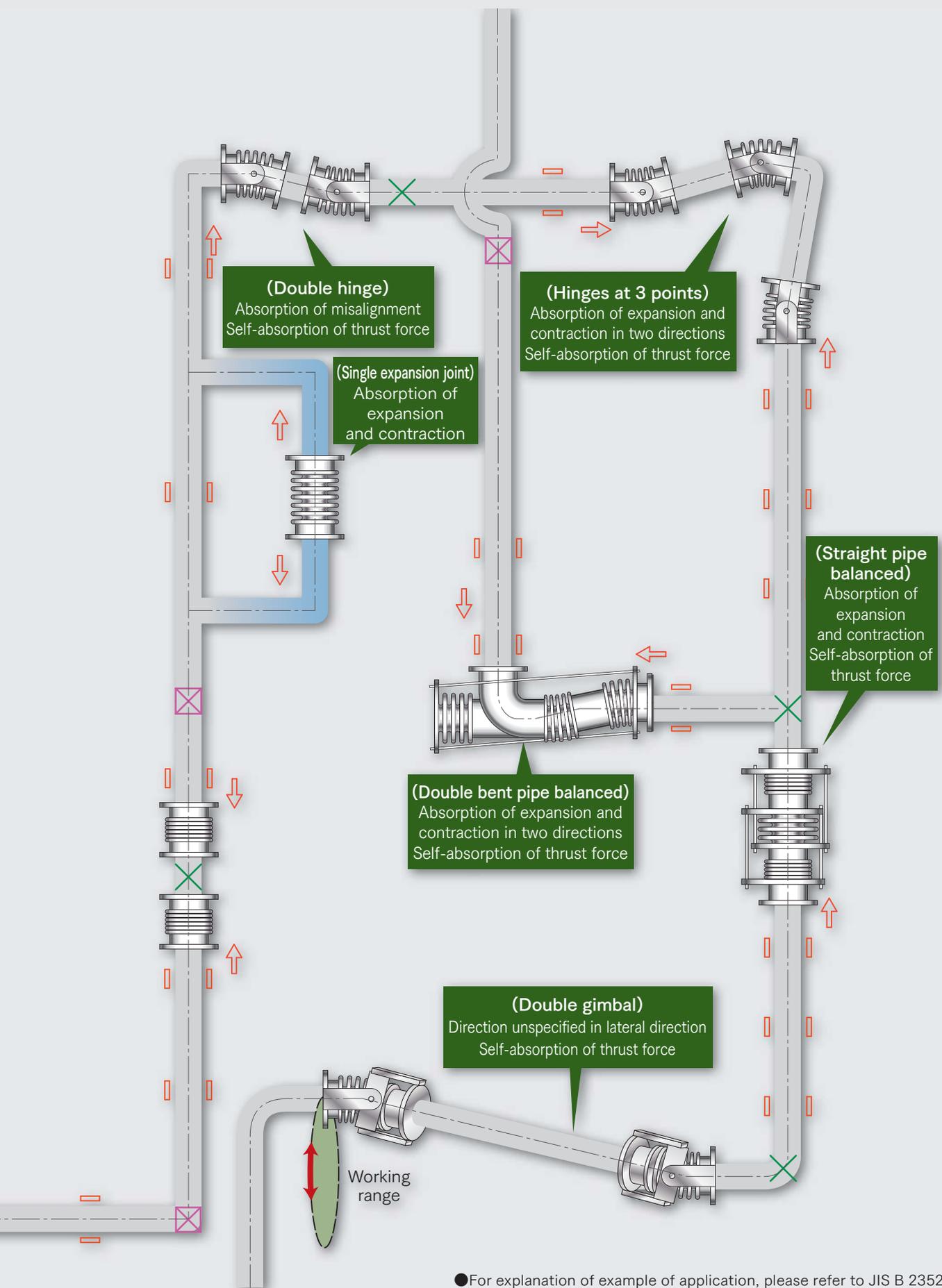


## Examples of application of bellows expansion joints

Terms and symbols

Term	Description	Symbol
Main anchor	Must be resistant to the expansion joint thrust force and the spring reaction force.	
Slide anchor	Must be resistant to the expansion joint thrust force and the spring reaction force but does not restrain the force in the sliding direction.	
Intermediate anchor	Must be resistant to the spring reaction force of expansion joint.	
Guide	Pipe guide device for transmitting smoothly the necessary force for centering of expansion joint and pipe and movement in the axial direction to the anchor	
Direction of expansion of pipe		





# Guide to order expansion joint

		Example of entry		Entry field	
Nominal diameter (A)		250			
Overall length (mm)		Desirable length 500			
Joint model	Upstream side	JPI150Lb-250RF(Fixed)			
	Downstream side	JPI150Lb-250RF(loose)			
Sleeve		<input checked="" type="checkbox"/> Required	<input type="checkbox"/> Not required	<input type="checkbox"/> Required	<input type="checkbox"/> Not required
Quantity (pieces)		1			
		Internal	External	Internal	External
Pressure (MPa)		1	—		
Temperature (°C)		180	—		
Fluid		Steam	Atmosphere		
Installation condition		Vertical			
axial (+) displacement (mm)		+27			
axial (–) displacement (mm)		-27			
Lateral displacement (mm)		-			
angular displacement (rad)		-			
Spring rate (N/mm, max)		-			
Life cycle (times)		3000			
Material	Bellows	SUS304			
	Sleeve	SUS304			
	Joint 1 on upstream side	STPG370			
	Joint 2 on upstream side	SFVC2A			
	Joint 1 on downstream side	STPG370			
	Joint 2 on downstream side	SFVC2A			
	Certificates for materials	<input type="checkbox"/> Required	<input checked="" type="checkbox"/> Not required	<input type="checkbox"/> Required	<input type="checkbox"/> Not required
Applicable standards, laws and regulations		-			
Paint		One layer of silver paint on iron surface			
Additional inspections		<input checked="" type="checkbox"/> Dye penetrant test (PT)	<input type="checkbox"/> Radiographic test (RT)	<input type="checkbox"/> Dye penetrant test (PT)	<input type="checkbox"/> Radiographic test (RT)
Other requirements					

※In inapplicable fields, enter -.



## Conforming to Fire Service Act

Flexible metal hose  
Universal expansion joints  
Technical guidelines

Applicable laws and regulations prescribe that flexible metal hoses and universal expansion joints should be used in the connections of tanks for storage or handling of dangerous liquids with piping to prevent the connections being damaged by earthquake and ground subsidence. Our company supplies flexible hoses and bellows which conform to the performance rating standards specified by the applicable laws and regulations.

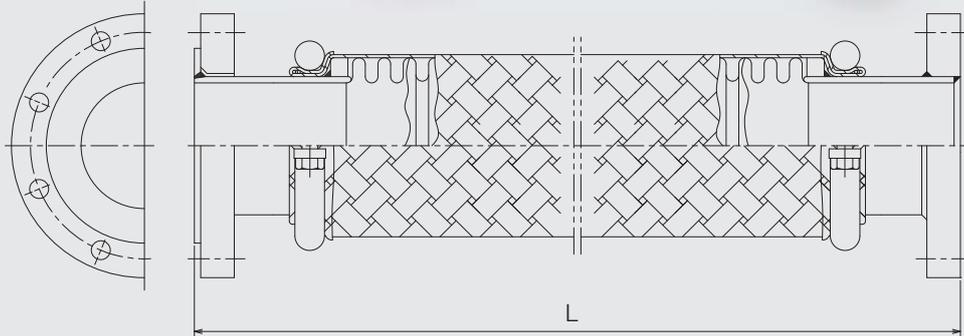
# Flexible metal hoses

## Standard specifications

Max. working pressure	1.0MPa
Max. working temperature	100°C



Hoses can be provided with Teflon inner layer.



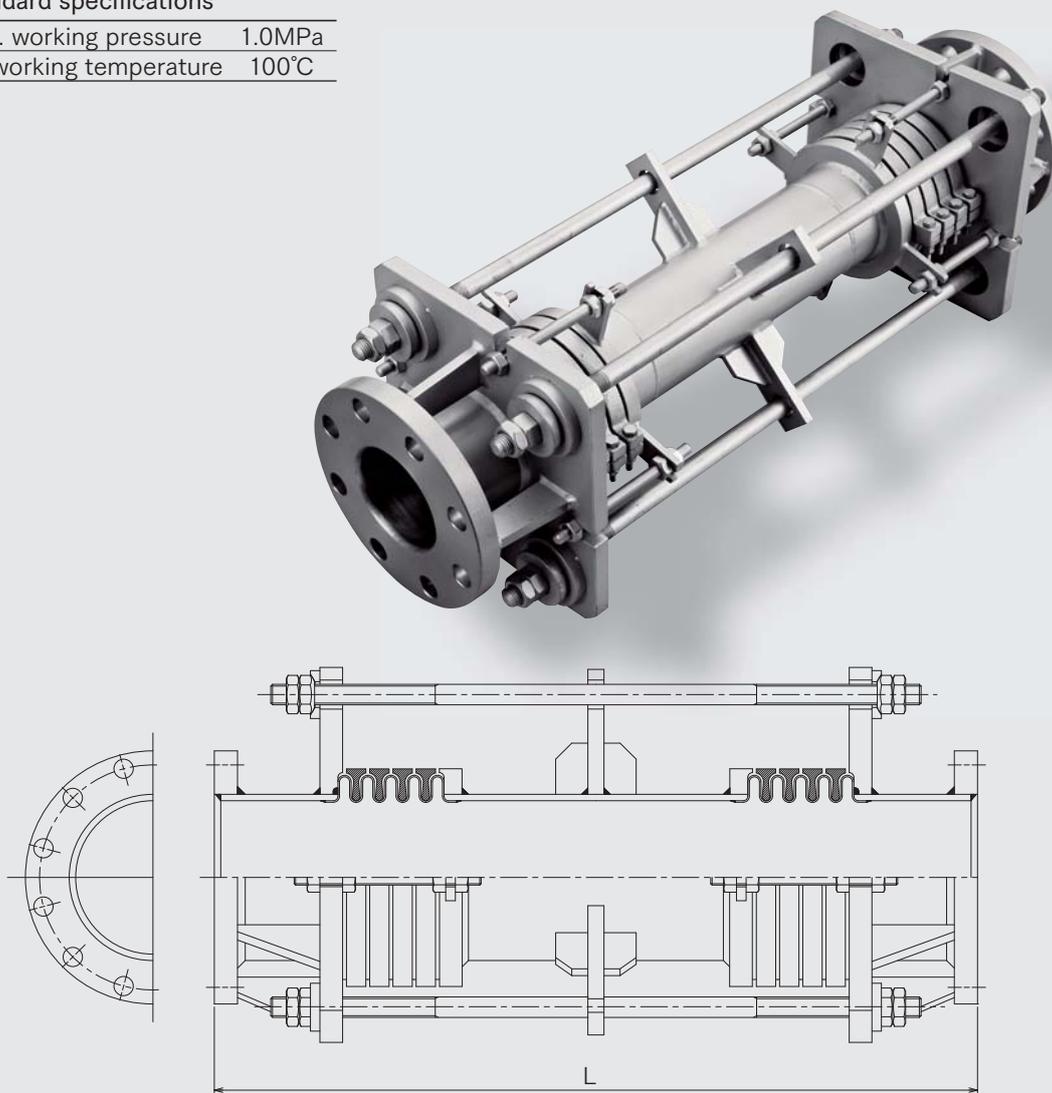
## Performance table

Nominal diameter		Max. Lateral displacement (mm)							
		50	100	150	200	250	300	350	400
A	B	Overall length L							
40	1•1/2	500	600	700	800	900	1,000	1,100	1,200
50	2	600	700	800	900	1,000	1,100	1,200	1,300
65	2•1/2	600	800	900	1,000	1,100	1,200	1,300	1,400
80	3	700	800	1,000	1,100	1,200	1,300	1,400	1,500
100	4	700	900	1,100	1,200	1,300	1,400	1,500	1,600
125	5	800	1,000	1,200	1,300	1,400	1,500	1,600	1,800
150	6	800	1,100	1,300	1,500	1,600	1,700	1,800	1,900
200	8	900	1,200	1,400	1,500	1,700	1,800	1,900	2,100
250	10	1,000	1,400	1,500	1,700	2,000	2,100	2,200	2,300
300	12	1,100	1,400	1,700	1,900	2,200	2,300	2,500	2,600
350	14	1,200	1,500	1,800	2,000	2,200	2,400	2,600	2,800
400	16	1,300	1,600	2,000	2,200	2,500	2,700	2,900	3,200

# Universal bellows type expansion joints

## Standard specifications

Max. working pressure	1.0MPa
Max. working temperature	100°C



## Performance table

Nominal diameter		Max. Lateral displacement (mm)							
		50	100	150	200	250	300	350	400
A	B	Overall length L							
80	3	700	1,000	1,400	1,700	2,100	2,400	2,700	3,100
100	4	700	1,100	1,400	1,800	2,100	2,500	2,800	3,200
125	5	800	1,200	1,600	2,000	2,300	2,700	3,100	3,500
150	6	800	1,200	1,600	2,000	2,400	2,800	3,200	3,600
200	8	900	1,300	1,700	2,100	2,500	2,900	3,300	3,700
250	10	1,000	1,400	1,800	2,200	2,600	3,000	3,300	3,700
300	12	1,000	1,400	1,800	2,200	2,600	3,000	3,300	3,700
350	14	1,100	1,500	1,900	2,300	2,700	3,100	3,400	3,800
400	16	1,200	1,600	2,100	2,400	2,800	3,200	3,600	4,000
450	18	1,200	1,700	2,200	2,600	3,100	3,500	4,000	4,500
500	20	1,300	1,800	2,300	2,800	3,300	3,800	4,300	4,800
550	22	1,300	1,900	2,500	3,000	3,600	4,100	4,700	5,300
600	24	1,400	1,900	2,500	3,000	3,600	4,100	4,700	5,300
650	26	1,400	1,900	2,500	3,000	3,600	4,100	4,700	5,300

# Technical guidelines

## Engineering guidelines for expansion joints (extract)

### ● Thickness of bellows of expansion joint (minimum value)

The thickness of formed bellows shall be larger than the following value depending on the nominal diameter of the relevant flexible hose.

