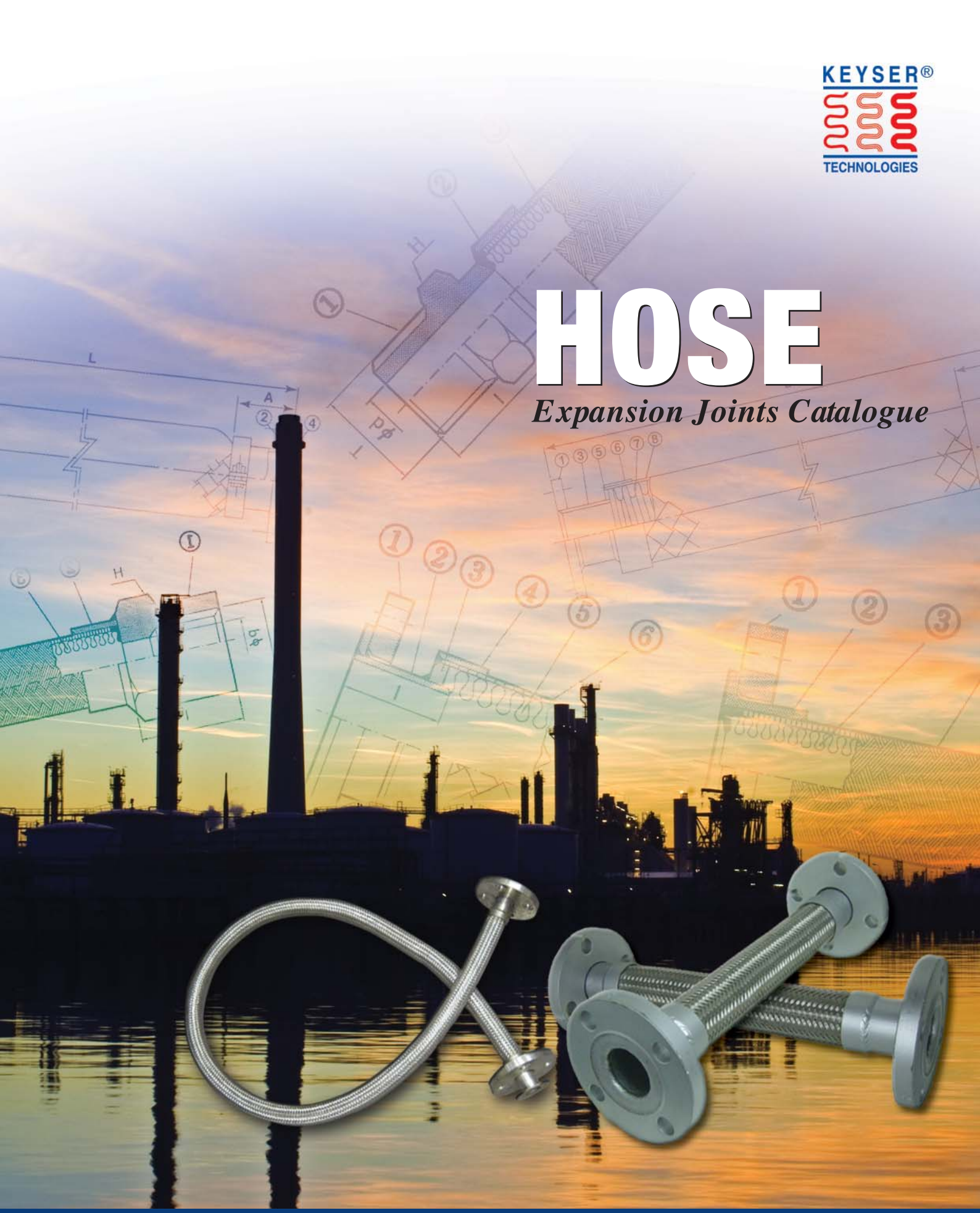
KEYSER®
TECHNOLOGIES

HOSE

Expansion Joints Catalogue

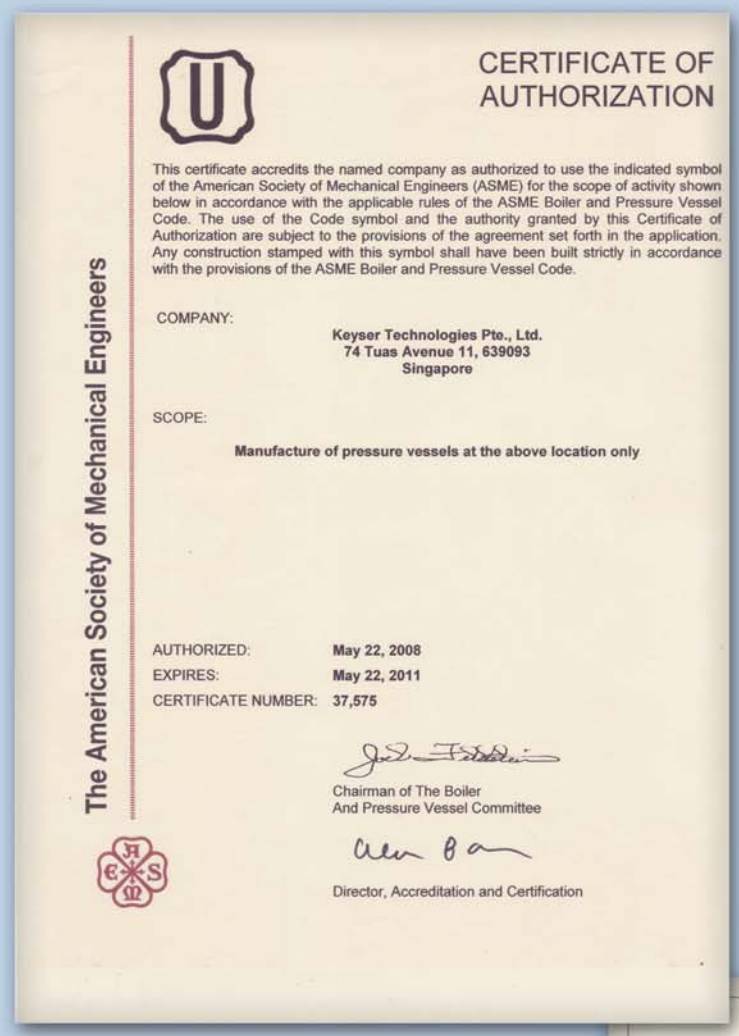


American Society of Mechanical Engineers
"U" Stamp Accredited

DNV
UKAS QUALITY MANAGEMENT 013

KEYSER TECHNOLOGIES PTE LTD
(DESIGN, MANUFACTURE OF EXPANSION JOINTS & ASSOCIATED STEEL FABRICATION WORKS)

Catalogue compiled and printed in 2009



CERTIFICATE OF AUTHORIZATION

The American Society of Mechanical Engineers

This certificate accredits the named company as authorized to use the indicated symbol of the American Society of Mechanical Engineers (ASME) for the scope of activity shown below in accordance with the applicable rules of the ASME Boiler and Pressure Vessel Code. The use of the Code symbol and the authority granted by this Certificate of Authorization are subject to the provisions of the agreement set forth in the application. Any construction stamped with this symbol shall have been built strictly in accordance with the provisions of the ASME Boiler and Pressure Vessel Code.

COMPANY:

Keyser Technologies Pte., Ltd.
74 Tuas Avenue 11, 639093
Singapore

SCOPE:

Manufacture of pressure vessels at the above location only

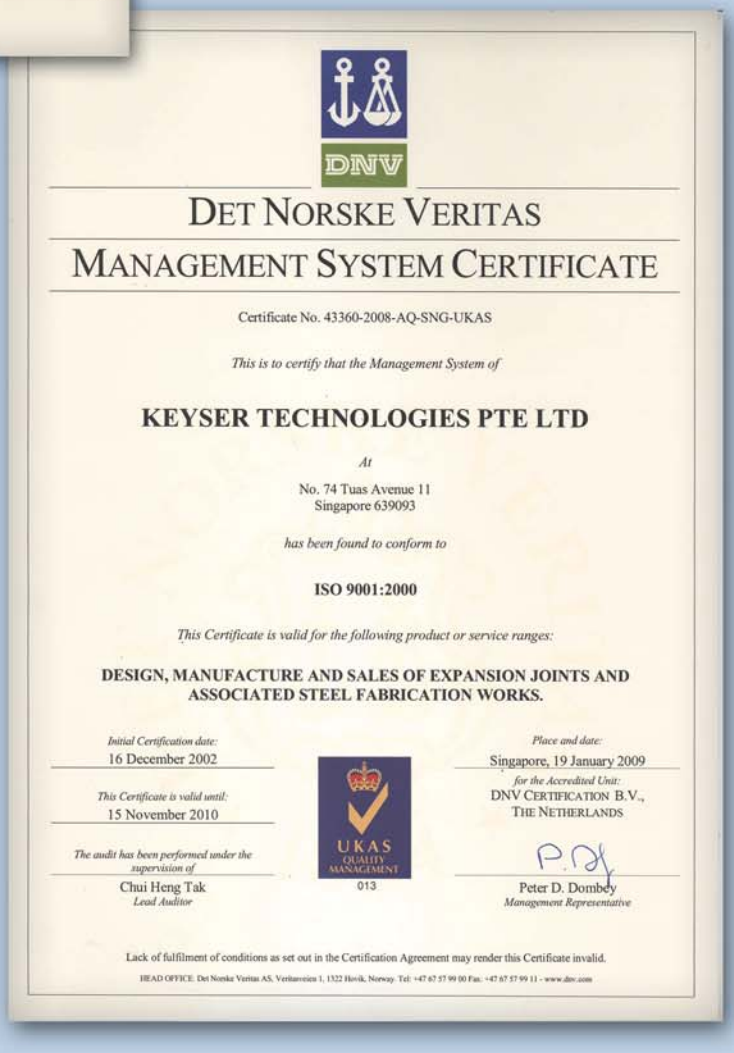
AUTHORIZED: **May 22, 2008**
EXPIRES: **May 22, 2011**
CERTIFICATE NUMBER: **37,575**

Chairman of The Boiler
And Pressure Vessel Committee

Director, Accreditation and Certification

The ***American Society of Mechanical Engineers (ASME)*** is a professional society focused on mechanical engineering known for setting codes and standards for mechanical devices. The ASME was founded in 1880 by Alexander Lyman Holley, Henry Rossiter Worthington, John Edison Sweet and Matthias N. Forney in response to numerous steam boiler pressure vessel failures. The ASME conducts one of the world's largest technical publishing operations through its ASME Press, holds numerous technical conferences and hundreds of professional development courses each year, and sponsors numerous outreach and educational programs.

As of 2006, the ASME has 120,000 members.



DNV

DET NORSKE VERITAS

MANAGEMENT SYSTEM CERTIFICATE

Certificate No. 43360-2008-AQ-SNG-UKAS

This is to certify that the Management System of

KEYSER TECHNOLOGIES PTE LTD

At

No. 74 Tuas Avenue 11
Singapore 639093

has been found to conform to

ISO 9001:2000

This Certificate is valid for the following product or service ranges:

DESIGN, MANUFACTURE AND SALES OF EXPANSION JOINTS AND ASSOCIATED STEEL FABRICATION WORKS.

Initial Certification date: 16 December 2002

This Certificate is valid until: 15 November 2010

The audit has been performed under the supervision of
Chui Heng Tak
Lead Auditor

UKAS QUALITY MANAGEMENT
013

Place and date: Singapore, 19 January 2009

for the Accredited Unit:
DNV CERTIFICATION B.V.,
THE NETHERLANDS

Peter D. Dombey
Management Representative

Lack of fulfilment of conditions as set out in the Certification Agreement may render this Certificate invalid.

HEAD OFFICE: Det Norske Veritas AS, Veritasveien 1, 1322 Hovik, Norway. Tel: +47 67 57 99 00 Fax: +47 67 57 99 11 - www.dnv.com

Stiftelsen Det Norske Veritas or DNV, established in 1864 in Norway, is a classification society organized as a foundation, with the objective of "Safeguarding life, property, and the environment". It was established in Norway to inspect and evaluate the technical condition of Norwegian merchant vessels.Together with Lloyd's Register and American Bureau of Shipping, DNV is one of the three major companies in the classification society business. DNV has its headquarters in Norway and has 300 offices in 100 countries, with 8,400 employees.

Important industries where the company operates include ship transport, energy, aviation, automotive, finance, food, heath care and information technology. It also conducts research in several fields where it operates.

KEYSER®
TECHNOLOGIES

VISION STATEMENT

Together, we will be the recognised leader in our industry for quality, service and responsiveness to customer needs.

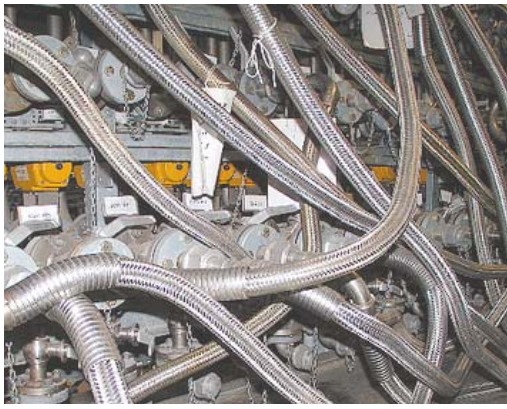
MISSION STATEMENT

Our mission is to provide the highest quality products and services to our customers. We will do this through investments in technology, product innovations, production processes, and the people, who are our asset to growth and profitability. Keyser Technologies shall continually improve the effectiveness of the company's quality management system.

OUR VALUES

- Respect for individuals
- Superior Customer Service
- Pride in craftmanship
- Honesty and Integrity
- Teamwork
- Strong Work Ethic
- Simplicity
- An atmosphere of open communications





INTRODUCTION

Keyser Technologies Pte Ltd specializes in the Manufacturing of Thermal Expansion Joints in Singapore. Keyser was established in Year 1995, solely as a Trading Service Company in various products. In Year 1999, Keyser entered into Metal Expansion Joints Industry and ventured with full steam into the Manufacturing of Metal Expansion Joints. This is where the first KEYFLEX bellow was produced. Since then, Keyser has progressively grown and expanded into many sectors of industry in Singapore, Asia and Pacific regions.

Keyser Technologies Pte Ltd is a diversified company where our main activity is to supply Expansion Joints in Metal, Rubber and Fabric types. We also provide a wide range of services, such as fabrication work and trading services. Of Quality ASSURANCE, Keyser obtained the Quality System Standard, as an ISO 9001:2000 Company in Singapore, certified by Det Norske Veritas (DNV). We are also accredited to ASME Stamp by Association of Mechancial Engineers (ASME). With respect to ISO 9001:2000 certification and America Society of Mechanical Engineering (ASME) U Symbol Stamp, Keyser is recognized in the Designing, Manufacturing and Sales of Thermal Expansion Joints and Associated Steel Fabrication Works. From the achieving of ISO 9001:2000 certification, Keyser holds a very strong stand in:

- Supplying high quality products;
- Prompt & efficient delivery;
- Providing premium services to our customers.

Keyser Technologies leads the region in advanced flexible hose engineering. Keyser has an unrivalled reputation in the design, manufacture and supply of a wide range of metal hoses in the region to suit various industries. The series of stringent tests and quality control ensures a product of the highest possible quality that meets the stringent demands of the industry today. Keyser's metal hoses are used throughout the region for use in automotive, petrol chemical plants, power generator plants and other industrial applications.

SELECTION OF METAL HOSES

A number of factors affect the selection of the right metal hose for the right application.

1. Pressure

a. Maximum Working Pressure

This is the maximum operating pressure the hose will be subjected to. It is usually at 25% of the ***Nominal Design Burst Pressure.***

b. Maximum Proof Pressure

This is the maximum test pressure the hose will be subjected to. It is usually at 150% of the ***Maximum Working Pressure*** with the hose installed straight.

c. Nominal Design Burst Pressure

This is the pressure point where the hose can be expected to rupture. Based on the minimum annealed tensile strength of the braid wire and corrugated hose alloys at 21ºC with the hose installed straight.

d. Shock Pressures

When this occur possibly due to fast closing valves, the peak pressure shall not exceed 50% of the ***Maximum Working Pressure***.

e. Pressure Relative to Unbraided Hose

At Maximum Working Pressure, 1 to 2.5% elastic elongation might take place in unbraided hose assembly. The unbraided hose should be unrestrained at one end or installed in a manner to allow free axial expansion due to pressure. This is to avoid squirm from occurring.

f. Pressure Relative to Braided Hose

Elongation occurs when internal pressure is applied to a corrugated metal hose. To avoid this, a wire braid sheath over the hose is applied. The braid has minimal effects on the bending and flexibility.

g. Pressure Relative to Temperature

For operating temperatures in excess of 21ºC, the tabulated pressures must be decreased in accordance with the table below.

Correction Factors
Apply to pressure rating for elevated

Temperature ºC	Material				
	Stainless Steel	Steel	Monel	Bronze	Inconel
20	1.00	1.00	1.00	1.00	1.00
66	.97	.99	.93	.92	.97
93	.94	.97	.90	.89	.94
121	.92	.96	.87	.86	.92
150	.88	.93	.83	.83	.88
177	.86	.91	.82	.81	.86
200	.83	.87	.79	.78	.83
230	.81	.86	.77	.75	.81
260	.78	.81	.73		.78
316	.74	.74	.72		.74
427	.66	.52	.70		.66
482	.62	.50			.62
538	.60				
593	.58				
649	.55				
704	.50				
760	.44				
816	.40				

Consult Keyser Technolgies whenever service conditions necessitate consideration of the influence of long time exposure at elevated temperature.

2. Maximum Service Temperatures Of Materials

Maximum Service Temperature			
Alloy	**Max. Temp. °C**	**Alloy**	**Max. Temp. °C**
Iconel 625	982	Brazing (RCuZn or BCuP-2)	
AISI Stainless Steel Type:		Bonze Hose	232
321	816	Steel Hose	454
316 ELC	816	Silvre Brazing(AWS-BAg-2)	316
304L	816	Aluminium 525-0 (5052-0)	316
304	454	Galvanizing	232
302	454	Soft Solder (Pb: 60, Sn: 40)	121
Mild Steel	454	(Pb: 95, Sn: 5)	177
Malleable Iron	427		
Manel	427		
Bronze	232		
Brass	232		
Copper	204		

Consult Keyser Technolgies whenever service conditions necessitate consideration of the influence of long time exposure at elevated temperature.

3. Flow Velocity

a. Use of a fully interlocked flexible metal hose

Where flow velocity exceeds 30.5m/sec (gas) / 15.25m/sec (liquid) in unbraided hose, or in 45.75m/sec (gas) / 22.84m/sec (liquid).

In conditions where there are bends, these flow conditions should be reduced by 50% for a 90º bend and 25% for a 45º bend.

b. Use of corrugated metal hose

When the amount of pressure drop through longer lengths of hose is a significant factor, a larger diameter hose may be required. Generally, pressure drop through a corrugated metal hose is approximately three times that in comparable size standard steel pipe.

4. Motion

a. Offset Motion

Offset motion is the parallel motion that occurs in a tube with flanges at both ends, while the distance between the flanges remain the same.

b. Radial Motion

When a tube is bent and attached, radial motion is the horizontal or vertical motion at the beginning of the circular arc. Generally called a moving loop, the amount of motion is expressed as the horizontal or vertical distance moved.

c. Axial Motion

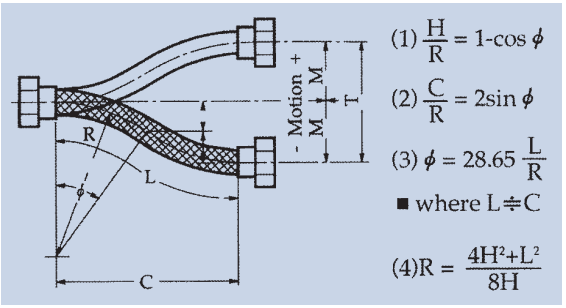
Axial motion refers to the dimensional variation of a flexible tube along its longitudinal axis, and displacement is expressed as the amount of extension/contraction.

d. Permanent Bend

Permanent Bends are used in place of ordinary bent pipe to simplify the connection of two piping systems.

e. Random Motion

This is the last mode of motion. A good example will be the garden hose. When it is freely handled, it moves randomly.



(1) $\frac{H}{R} = 1\text{-}\cos\phi$

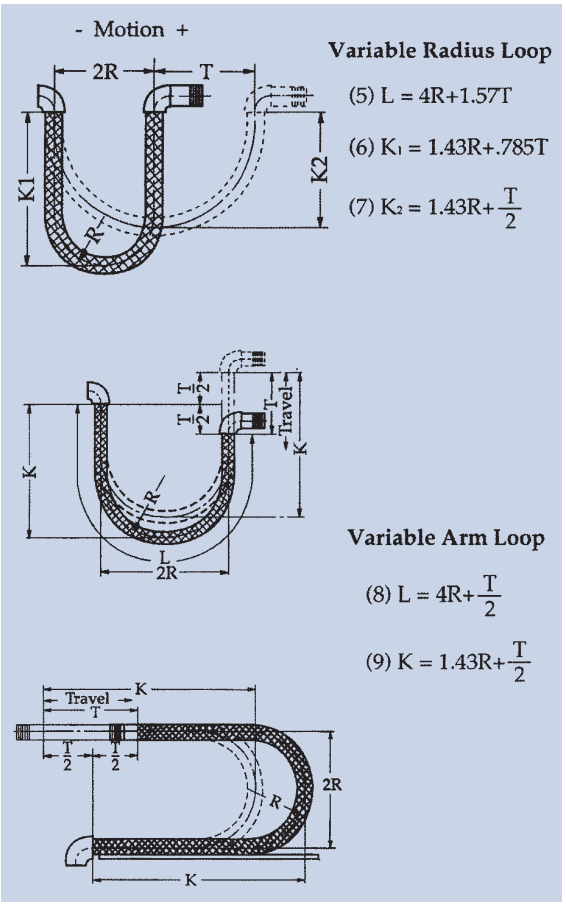
(2) $\frac{C}{R} = 2\sin\phi$

(3) $\phi = 28.65\frac{L}{R}$

■ where $L \doteqdot C$

(4) $R = \frac{4H^2+L^2}{8H}$

T	= total offset	mm
M	= offset one side of center	mm
H	= $+\frac{M}{2} = +\frac{T}{4}$	
L	= live length	mm
C	= Projected length	mm
R	= centerline bend radius	mm
ϕ	= offset angle	



Variable Radius Loop

(5) $L = 4R+1.57T$

(6) $K_1 = 1.43R+.785T$

(7) $K_2 = 1.43R+\frac{T}{2}$

Variable Arm Loop

(8) $L = 4R+\frac{T}{2}$

(9) $K = 1.43R+\frac{T}{2}$

T	= total offset	mm
L	= live length	mm
R	= bend radius	mm
K	= loop length	mm

5. Motion Frequency

A flexible metal hose may be subjected to repeated flexing or bending. Generally, these are separated into basic categories, vibration, intermittent, continuous and static bend.

a. Vibration

Vibration is shown as the un-shaded area of the chart in the diagram. When the expected combination of double amplitude and frequency falls into the shaded area, consult our engineers.

b. Intermittent Motion

This refers to the motion that occurs on a regular or irregular cyclic basis due to thermal expansion and contraction.

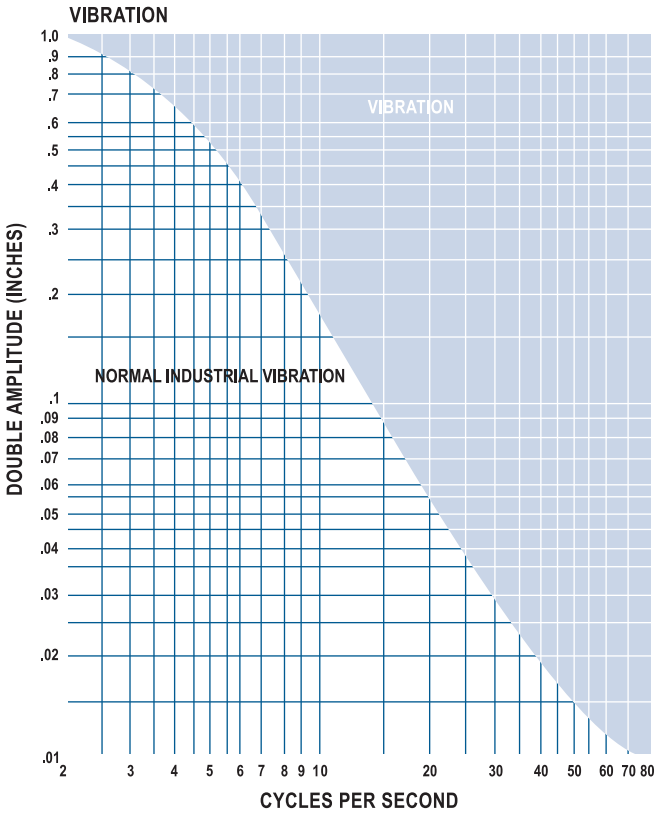
c. Continuous Motion

This refers to the motion that occurs on a regular cyclic basis normally at a slow cyclic rate and constant travel.

d. Static Bend

This refers to the minimum centre line bend radius which a flexible metal hose may

be bent for installation.