For our products, materials thicker by 20 to 65% than the standard thickness are used in consideration of long-term use.

Nominal diameter (A)	40	50	65	80	100	125	150	200	250	300	350	400	450	500	550	600	650	
Standard thickness value	0.5		0.8		1		1.2		1.5		2							

### ● Length of expansion joint and maximum amount of lateral displacement

The length and maximum amount of lateral displacement of flexible metal hoses and universal expansion joints are shown in the tables in the previous two pages. The length of a expansion joint shall be larger than the value for the maximum amount of lateral displacement shown in the table.

### ● Strength calculation

The value calculated by the specified strength calculation formula shall meet the specified value.

### ● Material

The specified material or a material equivalent to or better than the specified one shall be used.

### ● Static load test

When a expansion joint is filled with water and a weight (half of the weight of joint filled with water) is suspended for 1 min in the center of the joint horizontally placed with both ends fixed, the joint shall not leak water or shall not be damaged.

### ● Displacement pressure test

When a hydraulic pressure higher than the maximum operating pressure is applied to a expansion joint displaced to the maximum lateral displacement for 5 min, its parts shall not be deformed.

### ● Repeated displacement test

When a hydraulic pressure 1.5 times higher than the maximum operating pressure is applied to a joint for 5 minutes after the joint is displaced to the maximum lateral displacement repeatedly 1,000 times, the joint shall not leak water or shall not be damaged.

### ● Durability test (only flexible metal hoses)

When the maximum operating pressure is applied to a hose repeatedly 2,000 times or more, the length after testing shall be 105% or less of the length before testing.

### ● Stiffness test

When a hydraulic pressure 4 times higher than the maximum operating pressure is applied to a joint for 1 minute, the joint shall not leak water, and its length after testing shall be 115% or less of the length before testing in the case of a flexible joint or 102% or less in the case of a universal joint.

### ● Anticorrosion coating

Apply an anticorrosion paint to the external surface of expansion joint. It is unnecessary to treat stainless steel parts.

### ● Appearance

Expansion joint parts shall be free from defects, such as cracks and damages.

### ● Marking

Expansion joints shall be marked with the maximum operating pressure, bellows material, manufacturing date and manufacturer's name by an indelible method.



# 8

## Teflon hoses

Hybridflex  
Teflon hoses / Teflon coating

The most useful characteristic of Teflon is chemical resistance. It also excels in water repellency, non-tackiness, low friction and electrical insulating properties. Utilizing the features of Teflon, we have developed Hybridflex and Teflon hoses.

※Teflon is a registered trademark of Du Pont.

300  
APPROX

250

200

150

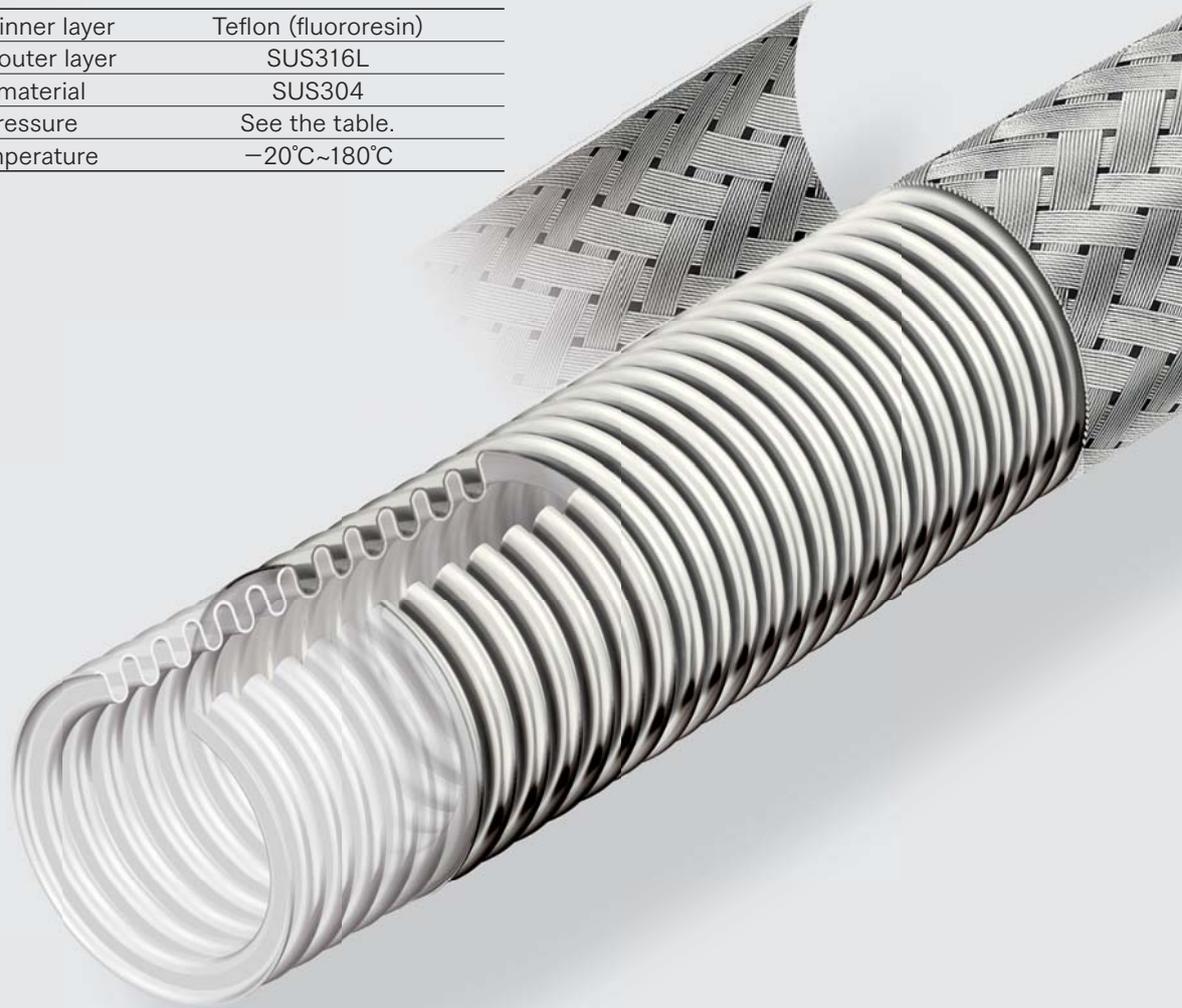
※We are ready to produce models not listed in the catalog. Please feel free to consult us.

# Hose specifications

Hybridflex is a flexible hose consisting of two corrugated pipes, Teflon inner pipe and stainless steel outer pipe. The Teflon inner layer excels in corrosion resistance and ensures flexibility. The stainless steel outer layer ensures pressure resistance.

## Standard specifications

Flexible hose inner layer	Teflon (fluororesin)
Flexible hose outer layer	SUS316L
Wire braid material	SUS304
Working pressure	See the table.
Working temperature	-20°C~180°C



## Standard dimensions and performance

Nominal diameter		Inner diameter (mm)	Thickness(mm)		Outer diameter (mm)		Min. bending radius (mm)		Max. working pressure (MPa) <sup>※1</sup>
A	B		SUS	Teflon	No braid	Single braid	Constant bending	Repeated bending	
20	3/4	19	0.2	1.0	29	31	50	210	2.0
25	1	24	0.2	1.0	36	38	70	250	2.0
32	1-1/4	30	0.2	1.5	44	46	80	270	1.7
40	1-1/2	37	0.26	1.5	54	56	100	330	1.5
50	2	45	0.26	2.0	64	66	130	350	1.4
65	2-1/2	61	0.3	2.0	82	84	170	510	1.2
80	3	73	0.3	2.0	98	100	200	600	1.0
100	4	96	0.3	2.2	123	125	240	750	1.0

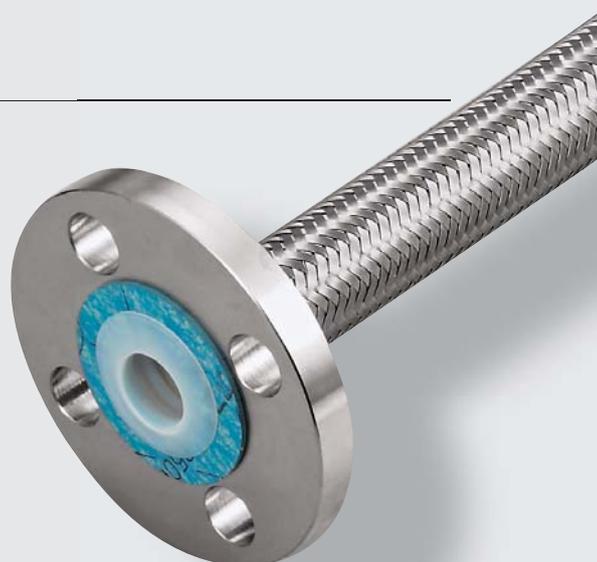
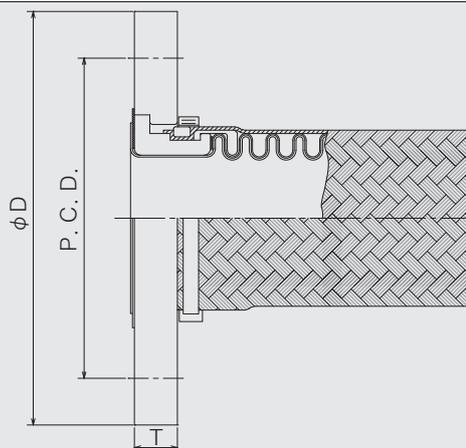
※Maximum length to be manufactured is 2000mm.

※The specifications are subject to change for product improvement without prior notice.

※Maximum working pressure may vary depending on design conditions.

※1 : pressure at working temperature 40°C, safety factor of 3 and weld efficiency of 1.

# Flange



## Standard specifications

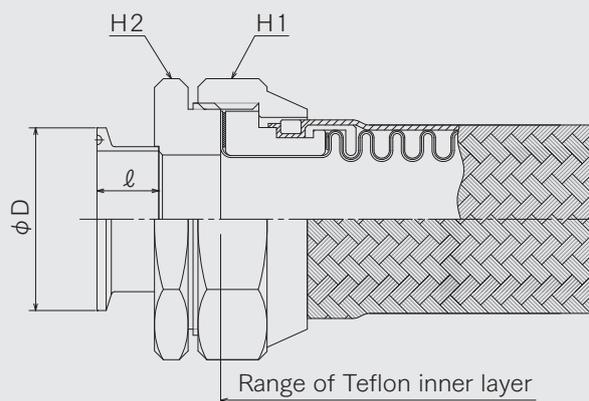
Nominal diameter		D	P.C.D.	T
A	B			
20	3/4	100	75	14
25	1	125	90	14
32	1-1/4	135	100	16
40	1-1/2	140	105	16
50	2	155	120	16
65	2-1/2	175	140	18
80	3	185	150	18
100	4	210	160	18

※Joint material: SUS304 (For other materials, please consult us.)

※The dimensions of flanges conforming to JIS 10K are shown.

※Other flanges can be fabricated.

# Ferrule (NW)

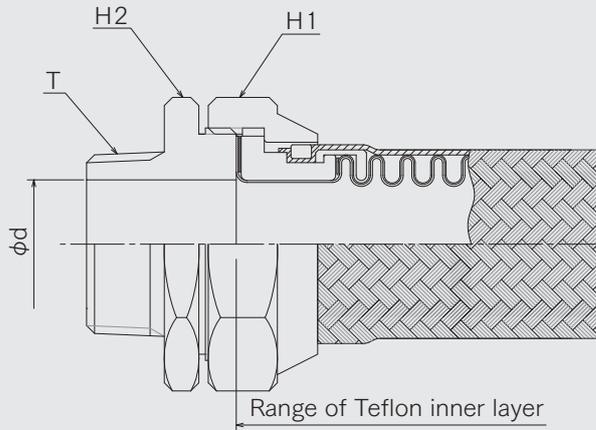


## Standard specifications

Nominal diameter		D	ℓ	H1	H2
A	B				
20	3/4	50.5	20.5	Hexagonal, flat46	Hexagonal, flat46
25	1	50.5	20.5	Hexagonal, flat54	Hexagonal, flat50
32	1-1/4	50.5	20.5	Hexagonal, flat60	Hexagonal, flat58
40	1-1/2	50.5	20.5	Octagonal, flat71	Octagonal, flat71
50	2	64.0	20.5	Octagonal, flat80	Octagonal, flat80

※Joint material: SUS304 (For other materials, please consult us.)

## Male screw

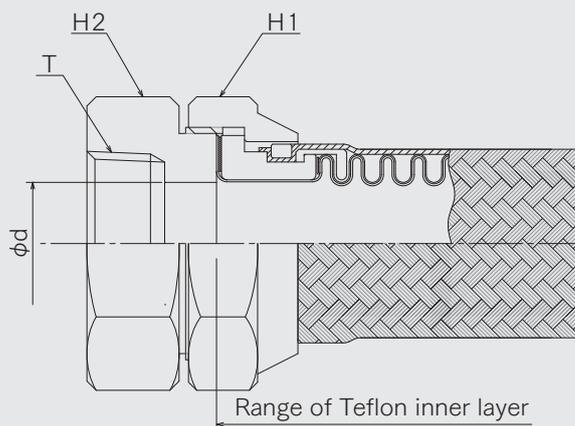


### Standard specifications

Nominal diameter		T	d	H1	H2
A	B				
20	3/4	R3/4	19	Hexagonal, flat46	Hexagonal, flat46
25	1	R1	24	Hexagonal, flat54	Hexagonal, flat50
32	1·1/4	R1·1/4	30	Hexagonal, flat60	Hexagonal, flat58
40	1·1/2	R1·1/2	37	Octagonal, flat71	Octagonal, flat71
50	2	R2	45	Octagonal, flat80	Octagonal, flat80

※Joint material: SUS304 (For other materials, please consult us.)

## Female screw



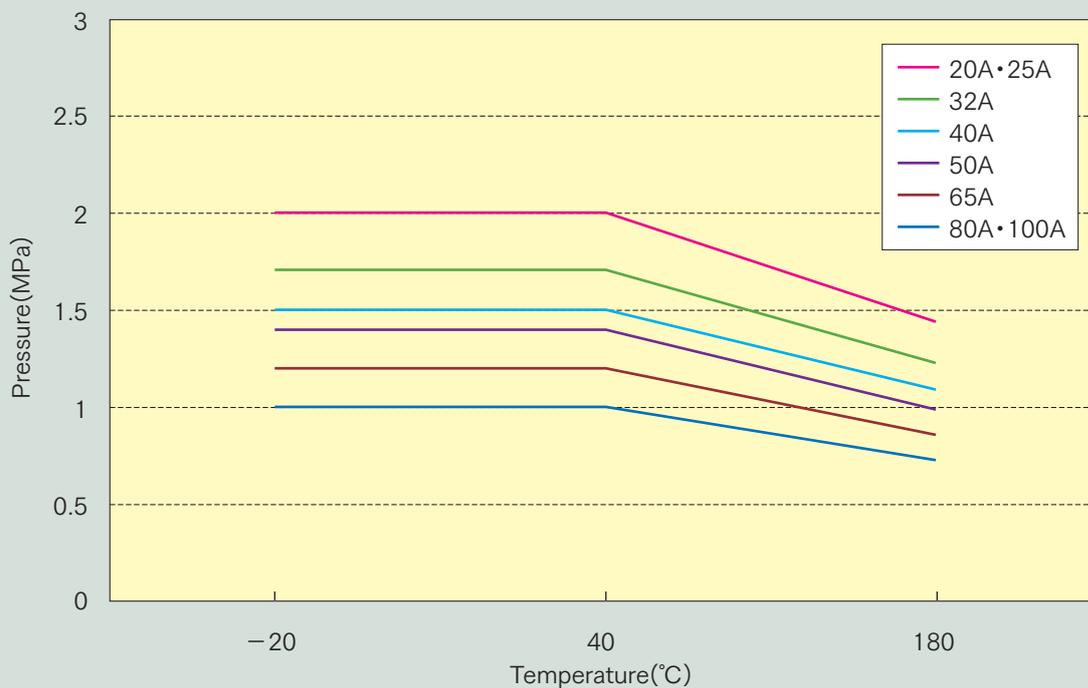
### Standard specifications

Nominal diameter		T	d	H1	H2
A	B				
20	3/4	Rc3/4	19	Hexagonal, flat46	Hexagonal, flat46
25	1	Rc1	24	Hexagonal, flat54	Hexagonal, flat50
32	1·1/4	Rc1·1/4	30	Hexagonal, flat60	Hexagonal, flat58
40	1·1/2	Rc1·1/2	37	Octagonal, flat71	Octagonal, flat71
50	2	Rc2	45	Octagonal, flat80	Octagonal, flat80

※Joint material: SUS304 (For other materials, please consult us.)

# Reference materials

## ① Relationship between temperature and pressure resistance



## ② Vacuum resistance performance

Results of heating test under vacuum

Size	Pressure	Temperature	Heating time	Result
20A	Vacuum	150°C	1 hour	No change
25A	Vacuum	150°C	1 hour	No change
32A	Vacuum	150°C	1 hour	No change
40A	Vacuum	150°C	1 hour	No change
50A	Vacuum	150°C	1 hour	No change
65A	Vacuum	150°C	1 hour	No change
80A	Vacuum	100°C	1 hour	No change
100A	Vacuum	100°C	1 hour	No change

※The above table shows the results of observation of the inside of the hoses after they are held in the furnace for 1 hour while they are being vacuumized.

## ③ Cautions for handling

- When fitting Hybridflex, take care not to bend it at a sharp angle or twist it.
- Do not remove the protective plate for shipping until just before fitting the hoses.
- When using Hybridflex at a high temperature, pay great attention to the pressure resistance.

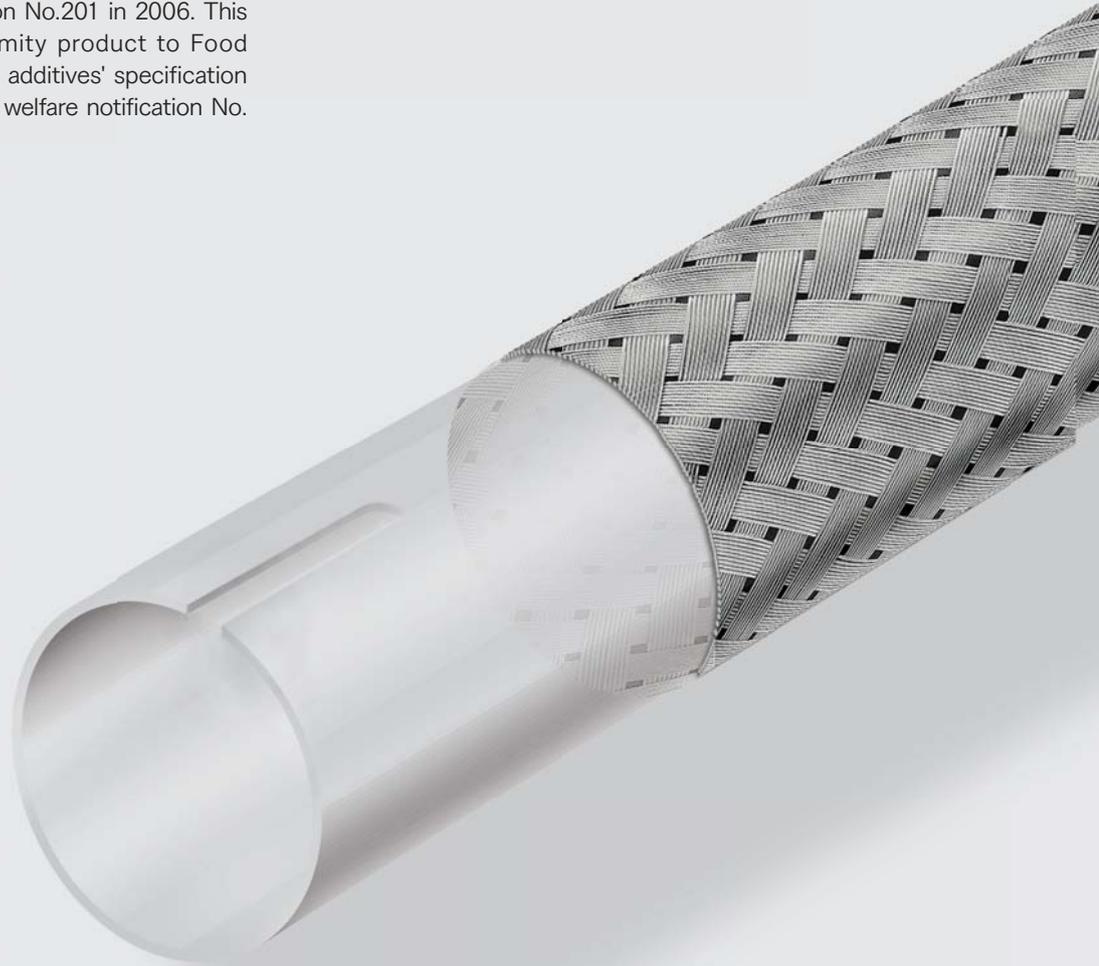
# Teflon hoses

■ Teflon hoses are straight Teflon hoses covered with braids. Their inner surfaces are smooth and they are suitable for transferring fluids having high viscosity.

■ This teflon hose uses teflon(PTFE) which passed the test by ministry of health, labour and welfare notification No.201 in 2006. This product is a conformity product to Food Sanitation Law・food, additives' specification standard. (Ministry of welfare notification No. 370 in 1959.)

## Standard specifications

hoses	Teflon (fluororesin)
Braid material	SUS304
Max. working pressure(MPa)	See the following table.
Max. working temperature	204°C

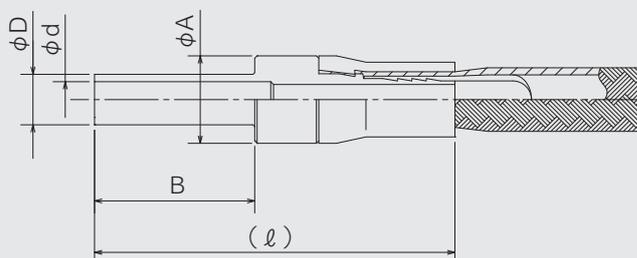


## Standard dimensions and performance

Nominal diameter		Inner diameter (mm)	Outer diameter (mm)	Max. working pressure (MPa)				Min. burst pressure (MPa)				Min. bending radius (mm)	Weight (Kg/m)
				Normal temperature		204°C		Normal temperature		204°C			
A	B			fluid	gas	fluid	gas	fluid	gas	fluid	gas		
8A	1/4	4.7	8.0	20.6	14.4	10.3	7.2	96.1	67.3	37.8	26.5	50	0.10
10A	3/8	8.0	11.3	17.2	12.1	8.6	6.0	68.6	48.0	24.3	17.0	100	0.165
15A	1/2	10.3	14.0	13.7	6.9	10.3	5.2	68.6	48.0	34.3	24.0	130	0.18
20A	3/4	16.0	20.0	8.6	4.3	6.5	3.3	34.3	17.2	19.6	9.8	195	0.26
25A	1	22.2	26.2	6.0	3.0	6.0	3.0	24.0	12.0	18.0	9.0	225	0.40

※Please be careful that maximum working pressure is different in fluid or in gas.

## Tube end (PS type joint)

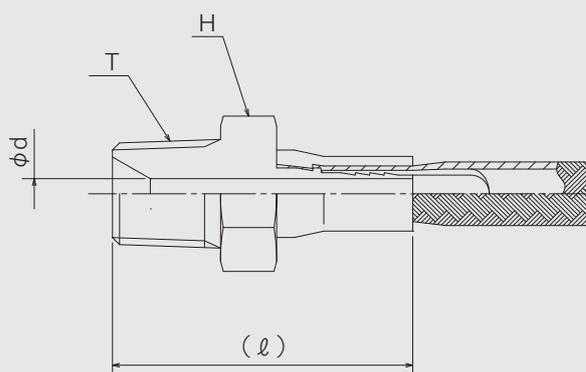


### Standard specifications

Nominal diameter		d	D	A	B	ℓ
A	B					
8	1/4	4.5	6.35	11	20	45
10	3/8	7.4	9.52	14	25	55
15	1/2	10.3	12.7	17	30	62
20	3/4	15.7	19.05	25	40	79
25	1	22.1	25.4	30	40	85

※Joint material: SUS304 (For other materials, please consult us.)

## Male fixed screw (Type SM joint)

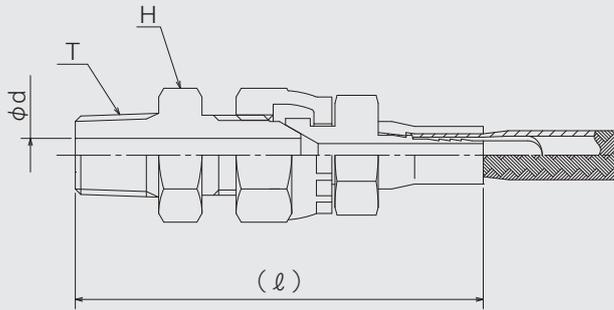


### Standard specifications

Nominal diameter		d	T	H	ℓ
A	B				
8	1/4	4.0	R1/4	Hexagonal, flat17	38.0
10	3/8	7.0	R3/8	Hexagonal, flat19	44.0
15	1/2	9.0	R1/2	Hexagonal, flat24	48.0
20	3/4	15.0	R3/4	Hexagonal, flat32	57.5
25	1	20.5	R1	Hexagonal, flat38	67.0

※Joint material: SUS304 (For other materials, please consult us.)