6. Cycle Life

The cycle life is affected by several factors such as operating pressure, operating temperature, bend radius, materials used etc. The cycle life is also proportional to the sum of the pressure stress range and deflection stress range.

Please note that all these information serves as a general guide only.

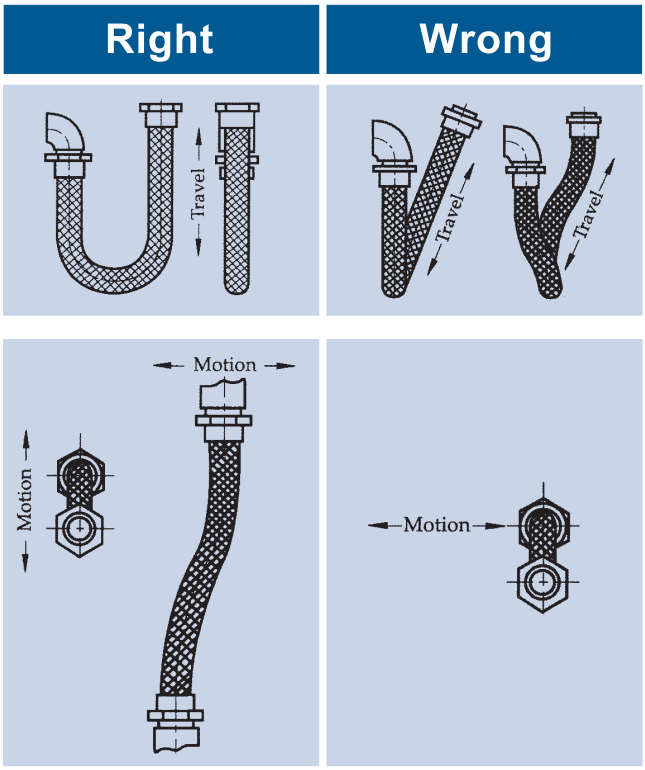
INSTALLATION METHODS

When installing hoses, there are 2 basic things to take note of.

1) Do Not Torque

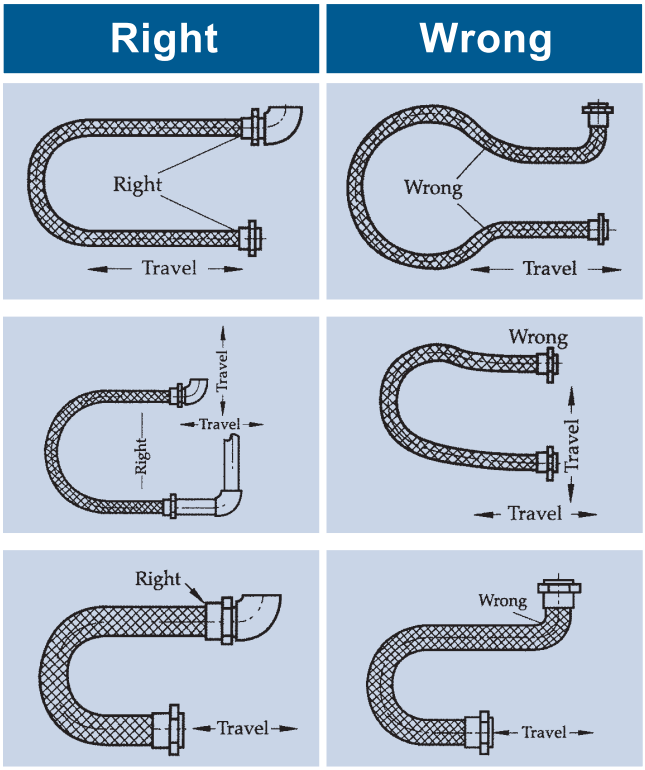
a. Use of unions or floating flanges to minimize possible torque damage to flexible tubes.

b. Always install tubes so that flexing takes place in one plane only.



2) Avoid Sharp Bend

a. Due to improper installation, flexible tube can be subjected to recurring sharp bends, which might result in fatigue and premature failure.



TYPES & APPLICATIONS

Keyser offers a comprehensive range of flexible hoses. The main advantages of metal hose include high resistance to both high and low temperatures, high strength, high corrosion resistance. They also reduce significantly any vibration or noise. They connects rigid piping which are misaligned to moving parts of machinery and equipments. A variety of choice of metal is available. Eg. Bronze, stainless steel, monel and inconel.

Types Of Hoses

Corrugated Metal Hose

Our complete range is widely used for conveying high pressure and temperature, corrosive and non-corrosive liquids, searching gases and dry materials. We are capable to manufacturing a full range from 1/4" to 16" ID.

Available Materials
Monel, Bronze, Carbon Steel, 321 SS, 316 SS

Interlocking Hose

Interlocked metal hose by helically winding and folding together the edges of specifically pre-formed metal strip. For low-pressure application or where pressure loss is to be held at a minimum, a pre-formed groove inside the interlocked joint is packed with copper/stainless steel wire and asbestos cord.

Bellows

Used primarily used as valve seals and pressure sensing devices, as well as flow channels for all types of media, Keyser Bellows are formed from lap-or butt-welded stainless steel, monel, inconel, hastelloy or any materials that can be weld.

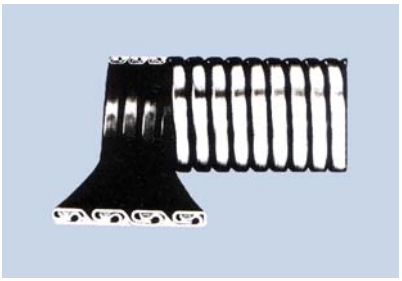
Available Materials
Galvanized Steel, Stainless Steel, Bronze, Aluminum

Interlocked Pressure Hose

High grade treated non-metal packing is simultaneously wound with the metal strip and located in a formed groove. This non-metal high temperature packing in fully-locked construction withstands the pressures to conduct safely non-searching media like water, oils etc. Available in sizes from 1”through 4” diameters.

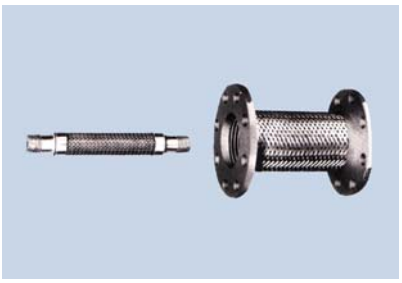
Tar & Asphalt Hose

Used for handling dangerous hottar, asphalt and oil because of their great strength and dependability, Keyser Tar & Asphalt hose incorporates a special helical winding with an non-metal high temperature packing. These are available in a variety of sizes from 3/4” to 4” ID.



Vibra Masters

Keyser Vibra Masters are available in annular corrugated stainless/carbon steel or bronze hoses. Noises, together with pump vibration will be absorbed by these Vibra Masters.



Available Materials

Bronze, Steel, Stainless Steel

TYPES OF PROTECTION

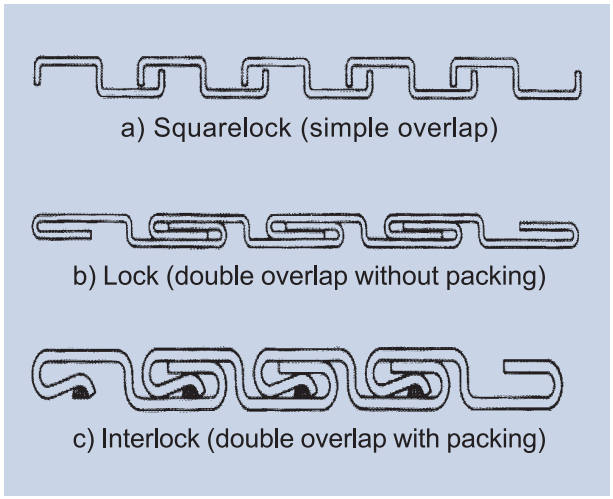
A flexible metal casing is used to protect the annular corrugated metal hose when it is subjected to external abuse such as dragging etc. Flex-wound interlocked metal hose provides this additional protection. Other coatings such as synthetics are also available on request. There are 2 methods of protection.

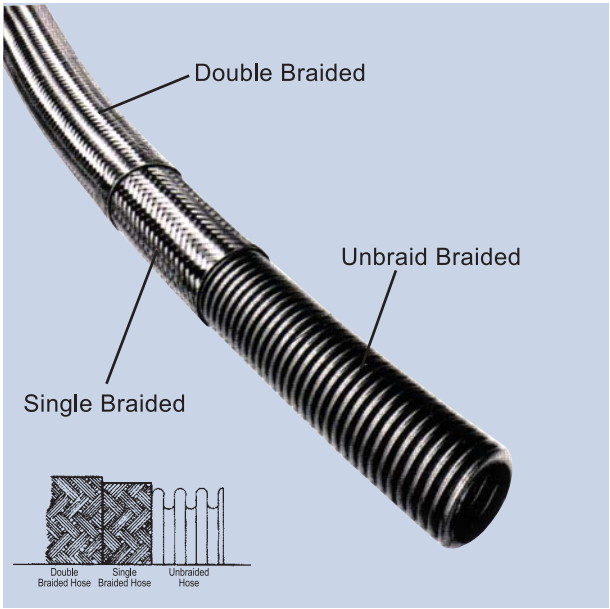
Protection Cover

This basic construction type can be categorized by:

a. Double overlap interlock type with packing
b. Double overlap interlock type without packing
c. Simple overlap squarelock type

* Materials used are Monel, Bronze, PVC, Zinc & Stainless Steel

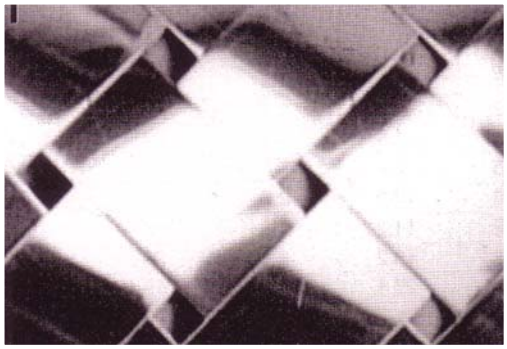




Double Braided

For very high pressure applications, double braided is recommended and for of moderate pressure applications, single braided is recommended. In low pressure applications, braiding is not necessary.

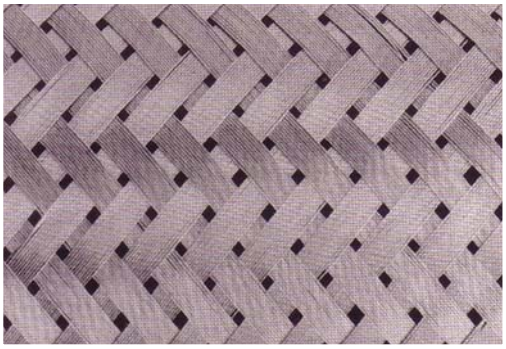
TYPES OF BRAID



Ribbon Strip Braids

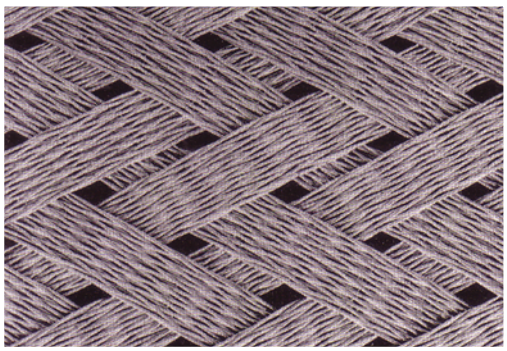
These can be applied where cracks can be easily formed due to fatigue and high movement frequencies.

a. Exceed 3m in length
b. Used for stationary piping



Flat Wire Braids

a. Used most frequently
b. Used primarily for moving pipes
c. Excels in flexible resistance and pressure resistance.



Braided Braids

a. Resistance to pressure significantly increases without sacrificing flex resistance
b. Increase in stretch ability
c. Maximum of 20 plys
d. Used primarily for moving pipes

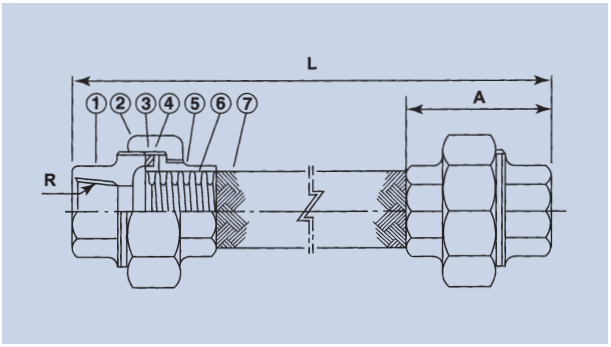
EXAMPLES OF DIFFERENT TYPES AND THEIR USAGE

KN-F100

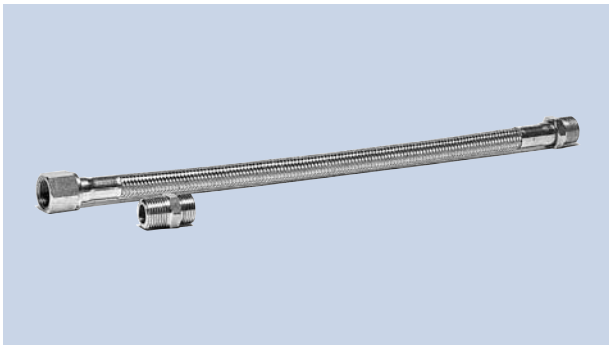
Features
- Both ends union female thread
- Material FCMB
- Easy piping work & low cost

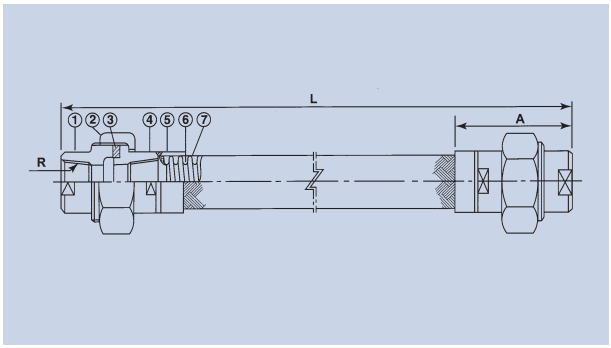
Purpose Of Application
- Pipe alignment
- Absorption of thermal deformation
- Absorption of machine vibration
- Connection with machine and pipe

Applications
- Air-conditioning connection
- Pump connection
- Connection for various machines



No.	Parts	Materials
1	Union Screw	FCMB
2	Union Nut	FCMB
3	Packing	Asbestos
4	Union Collar	SUS304
5	Union Sleeve	FCMB
6	Flexible Tube	SUS304
7	Braid	SUS304





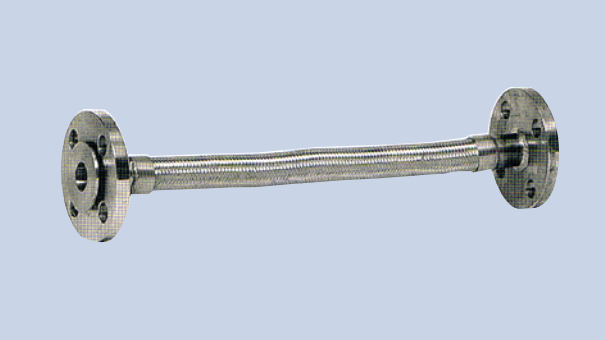
KN-F300

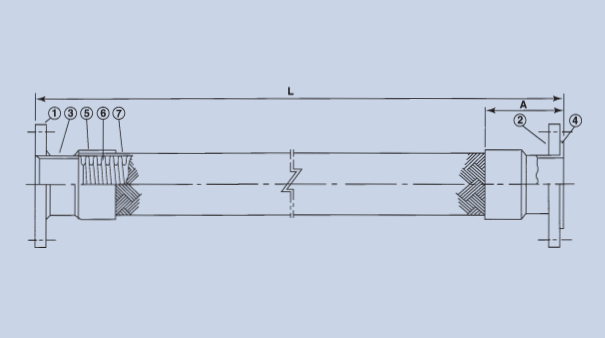
Features
- Both ends union female thread
- Suitable for high pressure
- Both union material can be selected depending on fluid

Purpose Of Application
- Pipe alignment
- Absorption of thermal deformation
- Absorption of machine vibration
- Connection with machine and pipe

Applications
- Air-conditioning connection
- Pump connection
- Connection for various machines

No.	Parts	Materials
1	Union Screw	SS400, S25C,SUS304
2	Union Nut	SS400, S25C,SUS304
3	Packing	Asbestos
4	Union Sleeve	SS400, S25C,SUS304
5	Collar	SUS304
6	Flexible Tube	SUS304
7	Braid	SUS304





KN-F7800A

Features

- One fixed end and the other with a loose flange
- High pressure type for more than 0.98MPa
- Can be matched to high pressure inserting steel ring to the waist of tube

Purpose Of Application

- Pipe alignment
- Absorption of thermal deformation
- Absorption of machine vibration
- Connection with machine and pipe

Applications

- Air-conditioning connection
- Pump connection
- Connection for various machines

No.	Parts	Materials
1	Fixed Flanges	SS400, SUS304
2	Loose Flanges	SS400, SUS304
3	Pipe	SGP, SUS304
4	Lap Joint	SGP, SUS304
5	Collar	SUS304
6	Flexible Tube	SUS304
7	Braid	SUS304

KN-F7800B

Features

- One fixed end and the other with a loose flange
- One body construction
- Ribbon braid is welding with ring and collar
- Applicable as underground use

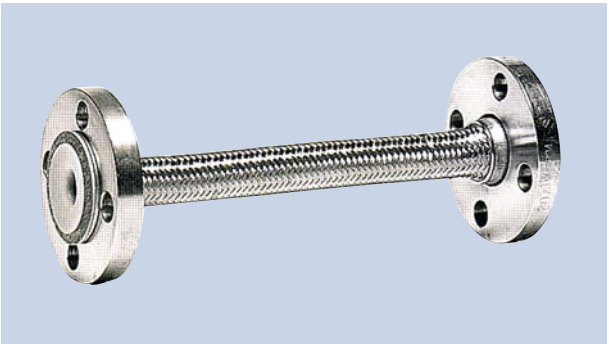
Purpose Of Application

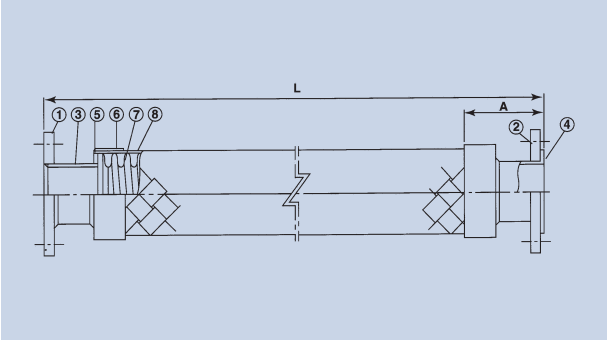
- Prevention of damage due to earthquake and sudden ground movements
- Pipe alignment
- Connection with machine and pipe

Applications

- Connection of tank
- Plant piping connection
- Water piping connection

No.	Parts	Materials
1	Fixed Flanges	SS400, SUS304
2	Loose Flanges	SS400, SUS304
3	Pipe	SGP, SUS304
4	Lap Joint	SGP, SUS304
5	Ring	SS400, SUS304
6	Collar	SUS304
7	Bellows	SUS304
8	Braid	SUS304





KN-F7800C

Features

- One fixed end and the other with a loose flange
- Ribbon braid tightened with braid band
- Large diameter
- Suitable for absorption of large movements

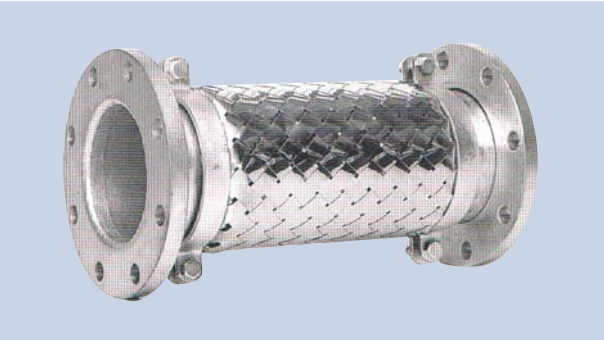
Purpose Of Application

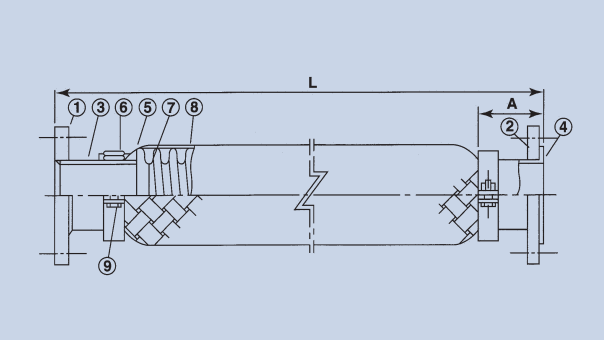
- Prevention of damage due to earthquake and sudden ground movements
- Pipe alignment
- Connection with machine and pipe

Applications

- Connection of tank
- Plant piping connection
- Water piping connection

No.	Parts	Materials
1	Fixed Flanges	SS400, SUS304
2	Loose Flanges	SS400, SUS304
3	Pipe	SGP, SUS304
4	Lap Joint	SGP, SUS304
5	Ring	SS400
6	Braid Band	SS400
7	Bellows	SUS304
8	Braid	SUS304
9	Bolt & Nut	SS400





CLASSIFICATION OF STAINLESS STEEL FLEXIBLE TUBES

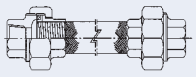
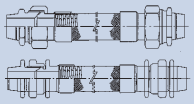
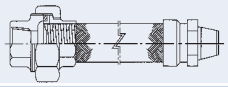
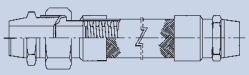
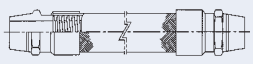
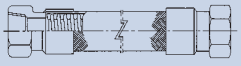
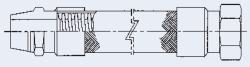
IN ① ② ③ ④

① Type

1	Union (Socket Welding)
2	Union (Butt Welding)
3	Screwed (Butt Welding)
4	Bevel (Butt Welding)
5	Flange (socket)
6	Flange (Butt Welding)
7	Flange (Band)

② Combination

0	Both Ends Loose Union (Female thread) + Union (Female thread)
1	Both Ends Loose Swivel Nut + Swivel Nut
2	One End Fixed Union (Female) + Adaptor (Male)
3	One End Swivel Nut + Adaptor (Male)
4	Both Ends Fixed Adaptor (Male) + Adaptor (Male)
5	Both Ends Fixed Swivel Nut (Female) + Swivel Nut (Female)
6	Both Ends Fixed Adaptor (Male) + Swivel Nut (Female)
7	Both Ends Loose Flanges
8	One End Fixed Flange
9	Both Ends Fixed Flange

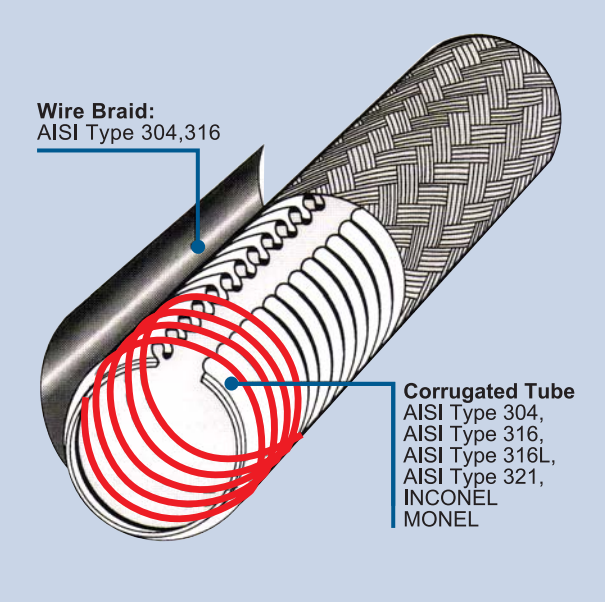
③ Materials Of Connection

0	SS400, S25C, FCMB
1	SUS304
2	SUS (contact part to liquid)+ Flange SS400

④ Standard of Connection

(no number)	Screwed
0	Others
1	JIS10K Flanges
2	JIS20K Flanges
3	ANSI150# Flanges
4	ANS1300# Flanges
5	BS4504 PN10 Flanges
6	BS4504 PN16 Flanges

TYPES OF FLEXIBLE TUBES

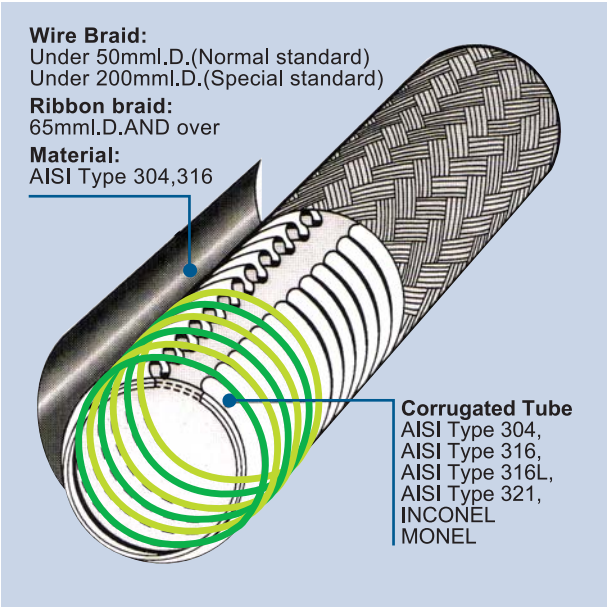


S-type (Spiral)

S-Type flexible tubes, made from stainless steel strips, is a helically corrugated tube manufactured by continuously processing the material on a high speed forming machine. It is then annealed in a continuous automatic bright annealing furnace without oxidization to eliminate residual stresses. This is recommended for medium or low pressure application.