## Male loose screw (Type SNM joint)

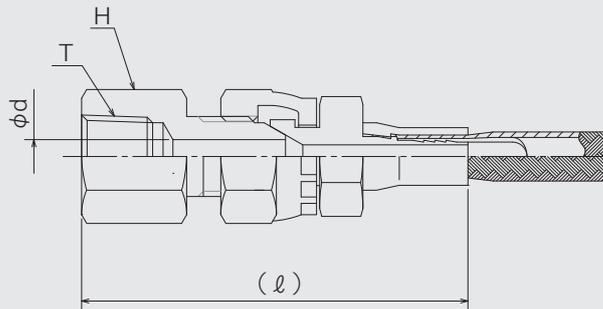


### Standard specifications

Nominal diameter		d	T	H	l
A	B				
8	1/4	4.5	R1/4	Hexagonal, flat19	67.5
10	3/8	7.0	R3/8	Hexagonal, flat22	75.5
15	1/2	10.0	R1/2	Hexagonal, flat27	81.0
20	3/4	16.0	R3/4	Hexagonal, flat32	95.0
25	1	21.5	R1	Hexagonal, flat41	105.0

※Joint material: SUS304 (For other materials, please consult us.)

## Female loose screw (Type SNF joint)

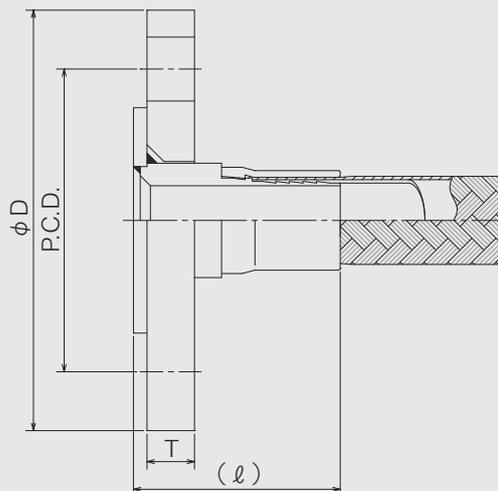


### Standard specifications

Nominal diameter		d	T	H	l
A	B				
8	1/4	5.5	Rc1/4	19	62.5
10	3/8	8.0	Rc3/8	22	71.5
15	1/2	10.0	Rc1/2	27	77.0
20	3/4	16.0	Rc3/4	36	89.0
25	1	22.0	Rc1	41	99.0

※Joint material: SUS304 (For other materials, please consult us.)

## Flange



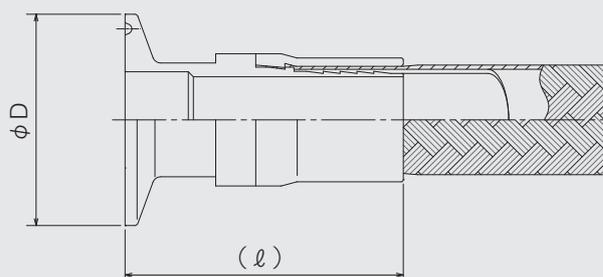
### Standard specifications

Nominal diameter		D	P.C.D.	T	ℓ
A	B				
10	3/8	90	65	12	33.0
15	1/2	95	70	12	46.0
20	3/4	100	75	14	54.5
25	1	125	90	14	61.0

※Joint material: SUS304 (For other materials, please consult us.)

※The dimensions of flanges conforming to JIS 10K are shown.

## Ferrule



### Standard specifications

Nominal diameter		D	ℓ
A	B		
25	1	50.5	66.0

※Joint material: SUS304 (For other materials, please consult us.)

# Teflon (fluororesin) coating

■ The Teflon (fluororesin) coating can form a Teflon film on the base metal surface through a firing process. The coating can be applied to complicated shapes without losing the features of Teflon.

## ■ Standard specifications

Diameter	15 A or more
Thermal resistance	150°C
Film thickness	100 μm~200 μm

## ■ Remarks

Products with coating resisting to up to 260°C are available. Both the inner and outer surfaces can be coated.



## Collar Circumferential Membrane Stress Due to Pressure

$$S'_1 = \frac{PD_c^2 L_t E_c k}{2(ntE_b L_t (D_b + nt) + t_c k E_c L_c D_c)}$$

## Bellows Circumferential Membrane Stress Due to Pressure

$$S_2 = \frac{PD_m K_r q}{2A_c}$$

## Bellows Meridional Membrane Stress Due to Pressure

$$S_3 = \frac{Pw}{2nt_p}$$

## Bellows Meridional Bending Stress ORK Due to Pressure

$$S_4 = \frac{P}{2n} \left( \frac{w}{t_p} \right)^2 C_p$$

## Technical information

Note: The above stresses should be evaluated for pressure capacity as follows:

$$S_1 \text{ \& } S_2 \leq C_{wb} W_b S_{ab} \quad S'_1 \leq C_{wc} W_c S_{ac}$$

How to use flexible hoses

$$S_3 + S_4 \leq C_m S_{ab} \quad (\text{Below the Creep Range})$$

Instructions for use / Reference materials

$$S_3 + (S_4/1.25) \leq S_{ab} \quad (\text{In the Creep Range})$$

## Bellows Meridional Membrane Stress Due to Deflection

$$S_5 = \frac{E_b t_p^2 e}{2w^3 C_f}$$

## Bellows Meridional Bending Stress Due to Deflection

$$S_6 = \frac{5E_b t_p e}{3w^2 C_d}$$

Note: Modulus of elasticity,  $E_b$ , in Equations (4-32) and (4-33) is at room temperature.

# Motion

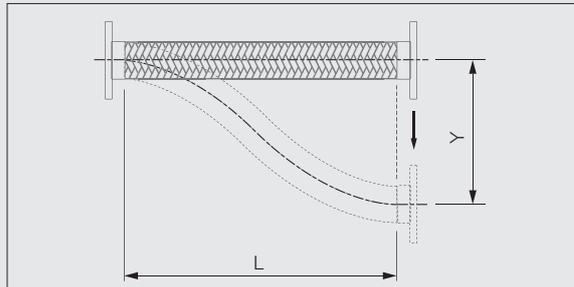
## 1. Offset motion (lateral displacement)

The offset motion includes parallel displacement where a hose moves parallel keeping constant the distance between the joints at both ends and backward displacement where a hose moves parallel reducing the distance between the joints at both ends.

The parallel displacement is applied in cases of absorption of vibration with small displacement and in cases where the face-to-face dimension is restrained.

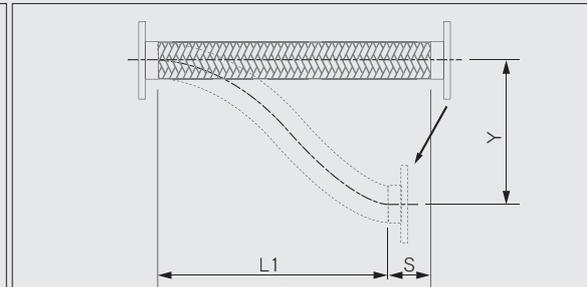
The backward displacement is applied in cases of absorption of ground subsidence with large displacement, in cases where the face-to-face dimension is not restrained and to L-shaped piping on which two flexible hoses are connected with an elbow.

Parallel displacement



[Explanation of symbols]  
 L : Hose length  
 Y : Amount of lateral displacement

Backward displacement



[Explanation of symbols]  
 L : Hose length  
 Y : Amount of lateral displacement  
 L1 : Length of hose after moving backward  
 S : Distance of backward motion  
 $S \leq L \times 5\%$

Type A

Nominal diameter (A)	Allowable displacement : Y (mm)		
	L=300	L=500	L=1000
8	36	61	122
10			
15			
20			
25			
32			
40	33	44	122
50			
65			
80			
100	22	44	122
125	16		
150	14		

Type A

Nominal diameter (A)	Allowable displacement : Y (mm)		
	L=300	L=500	L=1000
8	80	134	269
10			
15			
20			
25			
32			
40	48	133	269
50			
65			
80			
100	34	96	269
125	23		
150	21		

Type SF

Nominal diameter (A)	Allowable displacement : Y (mm)		
	L=300	L=500	L=1000
8	36	61	122
10			
15			
20			
25			
32			
40	37	44	122
50			
65			
80			
100	29	44	122
125	24		
150	23		

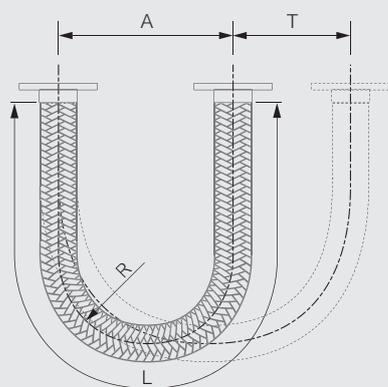
Type SF

Nominal diameter (A)	Allowable displacement : Y (mm)		
	L=300	L=500	L=1000
8	80	134	269
10			
15			
20			
25			
32			
40	60	125	269
50			
65			
80			
100	45	99	269
125	36		
150	34		

## 2.Radial motion (motion in bending radius)

The radial motion is horizontal or vertical movement of one end of a hose installed in the shape of U with the other end secured.

Horizontal movement



[Explanation of symbols]

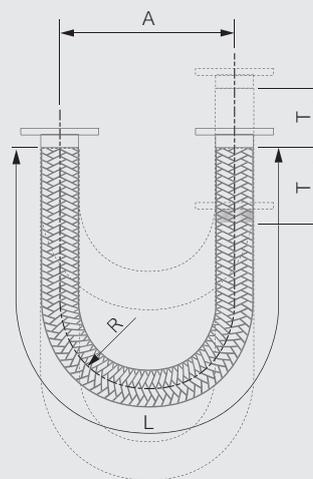
A : Distance of installation ( $2R$ )

T : Amount of displacement

L : Hose length

R : Bending radius

Vertical movement



[Explanation of symbols]

A : Distance of installation ( $2R$ )

T : Amount of displacement

L : Hose length

R : Bending radius

## 3.Axial motion (axial displacement)

The axial motion indicates the expansion or contraction in the axial direction. For flexible hoses, only an insignificant axial motion is allowed. Expansion joints (pages 55 to 72) are suitable for such displacement.

## 4.Permanent bending

The permanent bending and constant bending are used for correcting misalignment between pipes and for bends. Once a hose is bent, the hose will be kept in the state semipermanently.

## 5.Random motion

The random motion is free motion in which a hose moves freely like a watering hose and it is unclear at which points and to what degree it will be bent.

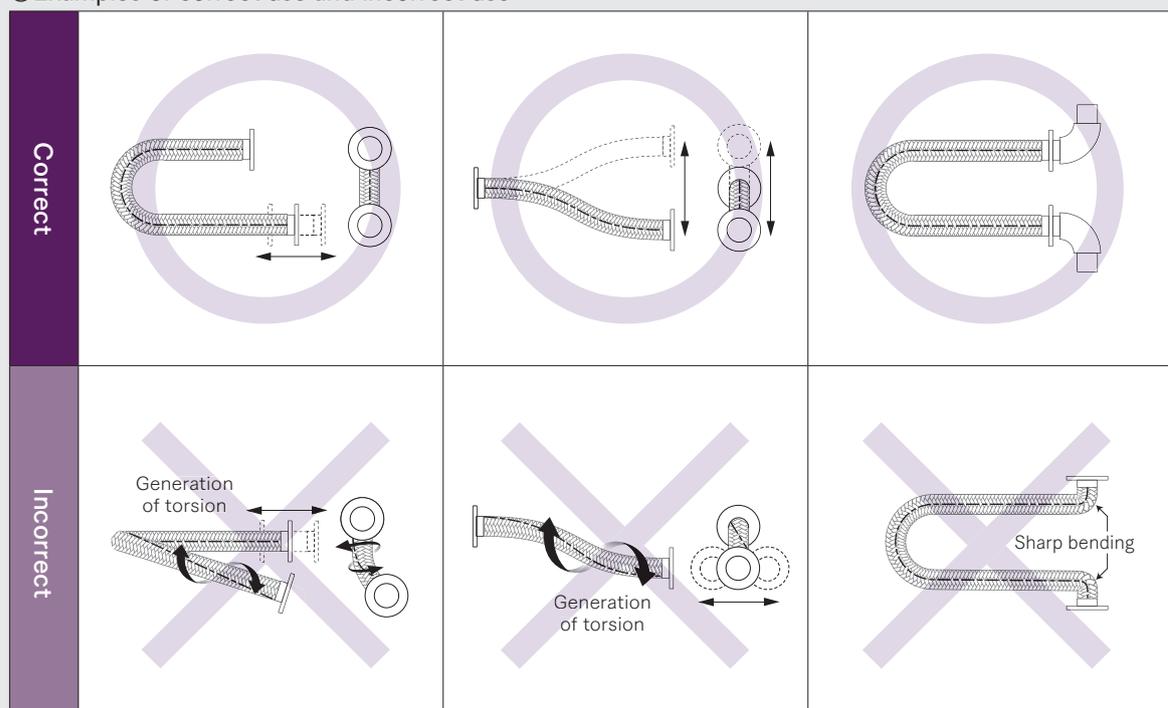
# Flexible hoses

## Instructions common to flexible hoses and bellows

- These products are made from thin plates. Even insignificant impact may damage the products. For transportation, pack them with sufficient packaging materials, and handle them carefully during transportation.
- Store the products in a clean and dry room. Avoid contact with high moisture, saline matter and highlyacid atmosphere.
- Use them in the ranges specified in drawings, delivery specifications and catalogs. If any product is used out of the design specifications, it may be damaged.
- Avoid using fluids which do not have corrosion resistance for each material.
- Do not expose the products directly to sparks from a welder or a grinder. When using a welder or a grinder near the products, appropriately protect them.
- If they are moved after installation or used as measures against vibration, fatigue cracks may develop in them in a short period.