A-type (Annular)

A-Type flexible tube, made from stainless steel strip or plate, is an annularly corrugated tube manufactured by continuously processing the material on a high speed forming machine. It is then annealed in continuous automatic bright annealing furnace. Unlike the S-Type, it has annular corrugations, thus it will not twist when subjected to elongation or contraction.

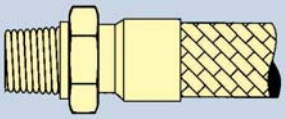


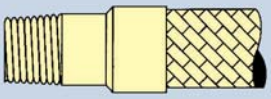
END CONNECTORS FOR CORRUGATED FLEXIBLE METAL HOSE

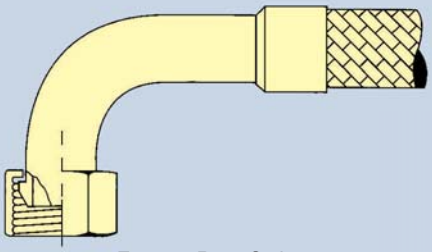
Welding or silver-brazing are methods used to attach the end connectors to corrugated flexible hose. These flexible hose are suitable for temperatures up to 250ºC.

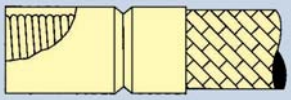
Terminations:
End connectors are available with terminations to current European, American and Japanese standards.

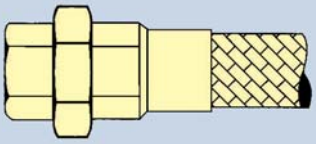
Metals:
End connections are often stocked in carbon steel, copper alloy as well as stainless steel.

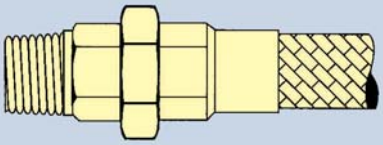

Male Hex Nipple

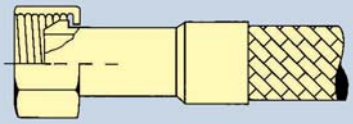

Male Pipe Nipple

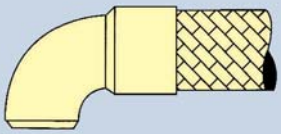

Female Bent Swivel

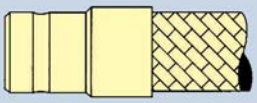

Female Coupling

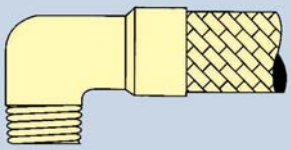

Female Union

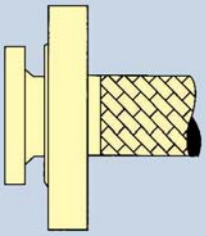

Male Union

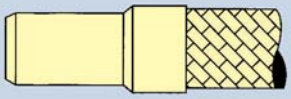

Female Swivel

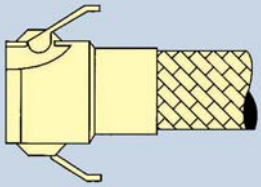

90° Welded Elbows

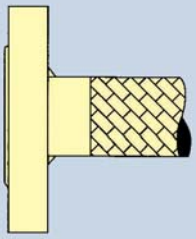

Male Camlock Coupling


Male Elbows


Swivel Flange

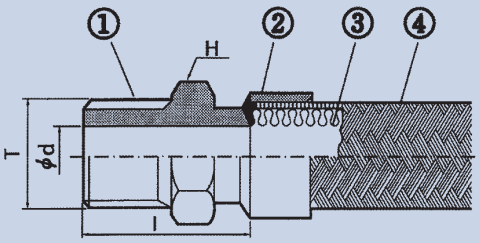

Weld Ends

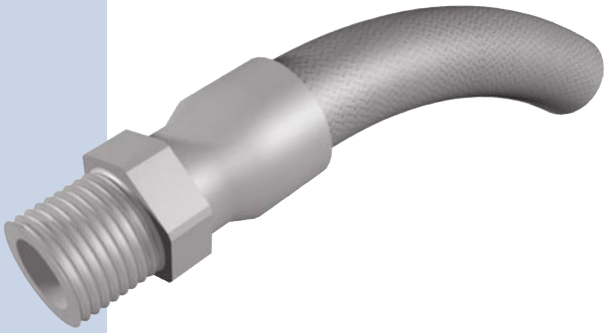

Female Camlock Coupling


Fixed Flange

STANDARD FITTINGS

Flexible Products & Expansion Joint





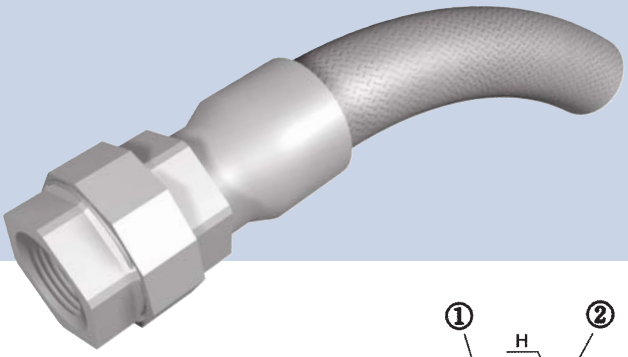
KMF-01

Type SM (Screw Male)

① Male Taper Pipe Thread / Malleable Iron
② Ferrule / Carbon Steel
③ Corrugations / AISI Type 304
④ Braid / AISI Type 304

- **Max Manufactured Size 100A(4")**

* Special order material is available in AISI type 304, brass, etc. in fittings.



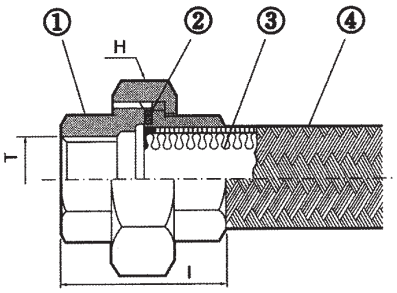
KMF-02

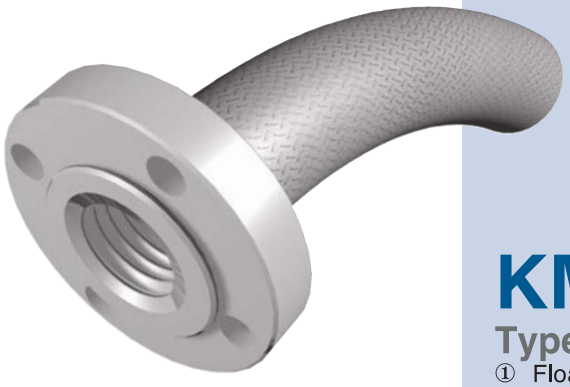
Type Union

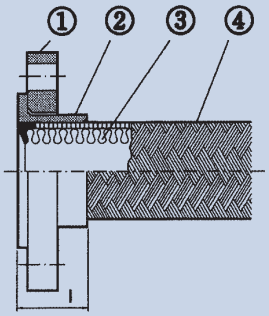
① Union Joint / Malleable Iron
② Packing / Teflon or High temp Non Metal packing
③ Corrugations / AISI Type 304
④ Braid / AISI Type 304

- **Max Manufactured Size 100A(4")**

* Special order material is available in AISI type 304, brass, etc. in fittings.







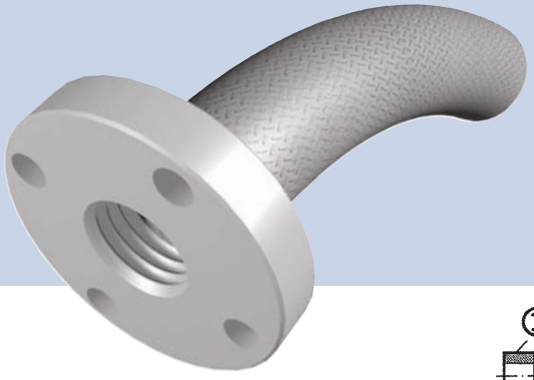
KMF-03

Type Floating Flange

① Floating Flange / Carbon Steel or Forged Steel
② Floating Flange joint / Carbon Steel. or AISI Type 304
③ Corrugations / AISI Type 304
④ Braid / AISI Type 304

- **Max Manufactured Size 500A(20")**

* Special order material is available in AISI type 304, brass, etc. in fittings.



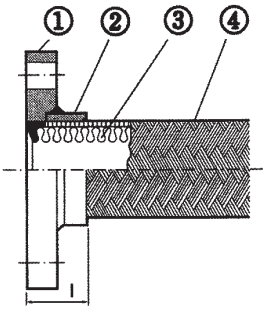
KMF-04

Type Fixed Flange

① Floating Flange / Carbon Steel or Forged Steel
② Ferrule / SS 304
③ Corrugations / AISI Type 304
④ Braid / AISI Type 304

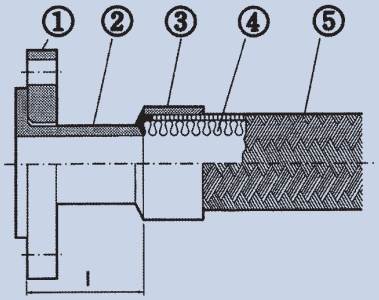
- **Max Manufactured Size 500A(20")**

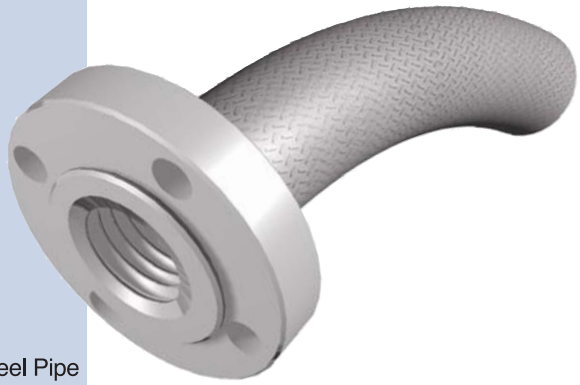
* Special order material is available in AISI type 304, brass, etc. in fittings.



STANDARD FITTINGS

Flexible Products & Expansion Joint





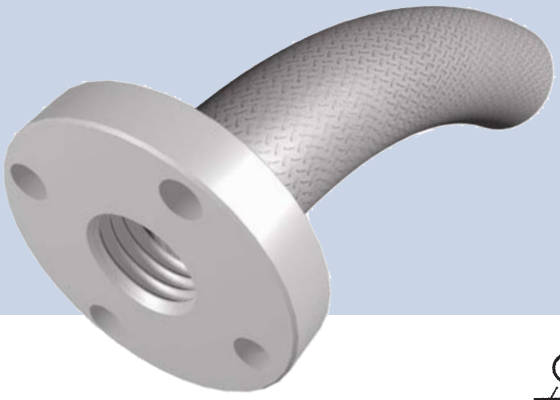
KMF-05

Type Floating Flange

① Floating Flange / Carbon Steel or Forged Steel
② Floating Flange joint / Carbon Steel Pipe or 304 / Stainless Steel Pipe
③ Ferrule / SS 304
④ Corrugations / AISI Type 304
⑤ Braid / AISI Type 304

- **Max Manufactured Size 500A(20")**

* Special order material is available in AISI type 304, brass, etc. in fittings.



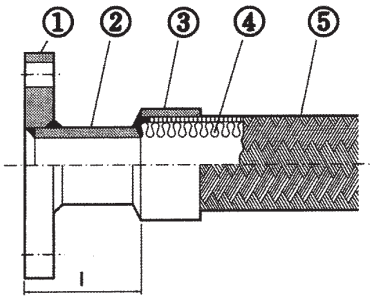
KMF-06

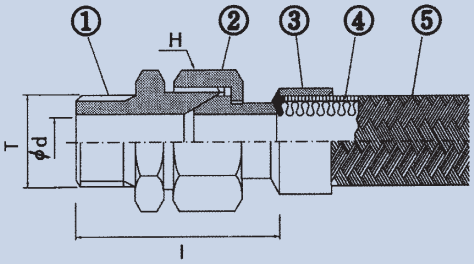
Type Fixed Flange

① Floating Flange / Carbon Steel or Forged Steel
② Floating Flange joint / Carbon Steel Pipe or 304 / Stainless Steel Pipe
③ Ferrule / SS 304
④ Corrugations / AISI Type 304
⑤ Braid / AISI Type 304

- **Max Manufactured Size 500A(20")**

* Special order material is available in AISI type 304, brass, etc. in fittings.





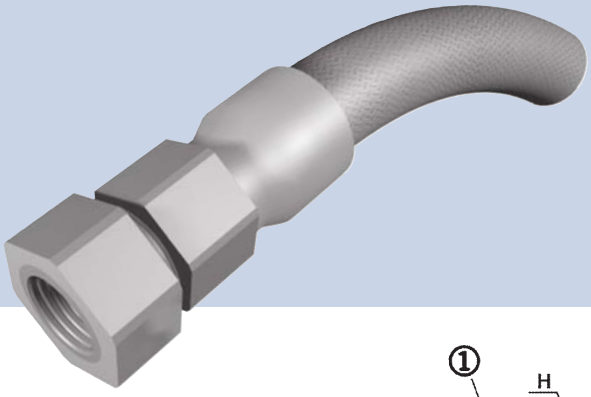
KMF-07

Type SN-Male

① Male Taper Pipe Thread / Carbon Steel
② SN-Fitting / Carbon Steel. or SS 304
③ Ferrule / SS 304
④ Corrugations / AISI Type 304
⑤ Braid / AISI Type 304

- **Max Manufactured Size 100A(4")**

* Special order material is available in AISI type 304, brass, etc. in fittings.



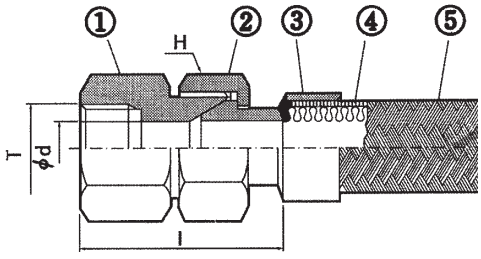
KMF-08

Type SN-Female

① Floating Flange / Carbon Steel
② SN-Fitting / Carbon Steel. or SS 304
③ Ferrule / SS 304
④ Corrugations / AISI Type 304
⑤ Braid / AISI Type 304

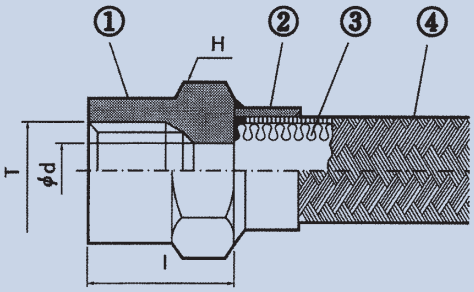
- **Max Manufactured Size 100A(4")**

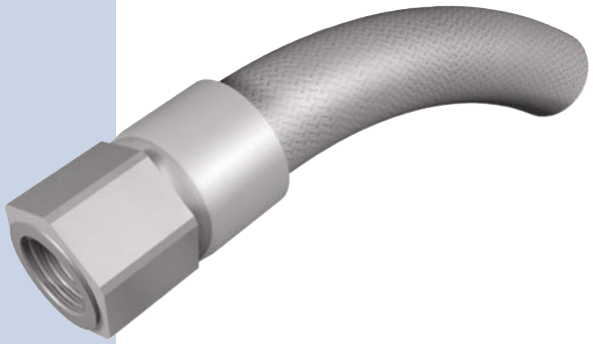
* Special order material is available in AISI type 304, brass, etc. in fittings.



STANDARD FITTINGS

Flexible Products & Expansion Joint





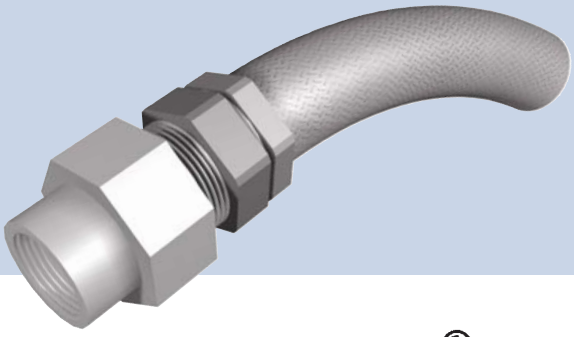
KMF-09

Type SF

① Female Taper Pipe Thread / Carbon Steel
② Ferrule / SS 304
③ Corrugations / AISI Type 304
④ Braid / AISI Type 304

- **Max Manufactured Size 100A(4")**

* Special order material is available in AISI type 304, brass, etc. in fittings.



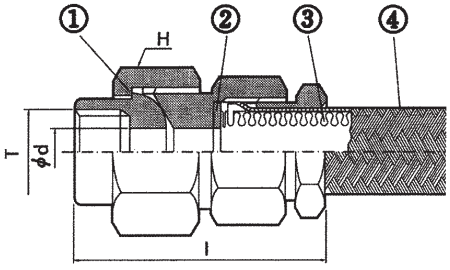
KMF-10

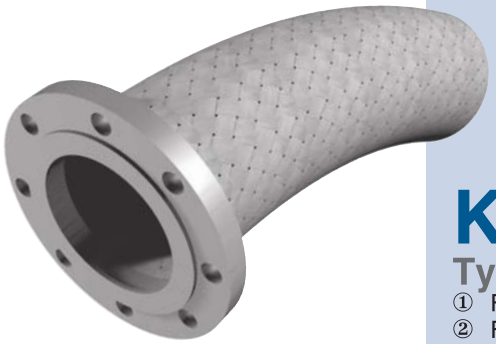
Type HU - Available for A-Type Flexible Tube

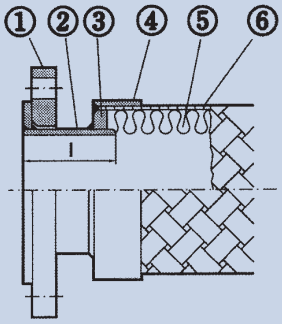
① Hu-Fitting / Carbon Steel
② Packing / Teflon or Non Matal Pecleing
③ Corrugations / AISI Type 304
④ Braid / AISI Type 304

- **Max Manufactured Size 100A(4")**

* Special order material is available in AISI type 304, brass, etc. in fittings.







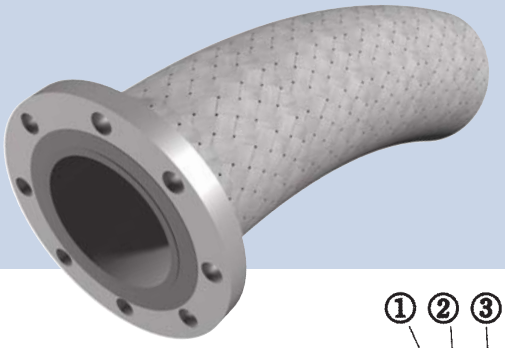
KMF-11

Type Floating Flange

① Floating Flange / Carbon Steel
② Floating Flange joint / Carbon Steel
③ Neck Ring / SS 304
④ Ferrule / Carbon Steel
⑤ Corrugations / AISI Type 304
⑥ Braid / AISI Type 304

- **Max Manufactured Size 500A(20")**

* Special order material is available in AISI type 304, brass, etc. in fittings.



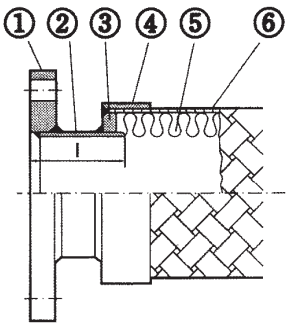
KMF-12

Type Fixed Flange

① Floating Flange / Carbon Steel
② Floating Flange joint / Carbon Steel
③ Neck Ring / SS 304
④ Ferrule / Carbon Steel
⑤ Corrugations / AISI Type 304
⑥ Braid / AISI Type 304

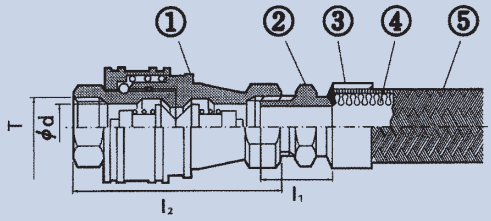
- **Max Manufactured Size 500A(20")**

* Special order material is available in AISI type 304, brass, etc. in fittings.



STANDARD FITTINGS

Flexible Products & Expansion Joint



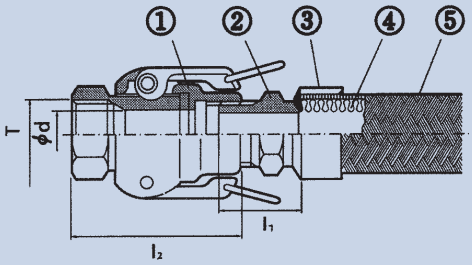
KMF-13

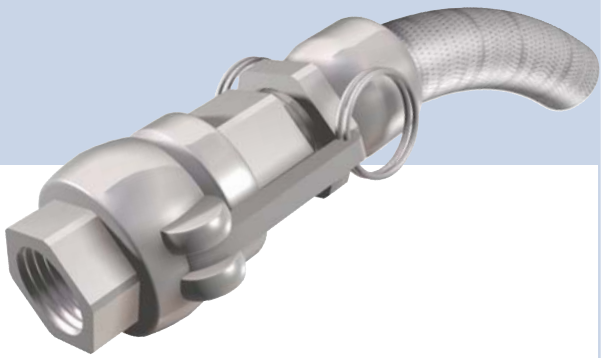
Type SM With Quick Disconect Self-seal Coupling

① Quick Disconect Self-seal Coupling / Brass or SS 304
② Male Taper Pipe Thread / Carbon Steel
③ Ferrule / SS 304
④ Corrugations / AISI Type 304
⑤ Braid / AISI Type 304

- **Max Manufactured Size 100A(4")**

* Special order material is available in AISI type 304, brass, etc. in fittings.





KMF-14

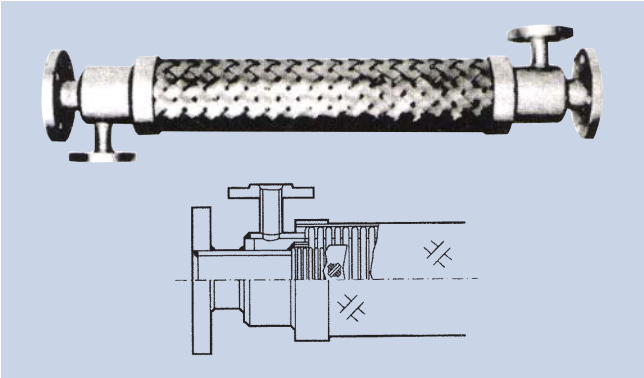
Type SM With Kamlok Quick Coupling

① KAMLOK / Bronze Casting. SS 304. Ss 316 etc
② Male Taper Pipe Thread / Carbon Steel
③ Ferrule / SS 304
④ Corrugations / AISI Type 304
⑤ Braid / AISI Type 304

- **Max Manufactured Size 300A(12")**

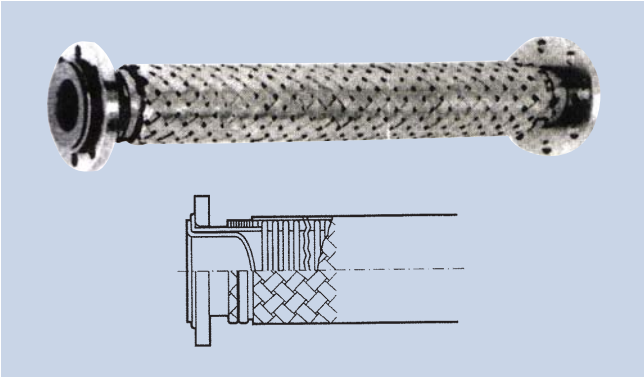
* Special order material is available in AISI type 304, brass, etc. in fittings.