## Flexible hoses

- When installing any flexible hose, do not apply torsion to it.  
To prevent damage owing to torsion during installation, it is recommended to use a joint, such as a loose flange, union joint or SNM joint, which can prevent torsion at one end of the tube.
- Do not install any flexible hose in such a way that the tube is twisted when it is bent.  
Install the tube in such a way that it is constantly on a certain plane to prevent damage to the tube caused by torsion when it is bent.
- Avoid bending any flexible hose at a sharp angle.  
If a tube is installed improperly, the tube may be repeatedly bent at a sharp angle. If a tube is used at a radius lower than the allowable minimum bending radius, it will be fatigued early and damaged in a short period.
- Do not expand or contract any flexible hose.  
Do not install a tube in an expanded or contracted condition exceeding the specified range.
- Reworking  
Avoid reworking any joint if possible. When reworking a joint, take care not to damage the hose or joint, and protect the hose to prevent entry of dust into the tube.
- Welding  
When welding a hose to a mating pipe joint, take utmost care that the hose is not thermally influenced. Otherwise, it may be distorted, or the material characteristics may be degraded, thereby resulting in early breakage.
- Examples of correct use and incorrect use



# Bellows

## Bellows

### ○When carrying

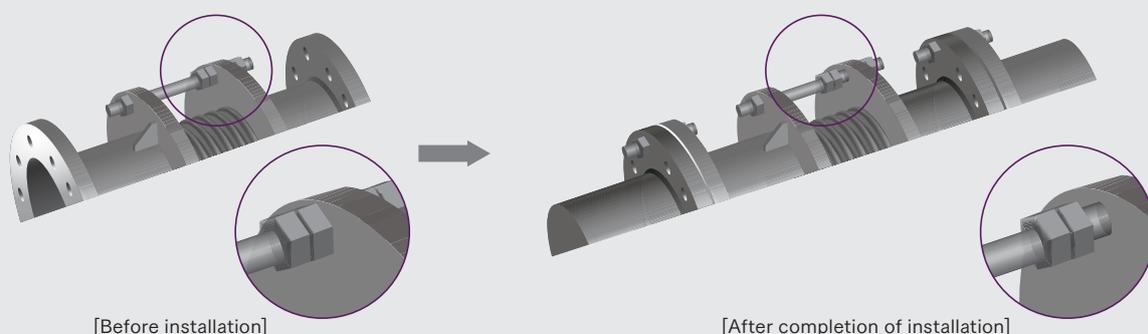
When lifting up and down bellows, fit a patch to the pipe zone, wind a wire rope around it, and lift the bellows. Do not wind a rope around the bellows, bellows protective cover, set bolt or guide rod.

### ○Set bolt

Bellows are provided with a set bolt for transportation and size adjustment. After the completion of installation of the bellows, remove the set bolt without fail before performing the pressure resistance test.

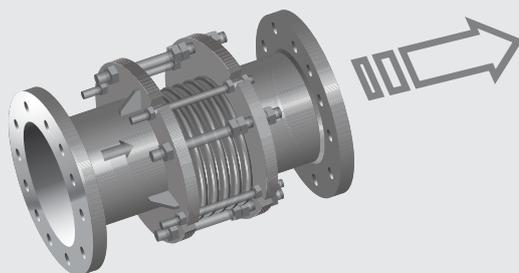
### ○Guide rods/tie rods

Guide rods/tie rods have been installed according to the design specifications. Do not loosen or tighten the nuts. The nuts to be adjusted after the completion of installation shall be adjusted as specified on the drawing.



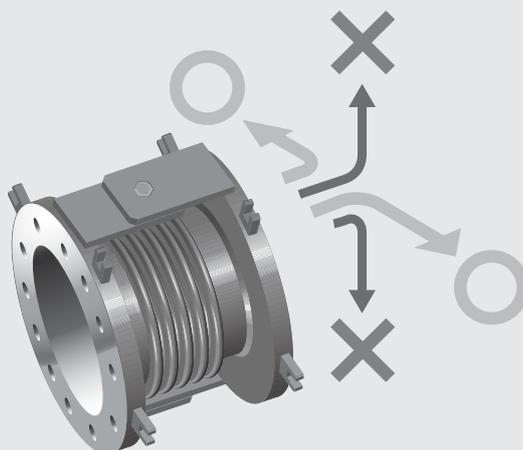
### ○Flowing direction

Bellows are marked with an arrow if the flowing direction through the bellows has been determined. Install such bellows in the indicated direction.



### ○Hinge type expansion joint (p.72)

The hinge type joints can absorb only angular displacement in a plane. When installing them, check carefully the hinge plate direction.

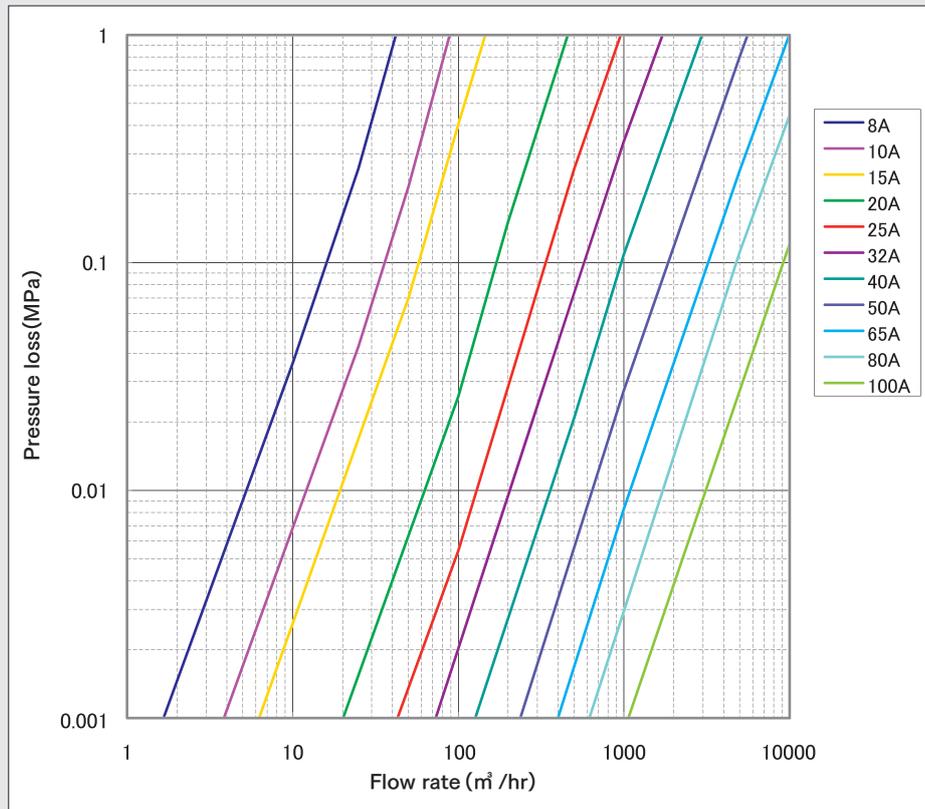


# Pressure loss (type A)

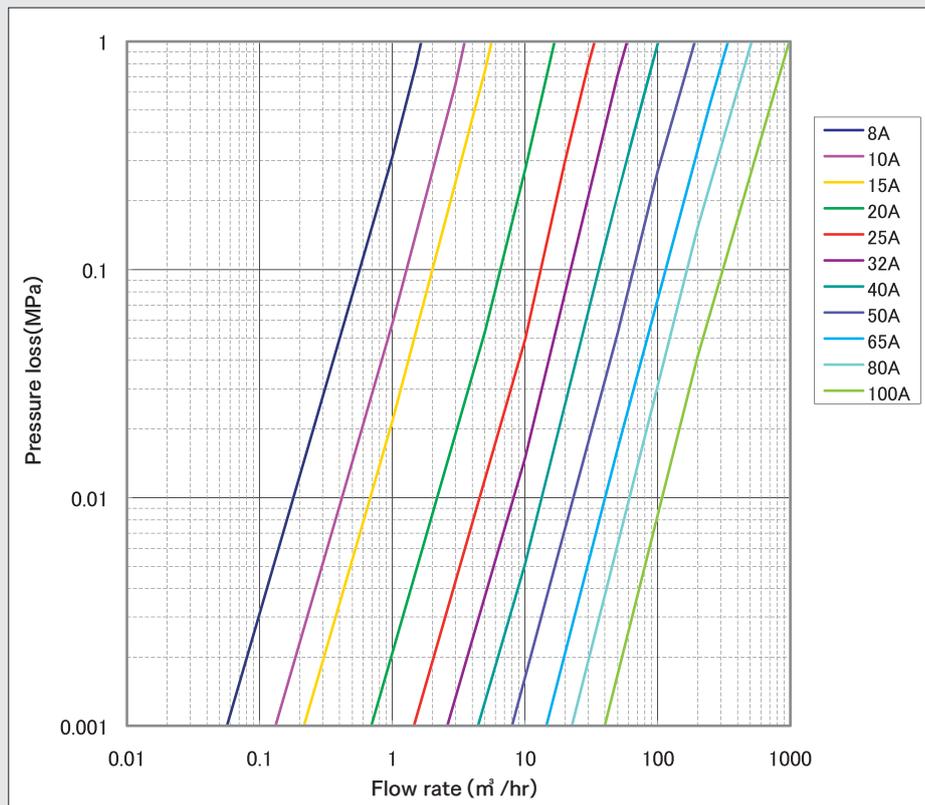
■ Pressure loss in 1 m of type A flexible hose

■ The following charts show calculated values, and there are some errors between these values and the values of actual products.

Air (20°C)



Water (20°C)

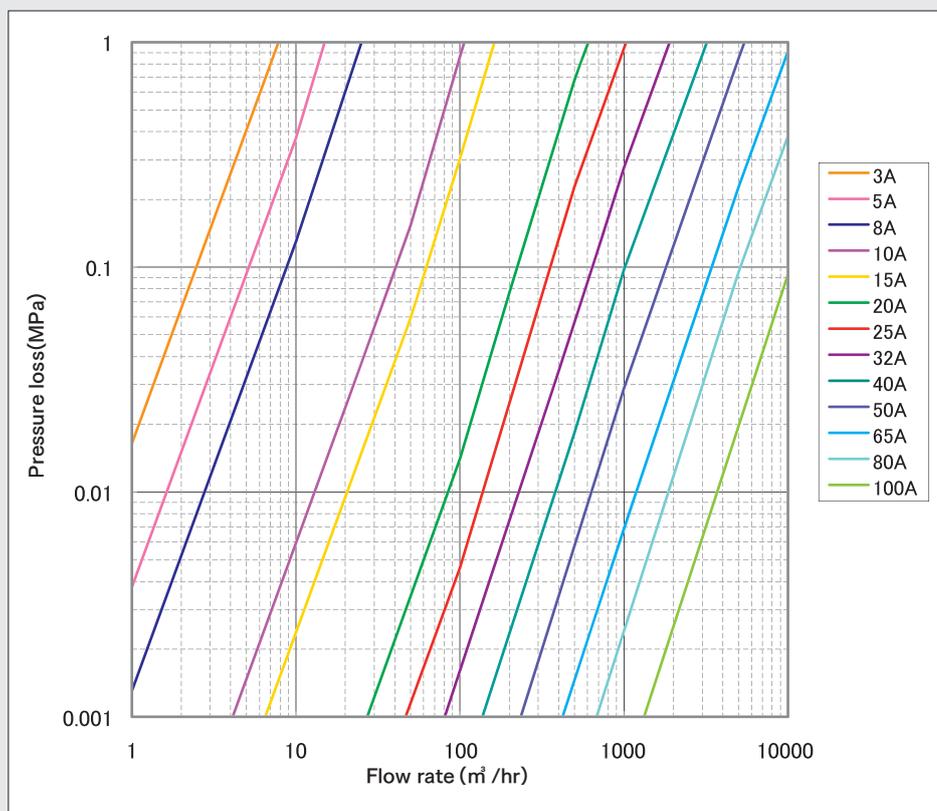


# Pressure loss (type SF)

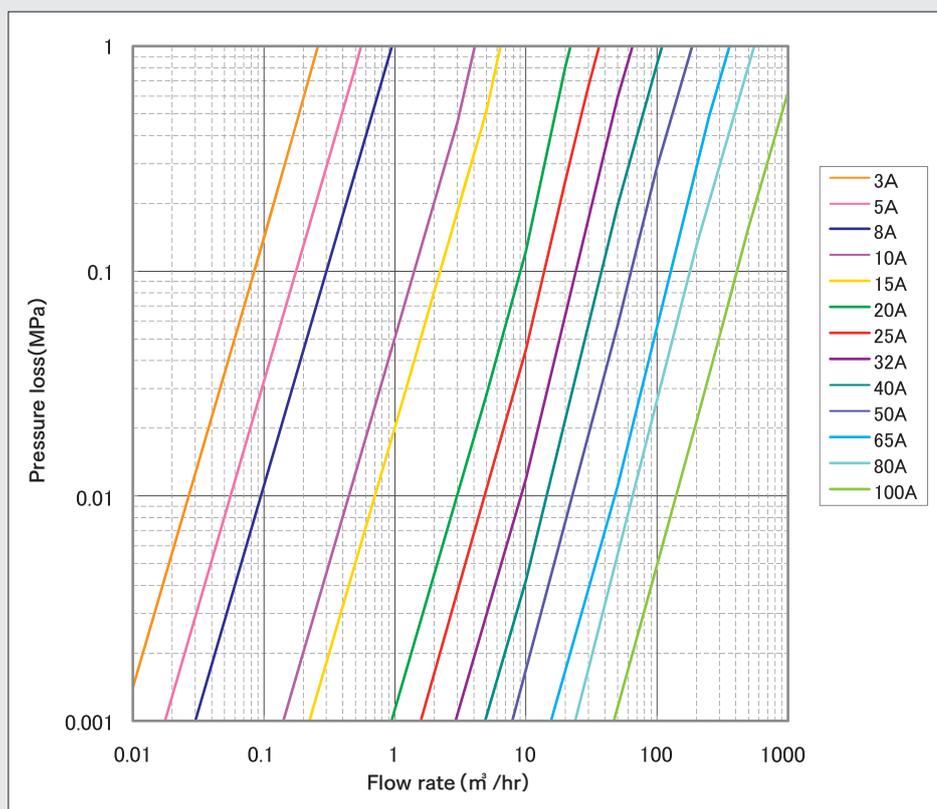
■ Pressure loss in 1 m of type SF flexible hose

■ The following charts show calculated values, and there are some errors between these values and the values of actual products.

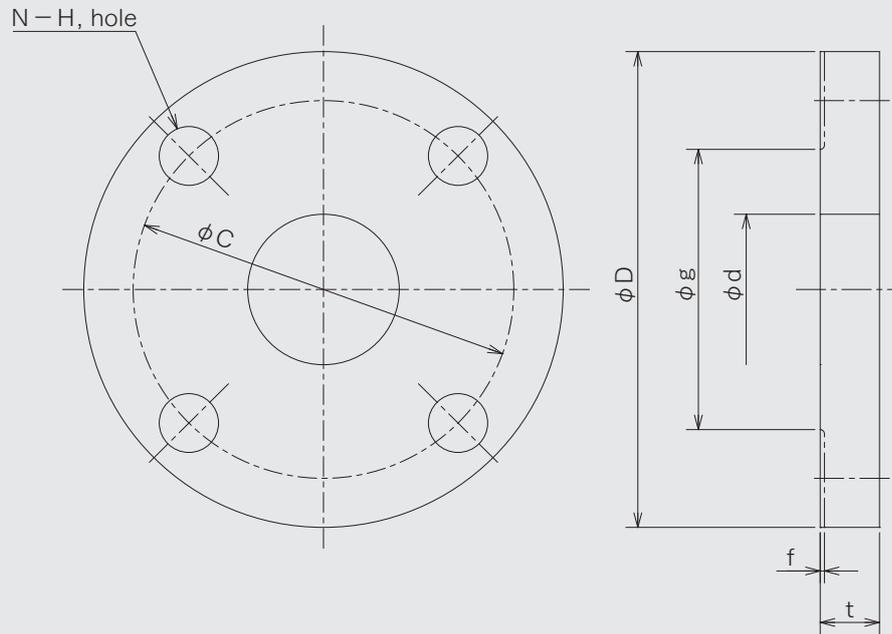
Air (20°C)



Water (20°C)

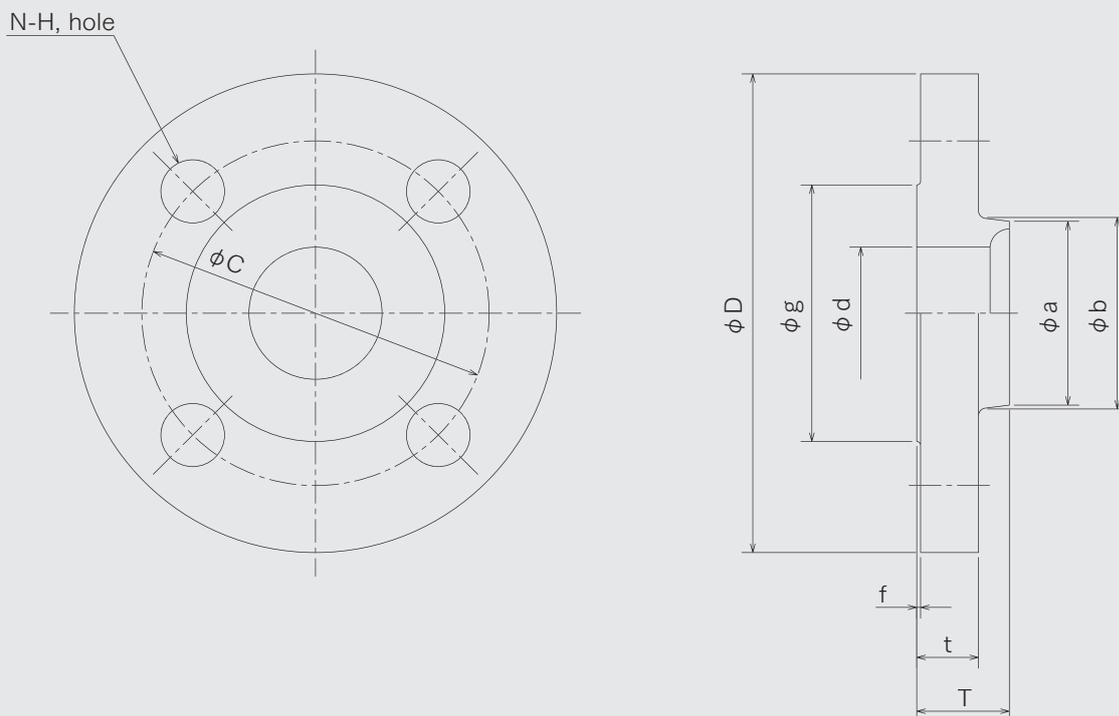


# Dimensions of flanges having nominal pressure of 10K(JIS B 2220 SOP)



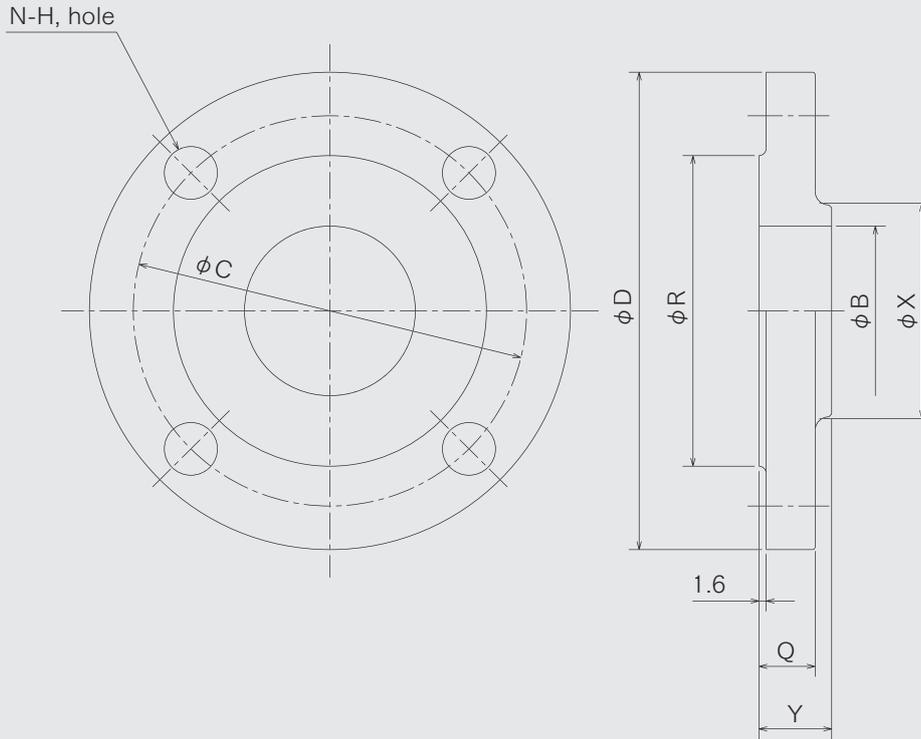
Nominal diameter		Flange outside diameter D	Flange thickness t	Inner diameter d	Raised face diameter g	Raised face height f	Pitch circle diameter C	Bolt hole H	Number of bolts N	Bolt
A	B									
10	3/8	90	12	17.8	48	1	65	15	4	M12
15	1/2	95	12	22.2	51	1	70	15	4	M12
20	3/4	100	14	27.7	56	1	75	15	4	M12
25	1	125	14	34.5	67	1	90	19	4	M16
32	1-1/4	135	16	43.2	76	2	100	19	4	M16
40	1-1/2	140	16	49.1	81	2	105	19	4	M16
50	2	155	16	61.1	96	2	120	19	4	M16
65	2-1/2	175	18	77.1	116	2	140	19	4	M16
80	3	185	18	90.0	126	2	150	19	8	M16
(90)	(3-1/2)	195	18	102.6	136	2	160	19	8	M16
100	4	210	18	115.4	151	2	175	19	8	M16
125	5	250	20	141.2	182	2	210	23	8	M20
150	6	280	22	166.6	212	2	240	23	8	M20
(175)	(7)	305	22	192.1	237	2	265	23	12	M20
200	8	330	22	218.0	262	2	290	23	12	M20
(225)	(9)	350	22	243.7	282	2	310	23	12	M20
250	10	400	24	269.5	324	2	355	25	12	M22
300	12	445	24	321.0	368	3	400	25	16	M22
350	14	490	26	358.1	413	3	445	25	16	M22
400	16	560	28	409	475	3	510	27	16	M24
450	18	620	30	460	530	3	565	27	20	M24
500	20	675	30	511	585	3	620	27	20	M24
550	22	745	32	562	640	3	680	33	20	M30
600	24	795	32	613	690	3	730	33	24	M30

# Dimensions of flanges having nominal pressure of 20K (JIS B 2220 SOH Type A)



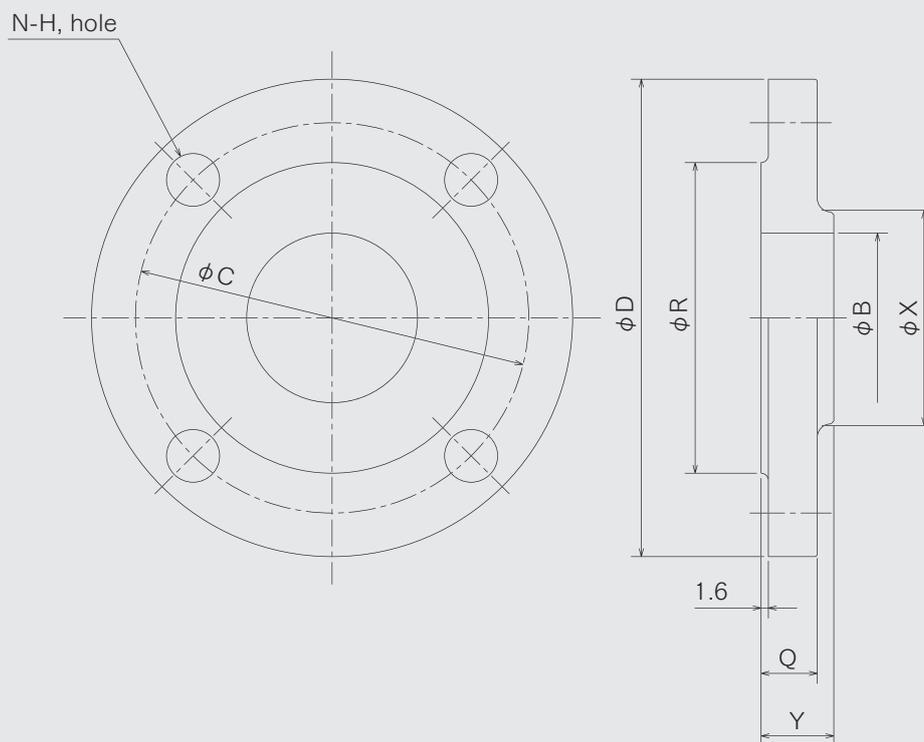
Nominal diameter		Flange outside diameter D	Flange thickness t	Inner diameter d	Overall length of flange T	Raised face diameter g	Raised face height f	Hub minor diameter a	Hub major diameter b	Pitch circle diameter C	Number of bolts N	Bolt hole H	Bolt
A	B												
10	3/8	90	14	17.8	20	46	1	30	32	65	4	15	M12
15	1/2	95	14	22.2	20	51	1	34	36	70	4	15	M12
20	3/4	100	16	27.7	22	56	1	40	42	75	4	15	M12
25	1	125	16	34.5	24	67	1	48	50	90	4	19	M16
32	1-1/4	135	18	43.2	26	76	2	56	60	100	4	19	M16
40	1-1/2	140	18	49.1	26	81	2	62	66	105	4	19	M16
50	2	155	18	61.1	26	96	2	76	80	120	8	19	M16
65	2-1/2	175	20	77.1	30	116	2	100	104	140	8	19	M16
80	3	200	22	90.0	34	132	2	113	117	160	8	23	M20
90	(3-1/2)	210	24	102.6	36	145	2	126	130	170	8	23	M20
100	4	225	24	115.4	36	160	2	138	142	185	8	23	M20
125	5	270	26	141.2	40	195	2	166	172	225	8	25	M22
150	6	305	28	166.6	42	230	2	196	202	260	12	25	M22
200	8	350	30	218.0	46	275	2	244	252	305	12	25	M22
250	10	430	34	269.5	52	345	2	304	312	380	12	27	M24
300	12	480	36	321.0	56	395	3	354	364	430	16	27	M24
350	14	540	40	358.1	62	440	3	398	408	480	16	33	M30x3
400	16	605	46	409	70	495	3	446	456	540	16	33	M30x3
450	18	675	48	460	78	560	3	504	514	605	20	33	M30x3
500	20	730	50	511	84	615	3	558	568	660	20	33	M30x3
550	22	795	52	562	90	670	3	612	622	720	20	39	M36x3
600	24	845	54	613	96	720	3	666	676	770	24	39	M36x3