SPECIAL FLEXIBLE HOSE ASSEMBLY



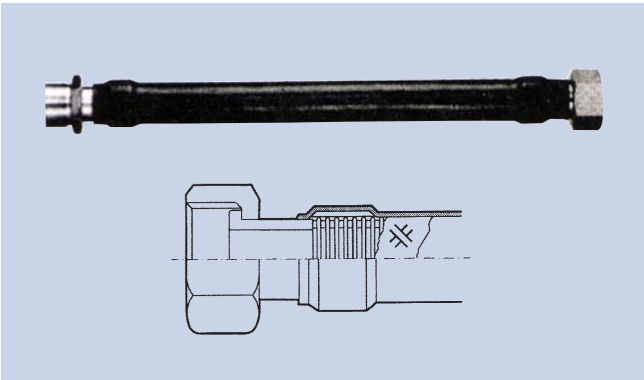
Jacketted Duples Flexible Tube Assembly

This assembly consists of currugated stainless steel inner tube and outer one.The jacket area between the inner and outer assemblies contains steam or other heat mediums to heat highly viscous fluid such as heavy oil or asphalt conveyed through inner corrugated tube in order to avoid solidification and clogging.



Flexible Tube Assembly With PTFE Tube

This assembly consists of corrugated stainless steel outer tube and PTFE inner plain tube. PTFE tube is inserted along the inner surface of outer tube to protect it from chemicals and corrosive gasses. As it has excellent properties in not only corrosion resistance but also sanitation, it can be used to convey foodstuff, it provides you with advantages brought from both stainless steel and PTFE. Also available in convoluted fully lined antistatic.



Flexible Tube For Underground Piping

This Flexible tube is designed for the use of underground piping. It has the protective made of synthetic rubber and so on to protect corrosion caused by soil surrounding it.

Others:

- Flexible tubing regulated by LPG Plant Association standard
- Flexible tubing regulated by the Law of High Pressure Control
- Flexible tubing for powder transportation

CORROSION RESISTANCE REFERENCE TABLE

The table below serves only as a reference guide in the selection of the most suitable host and fitting material. The listed media, unless otherwise stated, is considered to be pure at room temperature. Any change in the room condition will affect the rating. No attempt has been made to account for variations in service conditions since these variables are too complex.

Rating Code:

A - Suitable (normal condition)
B - Limited Service
C - Unsuitable

Note:

1. Susceptible to intergranular corrosion.
2. May cause explosive reaction.
3. Susceptible to stress corrosion cracking.
4. Susceptible to piting type corrosion.
5. Discolours.
6. Concentration over 50% and / or temperature over 95ºC refer to our Enginnering Department.

	Bronze	Monel	Carbon Steel	304L / 321 Stainless	316 Stainless		Bronze	Monel	Carbon Steel	304L / 321 Stainless	316 Stainless
Acetaldehyde	C [2]	A	B	A	A	Barium Chloride — Moist	B	B	B	C [3,4]	C [3]
Acetanilide	B [3]	B	B	B	B	Barium Hydroxide	C	B	B	B	A
Acetic Acid	C	B	C	B [1]	A [1]	Barium Sulfate	B	B	B	B	B
Acetic Anhydride	B	B	C	B	B	Barium Sulfide	C	C	C	B	B
Acetone	A	A	C	B	B	Beer	A	A	C	A	A
Acetophenone	A	A	A	B	B	Beet Sugar Syrups	A	A	B	A	A
Acetylene	C [2]	A	A	A	A	Benzaldehyde	C	B	C	B	B
Acrylates	B	B	B	B	B	Benzene (Benzol)	A	A	A	A	A
Acrylic Acid	B	B	C	B	B	Benzoic Acid	A	B	C	A	A
Acrylonltrile	A [4]	A	A	A	A	Benzylamine	C [3]	B	B	B	B
Alcohols	A [5]	A	A [5]	A	A	Benzyl Chloride — Dry	B	A	B	A	A
Alum	B	B	C	B	B	Benzyl Chloride — Moist	B	B	C	C [3,4]	C [3]
Alumina	A	A	A	A	A	Black Liquor, Sulfate Process	C	A	C	B	B
Aluminium Acetate	B	B	C	B	B	Bleaching Powder — Dry	B	A	C	A [3,4]	A
Aluminium Chloride — Dry	B [1]	A	B	A	A	Bleaching Powder — Moist	B [1]	B	C	C [3,4]	C [3,4]
Aluminium Chloride — Moist	C	B	C [3]	C [3,4]	C [3]	Borax	A	A	B	A	A
Aluminium Fluoride	B	B	B	C	C	Bordeaux Mixture	B	A	B	A	A
Aluminium Hydroxide	B	B	B	A	A	Boric Acid	B	B	C	A	A
Aluminium Sulfate	C	B	C	B [1,3]	A [3]	Boron Trichloride — Dry	B	B	A	B	B
Ammonia — Dry	A	A	A	A	A	Boron Trichloride — Moist	B	B	B	C [3,4]	C [3]
Ammonia — Moist	C [3]	C	C [3]	A	A	Boron Trifluoride — Dry	B	B	A	B	B
Ammonium Acetate	C	A	A	A	A	Brines	B	B	C	C [3,4]	C [3]
Ammonium Bromide	C	B	C	C [4]	C [4]	Bromic Acid	C	C	C	C	C
Ammonium Chloride — Dry	C [4]	A	B	A	A	Bromine — Dry	A	A	C	B	B
Ammonium Chloride — Moist	C [4]	B	C	C [3,4]	C [3]	Bromine — Moist	B	B	C	C	C
Ammonium Hydroxide 6	C [3]	A	B	A	A	Butadiene	A	A	A	A	A
Ammonium Nitrate	C [2]	C [2]	C [3]	A	A	Butane	A	A	A	A	A
Ammonium Sulfate	C	B	C	C [1]	B	Butanol (Butyl Alchol)	A	A	A [5]	A	A
Amyl Acetate	A	A	A	A	A	Butyl Phenols	B	A	B [5]	B	B
Amyl Alcohol	A	A	A	A	A	Butylamine	C [3]	A	A	A	A
Amyl Chloride — Dry	A	A	B	A	A	Butyric Acid	B	B	C	B	B
Amyl Chloride — Moist	C	B	C	C [3,4]	C [3]	Cadmium Chloride — Moist	B	B	C	C [3,4]	C [3]
Aniline	C [3]	A	C	B	B	Cadmium Chloride — Dry	B	A	A	A	A
Aniline Dyes	C [3]	A	C	B	B	Cadmium Sulfate	B	A	B	A	A
Asphalt	A	A	A	A	A	Calcium Bisulfite	B	B	B	B [1]	B
Atmosphere — Industrial	A	A	C	B [4]	A [4]	Calcium Bromide	B	B	C	C [3]	C [3]
Atmosphere — Marine	A	A	C	B [4]	B [4]	Calcium Chloride — Moist	B	B	C	C [3,4]	C [3]
Atmosphere — Rural	A	A	C	A	A	Calcium Chloride — Dry	B	A	A	A	A
Barium Carbonate	B	B	B	B	B	Calcium Fluoride	B	B	C	C	C
Barium Chloride — Dry	B	A	A	A	A	Calcium Hydroxide	B	B	C	B	B

	Bronze	Monel	Carbon Steel	304L / 321 Stainless	316 Stainless		Bronze	Monel	Carbon Steel	304L / 321 Stainless	316 Stainless
Calcium Hypochlorite — Moist	C	B	C	C[3,4]	C[3,4]	Ethylene Oxide	C[2]	B	B	A	A
Calcium Hypochlorite — Dry	B	A	B	A	A	Fatty Acids	C	B	C	B[14]	A
Calcium Nitrate	B	B	C[1]	B[1]	B	Ferric Chloride — Dry	B	A	B	A[1,3,4]	A[3,4]
Calcium Oxide	A	A	A	A	A	Ferric Chloride — Moist	C	B	C	C	C
Cane Sugar Syrups	A	A	B	A	A	Ferric Nitrate	C	C	C	B	B
Carbolic Acid (Phenol)	B	B	C	B	A	Ferric Sulfate	C	C	C	B[1]	A
Carbon Dioxide — Dry	A	A	A	A	A	Ferrous Chloride — Dry	B	A	B	A	A
Carbon Dioxide — Moist	C[4]	A	C	A	A	Ferrous Chloride — Moist	C	B	C	C[3,4]	C[3]
Carbonated Beverages	B	A	C	A	A	Ferrous Sulfate	B	A	C	B[4]	B
Carbonated Water	B[4]	A	C	A	A	Fluorine — Dry	B	A	A	A	A
Carbon Disulfide	B	B	B	B	B	Fluorine — Moist	C	B	C	C	C
Carbon Tetrachloride — Drv	A	A	B	A	A	Formaldehvde	A[5]	A[5]	B[5]	B	B
Carbon Tetrachloride — Moist	B	B	C	C[3,4]	C[4]	Formic Acid	B	B	C	B[1]	A
Caster Oil	A	A	A	A	A	Freon	A	A	A	A	A
Chlorine — Dry	A	A	B	A	A	Fruit Juices	C	A	C	A	A
Chlorine — Moist	C	B	C	C[3,4]	C[3]	Fuel Oil	B	A	C	A	A
Chloracetic Acid	C	B	C	C[3,4]	C[3]	Furfural	A	A	B	A	A
Chloric Acid	C	C	C	C[3]	C[3]	Gasoline	A	A	B	A	A
Chlorine Dioxide — Dry	B	A	B	A	A	Gelatine	A	A	C	A	A
Chlorine Dioxide — Moist	C	B	C	C[3,4]	C[3]	Glucose	A	A	B	A	A
Chloroform — Dry	A	A	A	A	A	Glue	B	A	C	A	A
Chloroform — Moist	B	B	C	C[3,4]	C[3]	Glutamic Acid	C[4,5]	B	C	B[3,4]	B[3,4]
Chromic Acid	C	B	C[3]	C[1,4]	B	Glycerin (Glycerol)	A	A	B[5]	A	A
Chromic Fluorides	C	B	C	C	C	Heptane	A	A	A	A	A
Chromic Hydroxide	B	B	B	B	B	Hexachloroethane — Dry	B	A	B	A	A
Chromium Sulfate	B	B	C	B	B	Hexachloroethane — Moist	C	B	C	C[4]	C[4]
Cider	A	A	C	A	A	Hydrazine	C[3]	C	C	A	A
Citric Acid	C	B	C	B	B	Hydrobromide Acid	C	C	C	C[4]	C
Coffee	A	A	C	A	A	Hydrocarbons, Pure	A	A	A	A	A
Copper Chloride — Dry	A	A	B	A	A	Hydrochloric Acid	C	B	C	C[4]	C[4]
Copper Chloride — Moist	B	B	C	C[3,4]	C[3]	Hydrocyanic Acid	C	B	C[3]	C[1,3]	C[3]
Copper Nitrate	C	C	C	A	A	Hydrofluoric Acid	C	B	C	C[1,3]	C
Copper Sulfate	C	B	C	B[1]	B	Hydrofluorsilicic Acid	C	B	C	C	C
Corn Oil	A	A	A	A	A	Hydrogen	A	A	A	A	A
Cottonseed Oil	A	A	A	A	A	Hydrogen Chloride — Dry	A	A	B	A	A
Creosole	B	A	A	A	A	Hydrogen Chloride — Moist	C	B	C	C[4]	C[4]
Crude Oil	B	A	C	C[1]	B	Hydrogen Peroxide	C	C	C	B	B
Cyclohexane	B	B	B	B	B	Hydrogen Sulfide — Dry	A[5]	A	B	A	A
DDT	B	B[4]	C	A	A	Hydrogen Sulfide — Moist	C[4,5]	B	C[3]	B[4]	A
Dichloroethane — Dry	A	A	A	A	A	Hydroquinone	B	B	B[5]	B	B
Dichloroethane — Moist	C	B	C	C[4]	C[4]	Kerosine (Kerosene)	A	A	B	A	A
Dichloroethylene — Dry	A	A	B	A	A	Lacquers	A	A	A	A	A
Dichloroethylene — Moist	C	B	C	C[4]	C[4]	Lacquer Solvents	A	A	A	A	A
Dichlorophenol	B	B	C	B[3]	B[3]	Lactic Acid	B	B	C	B[1,4]	B[1]
Dilsocyanate	B	A	B	A	A	Lime	A	A	B	A	A
Dimethyl Sulfate	B	B	B	B	B	Lime — Sulfur	C	B	C	B	B
Epichlorohydrin — Dry	B[4]	A	C[4]	A	A	Linseed Oil	A	A	B	A	A
Epichlorohydrin — Moist	C[4]	B	C[4]	C[3,4]	C[3]	Lithium Chloride — Dry	B	A	B	A	A
Ethane	A	A	A	A	A	Lithium Chloride — Moist	B	B	B	C[3,4]	C[3]
Ethers	A	A	B	A	A	Lithium Hydroxide	C	B	B	B	B
Ethyl Acetate	A	B	B	B	B	Magnesium Chloride — Dry	B	A	B	A	A
Ethyl Alcohol	A	A	A	A	A	Magnesium Chloride — Moist	B	B	C	C[3,4]	C[3]
Ethyl Benzene	B[5]	B	B	B[3]	B	Magnesium Hydroxide	A	A	A	A	A
Ethyl Chloride — Dry	A	A	A	A	A	Magnesium Sulfate	A	A	B	B	A
Ethyl Chloride — Moist	B	B	C	C[3,4]	C[3]	Maleic Acid	C	B	B	B[1]	B
Ethylene	A	A	A	A	A	Mercuric Chloride — Dry	B	A	B	A	A
Ethylene Chlorohydrin — Dry	B	A	B	A	A	Mercuric Chloride — Moist	C	B	C	C[3,4]	C[3]
Ethylene Chlorohydrin — Moist	C	B	C	C[4]	C[4]	Mercurous Nitrate	C[3]	B[3]	B	B	B
Ethylene Diamine	C[3]	B	B	B	B	Mercury	C	B[3]	B	B	B
Ethylene Glycol	A	A	A	A	A	Methyl Alcohol	A	A	A	A	A