# Dimensions of class 150Lb flanges (JPI-7S-15-1999, slip-on type)



Nominal diameter		Flange outside diameter D	Flange inside diameter B	Diameter of hub root X	Raised face diameter R	Thickness Q	Overall length Y	Pitch circle diameter C	Number of bolt holes N	Bolt hole H
A	B									
15	1/2	89	22.2	30.0	35.1	11.2	16	60.5	4	16
20	3/4	99	27.7	38.0	42.9	12.7	16	69.8	4	16
25	1	108	34.5	49.5	50.8	14.3	18	79.2	4	16
(32)	(1·1/4)	117	43.2	58.5	63.5	15.8	21	88.9	4	16
40	1·1/2	127	49.1	65.0	73.2	17.6	22	98.6	4	16
50	2	152	61.1	77.5	91.9	19.1	25	120.6	4	19
65	2·1/2	178	77.1	90.5	104.6	22.4	28	139.7	4	19
80	3	190	90.0	108	127.0	23.9	30	152.4	4	19
(90)	(3·1/2)	216	102.6	122	139.7	23.9	32	177.8	8	19
100	4	229	115.4	135	157.2	23.9	33	190.5	8	19
(125)	(5)	254	141.2	164	185.7	23.9	37	215.9	8	22
150	6	279	166.6	192	215.9	25.4	40	241.3	8	22
200	8	343	218.0	246	269.7	28.5	44	298.4	8	22
250	10	406	269.5	305	323.8	30.3	49	362.0	12	26
300	12	483	321.0	365	381.0	31.8	56	431.8	12	26
350	14	535	358.1	400	412.8	35.1	57	476.2	12	29
400	16	595	409.0	457	469.9	36.6	64	539.8	16	29
450	18	635	460.0	505	533.4	39.7	68	577.8	16	32
500	20	700	511.0	559	584.2	43.0	73	635.0	20	32
600	24	815	613.0	663	692.2	47.8	83	749.3	20	35

## Dimensions of class 300Lb flanges (JPI-7S-15-1999, slip-on type)



Nominal diameter		Flange outside diameter D	Flange inside diameter B	Diameter of hub root X	Raised face diameter R	Thickness Q	Overall length Y	Pitch circle diameter C	Number of bolt holes N	Bolt hole H
A	B									
15	1/2	95	22.2	38.0	35.1	14.3	22	66.5	4	16
20	3/4	117	27.7	48.0	42.9	15.8	25	82.6	4	19
25	1	124	34.5	54.0	50.8	17.6	27	88.9	4	19
(32)	(1-1/4)	133	43.2	63.5	63.5	19.1	27	98.6	4	19
40	1-1/2	155	49.1	70.0	73.2	20.6	30	114.3	4	22
50	2	165	61.1	84.0	91.9	22.4	33	127.0	8	19
65	2-1/2	190	77.1	100	104.6	25.4	38	149.4	8	22
80	3	210	90.0	117	127.0	28.5	43	168.1	8	22
(90)	(3-1/2)	229	102.6	133	139.7	30.3	44	184.2	8	22
100	4	254	115.4	146	157.2	31.8	48	200.2	8	22
(125)	(5)	279	141.2	178	185.7	35.1	51	235.0	8	22
150	6	318	166.6	206	215.9	36.6	52	269.7	12	22
200	8	381	218.0	260	269.7	41.2	62	330.2	12	26
250	10	444	269.5	321	323.8	47.8	67	387.4	16	29
300	12	520	321.0	375	381.0	50.8	73	450.8	16	32
350	14	585	358.1	425	412.8	53.9	76	514.4	20	32
400	16	650	409.0	483	469.9	57.2	83	571.5	20	35
450	18	710	460.0	533	533.4	60.5	89	628.6	24	35
500	20	775	511.0	587	584.2	63.5	95	685.8	24	35
600	24	915	613.0	702	692.2	69.9	106	812.8	24	42

# Dimensions of standard pipes

Pipe weight table

Nominal diameter		Outer diameter (mm)	JIS G 3459 Stainless steel pipes (SUS TP)													
			Nominal thickness													
			Sch 5S		Sch 10S		Sch 20S		Sch 40		Sch 80		Sch 120		Sch 160	
A	B	Thickness	Weight	Thickness	Weight	Thickness	Weight	Thickness	Weight	Thickness	Weight	Thickness	Weight	Thickness	Weight	
6	1/8	10.5	1.0	0.237	1.2	0.278	1.5	0.336	1.7	0.373	2.4	0.484	—	—	—	—
8	1/4	13.8	1.2	0.377	1.65	0.499	2.0	0.588	2.2	0.636	3.0	0.807	—	—	—	—
10	3/8	17.3	1.2	0.481	1.65	0.643	2.0	0.762	2.3	0.859	3.2	1.12	—	—	—	—
15	1/2	21.7	1.65	0.824	2.1	1.03	2.5	1.20	2.8	1.32	3.7	1.66	—	—	4.7	1.99
20	3/4	27.2	1.65	1.05	2.1	1.31	2.5	1.54	2.9	1.76	3.9	2.26	—	—	5.5	2.97
25	1	34.0	1.65	1.33	2.8	2.18	3.0	2.32	3.4	2.59	4.5	3.31	—	—	6.4	4.40
32	1-1/4	42.7	1.65	1.69	2.8	2.78	3.0	2.97	3.6	3.51	4.9	4.61	—	—	6.4	5.79
40	1-1/2	48.6	1.65	1.93	2.8	3.19	3.0	3.41	3.7	4.14	5.1	5.53	—	—	7.1	7.34
50	2	60.5	1.65	2.42	2.8	4.02	3.5	4.97	3.9	5.50	5.5	7.54	—	—	8.7	11.2
65	2-1/2	76.3	2.1	3.88	3.0	5.48	3.5	6.35	5.2	9.21	7.0	12.1	—	—	9.5	15.8
80	3	89.1	2.1	4.55	3.0	6.43	4.0	8.48	5.5	11.5	7.6	15.4	—	—	11.1	21.6
90	3-1/2	101.6	2.1	5.20	3.0	7.37	4.0	9.72	5.7	13.6	8.1	18.9	—	—	12.7	28.1
100	4	114.3	2.1	5.87	3.0	8.32	4.0	11.0	6.0	16.2	8.6	22.6	11.1	28.5	13.5	33.9
125	5	139.8	2.8	9.56	3.4	11.6	5.0	16.8	6.6	21.9	9.5	30.8	12.7	40.2	15.9	49.1
150	6	165.2	2.8	11.3	3.4	13.7	5.0	20.0	7.1	28.0	11.0	42.3	14.3	53.8	18.2	66.6
200	8	216.3	2.8	14.9	4.0	21.2	6.5	34.0	8.2	42.5	12.7	64.4	18.2	89.8	23.0	111
250	10	267.4	3.4	22.4	4.0	26.2	6.5	42.2	9.3	59.8	15.1	94.9	21.4	131	28.6	170
300	12	318.5	4.0	31.3	4.5	35.2	6.5	50.5	10.3	79.1	17.4	131	25.4	185	33.3	237
350	14	355.6	—	—	—	—	—	—	11.1	95.3	19.0	159	27.8	227	35.7	284
400	16	406.4	—	—	—	—	—	—	12.7	125	21.4	205	30.9	289	40.5	369
450	18	457.2	—	—	—	—	—	—	14.3	158	23.8	257	34.9	367	45.2	464
500	20	508.0	—	—	—	—	—	—	15.1	185	26.2	314	38.1	446	50.0	570
550	22	558.8	—	—	—	—	—	—	15.9	215	28.6	378	41.3	532	54.0	679
600	24	609.6	—	—	—	—	—	—	17.5	258	31.0	447	46.0	646	59.5	815
650	26	660.4	—	—	—	—	—	—	18.9	302	34.0	531	49.1	748	64.2	953

Nominal diameter		Outer diameter (mm)	JIS G 3454 Carbon steel pipes for pressure service (STPG)												JIS G 3452 Carbon steel pipes for ordinary piping (SGP)	
			Nominal thickness													
			Sch 10		Sch 20		Sch 30		Sch 40		Sch 60		Sch 80			
A	B	Thickness	Weight	Thickness	Weight	Thickness	Weight	Thickness	Weight	Thickness	Weight	Thickness	Weight	Thickness	Weight	
6	1/8	10.5	—	—	—	—	—	—	1.7	0.369	2.2	0.450	2.4	0.479	2.0	0.419
8	1/4	13.8	—	—	—	—	—	—	2.2	0.629	2.4	0.675	3.0	0.799	2.3	0.652
10	3/8	17.3	—	—	—	—	—	—	2.3	0.851	2.8	1.00	3.2	1.11	2.3	0.851
15	1/2	21.7	—	—	—	—	—	—	2.8	1.31	3.2	1.46	3.7	1.64	2.8	1.31
20	3/4	27.2	—	—	—	—	—	—	2.9	1.74	3.4	2.00	3.9	2.24	2.8	1.68
25	1	34.0	—	—	—	—	—	—	3.4	2.57	3.9	2.89	4.5	3.27	3.2	2.43
32	1-1/4	42.7	—	—	—	—	—	—	3.6	3.47	4.5	4.24	4.9	4.57	3.5	3.38
40	1-1/2	48.6	—	—	—	—	—	—	3.7	4.10	4.5	4.89	5.1	5.47	3.5	3.89
50	2	60.5	—	—	3.2	4.52	—	—	3.9	5.44	4.9	6.72	5.5	7.46	3.8	5.31
65	2-1/2	76.3	—	—	4.5	7.97	—	—	5.2	9.12	6.0	10.4	7.0	12.0	4.2	7.47
80	3	89.1	—	—	4.5	9.39	—	—	5.5	11.3	6.6	13.4	7.6	15.3	4.2	8.79
90	3-1/2	101.6	—	—	4.5	10.8	—	—	5.7	13.5	7.0	16.3	8.1	18.7	4.2	10.1
100	4	114.3	—	—	4.9	13.2	—	—	6.0	16.0	7.1	18.8	8.6	22.4	4.5	12.2
125	5	139.8	—	—	5.1	16.9	—	—	6.6	21.7	8.1	26.3	9.5	30.5	4.5	15.0
150	6	165.2	—	—	5.5	21.7	—	—	7.1	27.7	9.3	35.8	11.0	41.8	5.0	19.8
200	8	216.3	—	—	6.4	33.1	7.0	36.1	8.2	42.1	10.3	52.3	12.7	63.8	5.8	30.1
250	10	267.4	—	—	6.4	41.2	7.8	49.9	9.3	59.2	12.7	79.8	15.1	93.9	6.6	42.4
300	12	318.5	—	—	6.4	49.3	8.4	64.2	10.3	78.3	14.3	107	17.4	129	6.9	53.0
350	14	355.6	6.4	55.1	7.9	67.7	9.5	81.1	11.1	94.3	15.1	127	19.0	158	7.9	67.7
400	16	406.4	6.4	63.1	7.9	77.6	9.5	93.0	12.7	123	16.7	160	21.4	203	7.9	77.6
450	18	457.2	6.4	71.1	7.9	87.5	11.1	122	14.3	156	19.0	205	23.8	254	7.9	87.5
500	20	508.0	6.4	79.2	9.5	117	12.7	155	15.1	184	20.6	248	26.2	311	7.9	97.4
550	22	558.8	6.4	87.2	9.5	129	12.7	171	15.9	213	—	—	—	—	—	—
600	24	609.6	6.4	95.2	9.5	141	14.3	210	—	—	—	—	—	—	—	—
650	26	660.4	7.9	127	12.7	203	—	—	—	—	—	—	—	—	—	—

※The unit of dimensions is mm, and the unit of weight is kg/m.

※The data on 175A and 225A SGP are omitted.

※The weight values of pipes made of SUS 304 are shown as the weight of stainless steel pipes.

# Pipe heat deformation

Temperature (°C)	Steel pipe (mm)	Stainless steel pipe (mm)
-40	-0.645	-0.948
-30	-0.545	-0.792
-20	-0.435	-0.635
-10	-0.330	-0.478
0	-0.230	-0.326
10	-0.117	-0.175
20	-0.015	-0.016
30	0.103	0.152
40	0.218	0.321
50	0.328	0.488
60	0.442	0.654
70	0.553	0.824
80	0.670	0.994
90	0.784	1.162
100	0.917	1.332
110	1.044	1.504
120	1.153	1.674
130	1.270	1.847
140	1.403	2.021
150	1.527	2.193
160	1.660	2.367
170	1.790	2.545
180	1.922	2.725
190	2.059	2.905
200	2.192	3.086
210	2.328	3.268
220	2.470	3.449
230	2.606	3.634
240	2.743	3.816
250	2.880	3.996
260	3.017	4.175
270	3.160	4.355
280	3.309	4.535
290	3.454	4.723
300	3.602	4.909
310	3.750	5.097

Temperature (°C)	Steel pipe (mm)	Stainless steel pipe (mm)
320	3.895	5.282
330	4.057	5.470
340	4.210	5.660
350	4.367	5.851
360	4.520	6.040
370	4.672	6.230
380	4.836	6.423
390	4.995	6.617
400	5.149	6.813
410	5.310	7.004
420	5.471	7.198
430	5.633	7.394
440	5.796	7.549
450	5.972	7.800
460	6.140	7.998
470	6.304	8.192
480	6.473	8.394
490	6.636	8.595
500	6.798	8.796
510	6.959	9.000
520	7.121	9.204
530	7.284	9.406
540	7.445	9.605
550	7.617	9.814
560	7.788	10.015
570	7.962	10.217
580	8.135	10.428
590	8.310	10.637
600	8.475	10.838
610	8.635	11.042
620	8.790	11.237
630	9.946	11.452
640	9.104	11.655
650	9.268	11.859
660	9.437	12.059
670	9.603	12.264

※Heat deformation per m at each temperature based on deformation at 70° F (21.1° C) (extracted from EJMA)

# Corrosion table

■ This table is designed as a guide to selection of materials of flexible hoses and bellows.

■ The corrosion resistance varies depending on the fluid conditions, such as temperature and concentration. The performance shown in the table may not be assured.

○ : Applicable

× : Inapplicable

– : Unknown

Fluid	Concentration (%)	Temperature (°C)	SUS 304	SUS 316L	HASTELLOY	Fluid	Concentration (%)	Temperature (°C)	SUS 304	SUS 316L	HASTELLOY
Acetylene	100	40	○	○	○	Hydrochloric acid (aerated)	40	10	×	×	–
		200	○	○	–			10	10	×	×
Acetone	100	40	○	○	○	Chlorine	100		10	○	○
		100	○	–	○			90	100	○	○
	10	40	○	○	○		10		×	×	○
		100	○	–	○		100	–	–	×	
Sulfurous acid	100	40	×	×	×	Sea Water	100	25	×	×	○
		100	×	×	×	100	10	×	×	–	
	90	65	○	○	–	Hydrogen peroxide	10	10	○	○	○
10	10	×	×	×	100			×	×	–	
Sodium sulfite	50	10	–	○	–	Gasoline	150	100	○	○	○
		100	×	○	–	Gallium	150	100	○	–	×
	30	40	×	○	○	Ethylene glycol	100	10	○	○	–
100		×	○	○	100			○	○	–	
Ammonia (Anhydrous)	100	40	○	○	○	Glycerol	100	10	○	○	○
		200	○	○	○			200	○	○	○
Sulfur	100	40	×	○	○		10	10	○	○	○
		150	×	×	○	100		○	○	○	
	90	10	×	○	–	Chlorosilanes	100	10	×	×	×
150		–	×	×	100			×	×	×	
Isopropyl alcohol (isopropanol)	100	40	○	○	○	Crude oil	100	40	○	○	○
		100	○	○	○	Acetic acid (Aerated)	100	10	○	○	○
90	40	○	○	–	10			10	○	○	○
	100	○	○	○		100	○	○	○		
Ethanol (Ethyl alcohol)	100	40	○	○	○	Ethyl acetate	100	10	○	○	○
		100	○	○	○			90	10	○	○
	10	40	○	○	○		150		–	○	○
Ethane	100	40	○	○	–	Butyl acetate	100	25	○	○	○
		200	○	○	–			10	25	–	○
Ethylene glycol	100	40	○	○	–		100		100	○	○
		100	○	○	–	10		25	–	○	○
	100	10	×	–	○		100	100	–	○	○
100		–	–	×	Arsenic trichloride	100		10	×	×	×
Aluminum chloride	10	10	×	×			○	10	10	×	×
		100	–	–	○	Boron trichloride	100		25	×	×
Hydrogen chloride (Anhydrous)	100	40	○	○	○			90	10	×	–
		200	○	○	○	10	10		×	×	×
Ferrous chloride	70	40	–	–	×		Sodium hypochlorite	10	10	×	×
		10	10	×	×	×			×	×	
Ferric chloride	70	25	×	×	×	90	40	×	×	×	
		25	×	×	○		100	10	○	○	○
	10	25	×	×	○	90		10	×	×	–
Phosphoryl chloride (Phosphorus oxychloride)	100	10	○	○	×		Carbon tetrachloride	100	10	○	○
		150	×	×	×	100			100	○	○
	90	10	×	×	×			125	–	–	×
Magnesium chloride	100	40	–	–	○	90	10	×	–	–	
		100	–	–	○		100	10	○	○	○
	10	40	×	×	○	100		100	×	×	×
Methyl chloride	100	25	○	○	–		Cyclohexanol	100	10	○	○
		100	○	○	–	100			10	×	×
	90	25	×	–	–		100	100	×	×	×
Methylene chloride	100	25	○	×	○	Cyclohexane		100	10	×	×
		100	×	×	○		100		100	×	×
	90	25	○	○	–	Cyclohexene		100	10	×	×
100	100	–	○	–	100		100		×	×	×
Oxalic acid	100	10	×	×		×	100	10	×	×	×
		100	×	×	×	100		×	×	×	

■ This table is designed as a guide to selection of materials of flexible hoses and bellows.

■ The corrosion resistance varies depending on the fluid conditions, such as temperature and concentration. The performance shown in the table may not be assured.

○ : Applicable

× : Inapplicable

— : Unknown

Fluid	Concentration (%)	Temperature (°C)	SUS 304	SUS 316L	HASTELLOY	
Bromine-dry	100	10	×	—	○	
		100	×	×	×	
	90	10	—	—	×	
Bromine-wet	100	10	×	×	○	
		125	—	—	×	
90	10	10	—	—	×	
		100	×	×	○	
Nitric acid	30	10	○	○	—	
		125	×	×	—	
Potassium hydroxide	100	10	○	○	—	
		50	10	×	×	×
		100	×	×	×	
Sodium hydroxide	70	40	○	○	—	
		100	×	×	×	
		40	10	×	○	○
40	100	40	×	×	—	
		50	40	×	○	×
		10	40	×	○	×
Barium hydroxide	50	40	×	○	×	
		100	×	○	×	
		10	40	×	○	×
Sodium carbonate	100	40	○	○	○	
		100	○	○	○	
		10	40	○	○	○
Triethylene glycol	100	40	○	○	○	
		100	○	○	○	
		25	○	○	○	
Toluene	100	100	○	○	○	
		40	○	○	○	
Naphtha	100	100	○	○	○	
		40	○	○	○	
Carbon dioxide	100	40	○	○	○	
		100	○	○	○	
		10	40	○	○	○
Urea	50	40	×	×	—	
		100	×	×	—	
		10	10	○	○	—
Butane	100	40	×	×	—	
		100	○	○	○	
		40	○	○	○	
Hydrogen fluoride	100	40	×	○	○	
		150	—	×	×	
Hydrofluoric acid	100	10	—	○	○	
		40	×	—	×	
		40	10	×	—	○
Flourine gas	100	100	×	—	×	
		40	○	○	○	
		200	○	○	○	
Propane	100	40	○	○	○	
		100	○	○	○	
Benzene	100	40	○	—	×	
		100	○	—	×	
		10	40	○	○	×
100	100	40	○	○	×	
		100	○	○	×	
Pentane	100	40	×	×	○	
		100	×	×	○	
		40	○	○	○	

Fluid	Concentration (%)	Temperature (°C)	SUS 304	SUS 316L	HASTELLOY	
Boric acid	100	40	—	—	×	
		10	40	○	○	○
		150	○	○	○	
Maleic anhydride	100	25	○	○	—	
		200	○	○	—	
Acetic anhydride	100	40	×	○	○	
		100	×	○	○	
		10	40	—	—	○
Methanol	100	25	○	○	○	
		100	○	○	○	
		10	25	×	○	○
100	100	25	×	○	○	
		100	×	○	○	
		40	○	○	○	
Methane	100	40	○	○	○	
		100	○	○	○	
Methl ethyl ketone	100	25	○	○	○	
		100	○	○	×	
		10	25	×	×	×
100	100	25	×	×	×	
		100	×	×	×	
		40	○	○	○	
Iodine	100	150	—	×	○	
		40	○	○	×	
Hydrogen sulfide	100	40	○	○	×	
		100	×	×	×	
Sulfuric acid	100	10	○	○	—	
		40	×	×	—	
		50	10	×	×	○
40	100	40	×	—	×	
		40	×	○	×	
		100	×	○	×	
Zinc sulfate	40	10	○	○	○	
		100	×	○	○	
		10	100	×	○	○
Aluminum sulfate	100	10	○	○	×	
		100	×	×	×	
		90	10	○	○	○
Ammonium sulfate	40	100	×	×	○	
		10	10	×	×	×
		100	—	×	×	
Calcium sulfite	10	40	○	○	○	
		100	○	○	○	
Potassium sulfate	100	10	○	○	○	
		40	○	○	×	
Sodium sulfate	100	100	○	○	×	
		40	○	○	×	
		30	100	○	○	×
Barium sulfate	100	10	×	×	×	
		100	×	×	—	
		10	10	×	×	—
Magnesium sulfate	100	25	×	×	○	
		100	×	×	×	
		40	25	○	○	○
100	100	○	○	○		

# Unit conversion table

## Pressure

Pa	kPa	MPa	bar	atm	kgf/cm <sup>2</sup>	mmH <sub>2</sub> O (mmAq)	mmHg (Torr)	psi
1	1×10 <sup>-3</sup>	1×10 <sup>-6</sup>	1×10 <sup>-5</sup>	9.86923×10 <sup>-6</sup>	1.01972×10 <sup>-5</sup>	1.01972×10 <sup>-1</sup>	7.50062×10 <sup>-3</sup>	1.45×10 <sup>-4</sup>
1×10 <sup>3</sup>	1	1×10 <sup>-3</sup>	1×10 <sup>-2</sup>	9.86923×10 <sup>-3</sup>	1.01972×10 <sup>-2</sup>	1.01972×10 <sup>2</sup>	7.50062	1.45×10 <sup>-1</sup>
1×10 <sup>6</sup>	1×10 <sup>3</sup>	1	10	9.86923	1.01972×10	1.01972×10 <sup>5</sup>	7.50062×10 <sup>3</sup>	1.45×10 <sup>2</sup>
1×10 <sup>5</sup>	1×10 <sup>2</sup>	1×10 <sup>-1</sup>	1	9.86923×10 <sup>-1</sup>	1.01972	1.01972×10 <sup>4</sup>	7.50062×10 <sup>2</sup>	1.45×10
1.01325×10 <sup>5</sup>	1.01325×10 <sup>2</sup>	1.01325×10 <sup>-1</sup>	1.01325	1	1.03323	1.03323×10 <sup>4</sup>	7.60000×10 <sup>2</sup>	1.47×10
9.80665×10 <sup>4</sup>	9.80665×10	9.80665×10 <sup>-2</sup>	9.80665×10 <sup>-1</sup>	9.67841×10 <sup>-1</sup>	1	1×10 <sup>4</sup>	7.35559×10 <sup>2</sup>	1.422×10
9.80665	9.80665×10 <sup>-3</sup>	9.80665×10 <sup>-6</sup>	9.80665×10 <sup>-5</sup>	9.67841×10 <sup>-5</sup>	1×10 <sup>-4</sup>	1	7.35559×10 <sup>-2</sup>	1.422×10 <sup>-3</sup>
1.33322×10 <sup>2</sup>	1.33322×10 <sup>-1</sup>	1.33322×10 <sup>-4</sup>	1.33322×10 <sup>-3</sup>	1.31579×10 <sup>-3</sup>	1.35951×10 <sup>-3</sup>	1.35951×10	1	1.933×10 <sup>-2</sup>
6.895×10 <sup>3</sup>	6.895	6.895×10 <sup>-3</sup>	6.895×10 <sup>-2</sup>	6.800×10 <sup>-2</sup>	7.031×10 <sup>-2</sup>	7.031×10 <sup>2</sup>	5.171×10	1

## Nominal diameter

A	B
8	1/4
10	3/8
15	1/2
20	3/4
25	1
32	1·1/4
40	1·1/2
50	2
65	2·1/2
80	3
90	3·1/2
100	4
125	5
150	6
200	8
250	10
300	12
350	14
400	16
450	18
500	20
550	22
600	24
650	26
700	28
750	30
800	32
850	34
900	36
950	38
1000	40
1050	42
1100	44
1150	46
1200	48
1250	50
1300	52
1350	54
1400	56
1450	58
1500	60

## Stress

MPa (N/mm <sup>2</sup> )	kgf/mm <sup>2</sup>
1	1.01972×10 <sup>-1</sup>
9.80665	1

## Force

N	kgf	lbf
1	1.01972×10 <sup>-1</sup>	2.2481×10 <sup>-1</sup>
9.80665	1	2.20462
4.4482	4.5359×10 <sup>-1</sup>	1

## Length

m	in	ft
1	3.937×10	3.281
2.540×10 <sup>-2</sup>	1	8.333×10 <sup>-2</sup>
3.048×10 <sup>-1</sup>	12	1

## Weight

kg	lb	ton
1	2.205	1×10 <sup>-3</sup>
4.536×10 <sup>-1</sup>	1	4.536×10 <sup>-4</sup>
1000	2205	1

## Flow rate

Pa·m <sup>3</sup> /sec	Torr·ℓ/sec	atm·cm <sup>3</sup> /sec	scm
1	7.50062	9.86923	5.92154×10 <sup>2</sup>
1.33322×10 <sup>-1</sup>	1	1.31579	7.89474×10
1.01325×10 <sup>-1</sup>	7.60000×10 <sup>-1</sup>	1	60
1.68875×10 <sup>-3</sup>	1.26667×10 <sup>-2</sup>	1.66667×10 <sup>-2</sup>	1

## Temperature

K	°C	°F
0	-273.15	-459.67
273.15	0	32
255.37	-17.78	0



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