	Bronze	Monel	Carbon Steel	304L / 321 Stainless	316 Stainless		Bronze	Monel	Carbon Steel	304L / 321 Stainless	316 Stainless
Methane	A	A	A	A	A	Sodium Chloride — Moist	B	B	C	C [3,4]	C [3]
Methyl Chloride — Dry	A	A	A	A	A	Sodium Chromate	A	A	B	A	A
Methyl Chloride — Moist	B	B	C	C [3,4]	C [3]	Sodium Citrate	C	B	B	B	B
Methyl Ethyl Ketone	B	B	B	B	B	Sodium Cyanide	C [4]	B	B	B	B
Milk	B	A	C	A	A	Sodium Dichromate	C	B	C	A	A
Mine Water	C	B	C	B	B	Sodium Fluoride	B	A	B	C [4]	C
Naphthalene	B	B	A	A	A	Sodium Hydroxide 6	B [4]	A	B [3]	B [3]	B [3]
Natural Gas	A	A	A	A	A	Sodium Hypochlorite — Dry	B	A	B	A	A
Nickel Chloride — Dry	B	A	B	A	A	Sodium Hypochlorite — Moist	C	B	C	C [1,4]	C [4]
NIckel Chloride — Moist	C	B	C	C [3,4]	C [3]	Sodium Metasilicate	B	A	B	A	A
Nitric Acid	C	C	C	A	A	Sodium Nitrate	B	A	B [3]	A	A
Nitrotoluene	B	B	B	B	B	Sodium Nitrite	B	B	B	B	B
Nitrogen	A	A	A	A	A	Sodium Peroxide	C	B	C	A	A
Oleic Acid	B [5]	A	C	B [4]	B	Sodium Phosphate	B	A	C	A	A
Oleum (Fuming H2S04)	C	C	B [3]	B	B	Sodium Silicate	A	A	B	A	A
Oxalic Acid	B	B	C	C [1]	B [1]	Sodium Sulfate	A	A	B	B [3]	B
Oxygen	A	A	C	A	A	Sodium Sulfide	C	A	C	B [4]	B
Palmitic Acid	B	A	C	A	A	Sodium Sulfite	B	A	C	B	B
Parafin	A	A	B	A	A	Sodium Thiosulfate	C	A	C	B	B
Pentane	B	B	B	B	B	Stannic Chloride — Dry	B	A	B	A	A
Phenol (Carbolic Acid)	B	B	C	B	A	Stannic Chloride — Moist	C	B	C	C [3,4]	C [3]
Phosphoric Acid	C	B	C	C [1]	B [1]	Stannous Chloride — Dry	B	A	B	A	A
Phthalic Acid	B	B	C	B [1]	B	Stannous Chloride — Moist	C	B	C	C [3,4]	C [3]
Picric Acid	C	C	C	B	B	Steam	A	A [3]	C	A	A
Potassium Bromide	B	B	C	C	C	Stearic Acid	B	B	C [5]	B	B
Potassium Carbonate	B	A	B	A	A	Strontium Nitrate	B	B	C	B	B
Potassium Chloride — Dry	A	A	A	A	A	Sulfate Black Liquor	C	B	B	B	B
Potassium Chloride — Moist	B [3]	B	C	C [3,4]	C [3]	Sulfate Green Liquor	C	B	B	B [3]	B
Potassium Chromate	B	B	C	B	B	Sugar Solutions	A	A	B	A	A
Potassium Cyanide	C [4]	A	B	B	B	Sulfur — Dry	C	A	B	A	A
Potassium Dichromate	C	A	C	A	A	Sulfur — Molten	C	C	C	C	B
Potassium Fluoride	B	B	C	C	C	Sulfur Chloride — Dry	B	A	C	A	A
Potassium Hydroxide	C [5]	A [3]	B [3]	B [3]	A	Sulfur Chloride — Moist	C	B	C	C [3,4]	C [3]
Potassium Nitrate	B	B	B	B	A	Sulfur Dioxide — Dry	B	B	C	C [1]	B
Potassium Permanganate	B	B	B	B	B	Sulfur Dioxide — Moist	C [4]	C	C	C [1]	B
Potassium Sulfate	B	B	C	B	B	Sulfur Trioxide — Dry	A	A	C	A	A
Propane	A	A	A	A	A	Sulfuric Acid, 95-100%	B	B	B	A	A
Propylene	A	A	A	A	A	Sulfuric Acid, 80-95%	B	B	C	B	B
Propylene Oxide	C	C	C	A	A	Sulfuric Acid, 40-80%	C	C	C	C [1]	C [1]
Propylene Dichloride — Dry	B	A	B	A	A	Sulfuric Acid, 40%	C	C	C	C [1]	C [1]
Propylene Dichloride — Moist	C	B	C	C [4]	C [4]	Sulfurous Acid	B	B	C	C [1,4]	C [1,4]
Pyridine	B [5]	B	B [5]	B	B	Tall Oil	C	B	B	B	B
Pyrrolidine	C [3]	B	B	B	A	Tannic Acid	B	B	C [5]	B	B
Quinine	B	B	C	B	B	Tar	A	A	B	A	A
Rosin	A [5]	A	C [5]	A	A	Tartaric Acid	C	B	C	B	B
Sea Water	B	B	C	C [3,4]	C [3]	Tetraphosphoric Acid	C	C	C	B	B
Sewage	A	A	B	A	A	Toluene	A	A	A	A	A
Silver Salts	C	A	C	B	B	Trichloroacetic Acid	C	B	C	C [3,4]	C [4]
Silver Nitrate	C	C	C [3]	B	A	Trichloroethane — Dry	A	A	A	A	A
Soap Solutions	A	A	B	A	A	Trichloroethane — Moist	C	B	C	C [4]	C [4]
Sodium	C	A	A	A	A	Trichloroethylene — Dry	A	A	A	A	A
Sodium Acetate	B	B	B	B [4]	B	Trichloroethylene — Moist	C	B	C	C [4]	C [4]
Sodium Bicarbonate	B	A	C	A	A	Turpentine	A	A	B	A	A
Sodium Bisulfate	B	B	C	B [1,4]	A	Varnish	A	A	B	A	A
Sodium Bisulfite	C [4]	B [4]	C	B	B	Vinegar	B	B	C	A	A
Sodium Bromide	B	B	B	C	C	Water, Potable	A	A	C	A	A
Sodium Carbonate	B	A	B	A	A	Xylene	B	A	B	A	A
Sodium Chlorate — Dry	B	A	A	A	A	Zinc Chloride — Dry	B	A	A	A	A
Sodium Chlorate — Moist	B	B	C	C [3,4]	C [3]	Zinc Chloride — Moist	C [4]	B	C	C [3,4]	C [3]
Sodium Chloride — Dry	B	A	B	A	A	Zinc Sulfate	B	B	C	B	A

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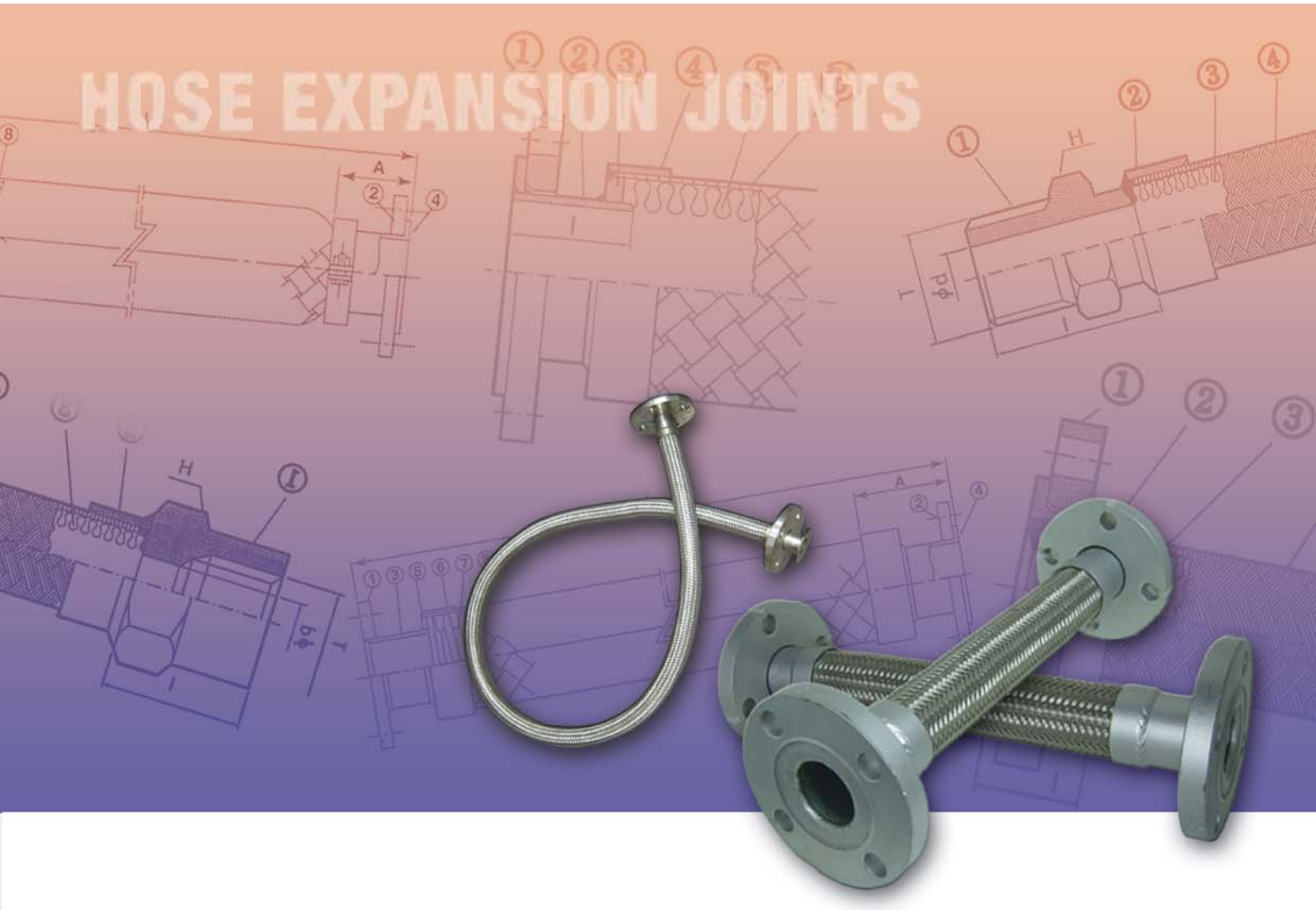

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