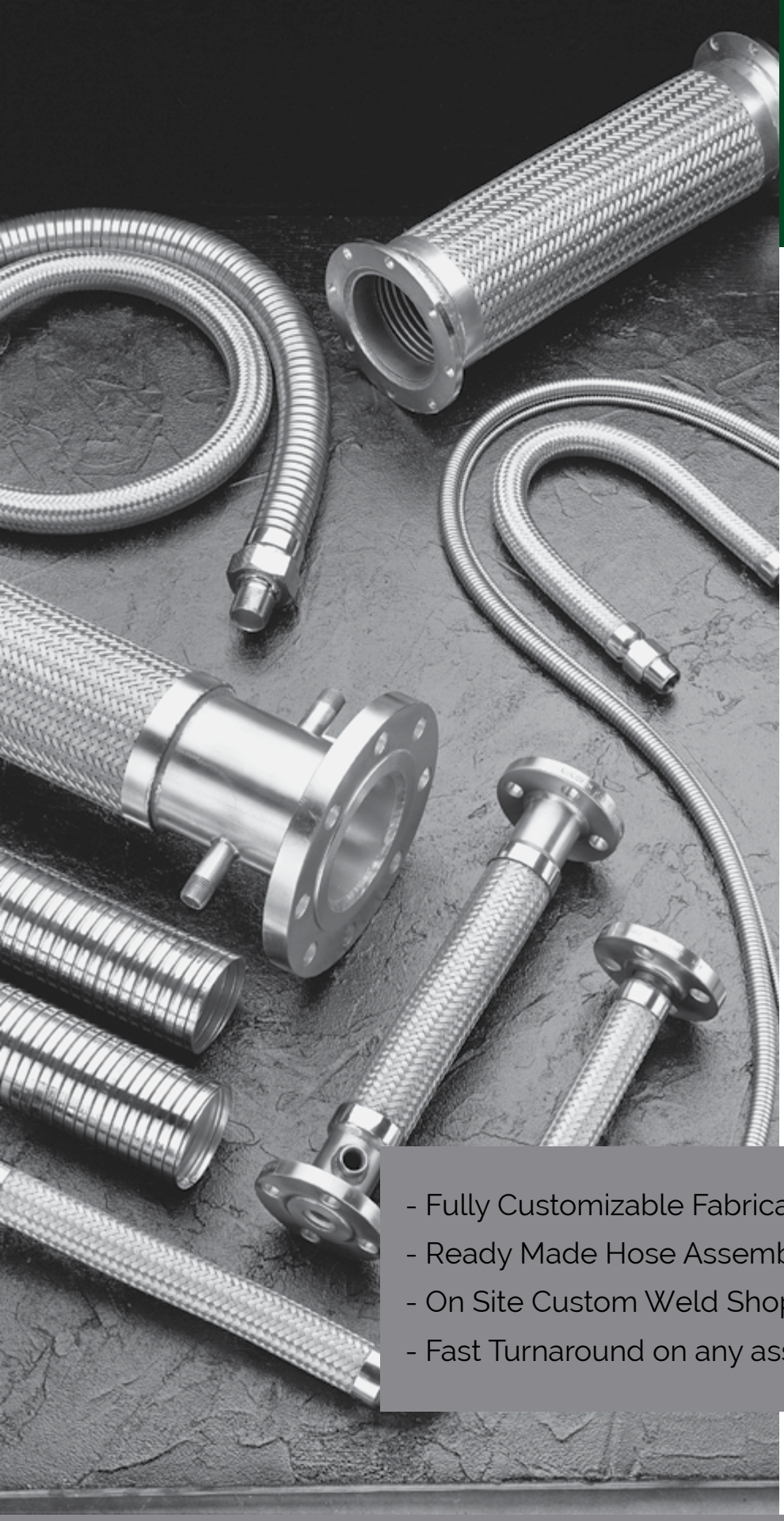


McGill HOSE & COUPLING

METAL HOSE & ASSEMBLIES

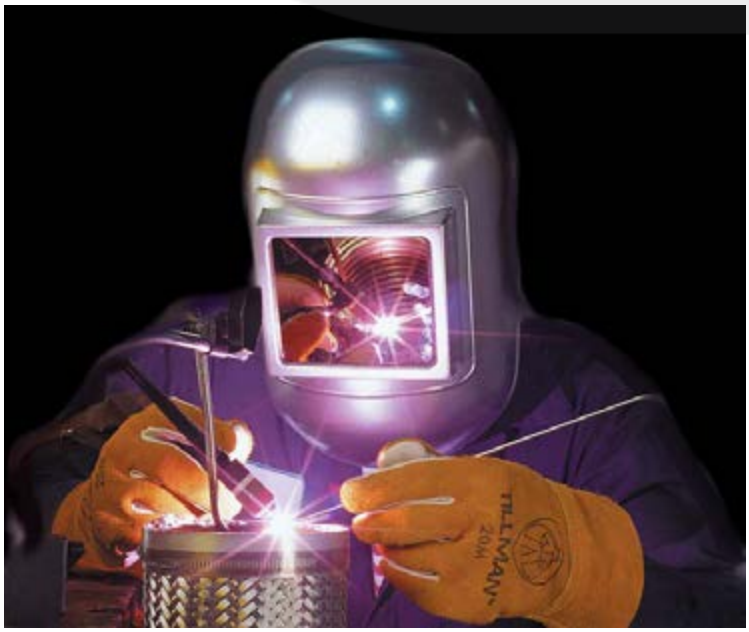
- Fully Customizable Fabrication
- Ready Made Hose Assemblies
- On Site Custom Weld Shop
- Fast Turnaround on any assembly

www.mcgillhose.com - sales@mcgillhose.com

Why Choose McGill?

Having a full understanding of the demanding applications where using metal hose can be critical in determining success. The team here at McGill Hose & Coupling we will use our years of experience to help achieve the best possible solution for your metal hose needs through consulting with you on your various applications and prior history.

We are well-versed in the many applications that metal hose can be used for, making McGill Hose & Coupling the top choice in the region. These include applications requiring corrosion resistance, extreme high & low temperature capabilities, or high durability among many more.



Why Corrugated Metal?

Generally, there are eight factors to consider to help you to know when to use "flexible" or **corrugated metal hose**:

1. TEMPERATURE EXTREMES If either the temperature of the media going through the hose or the surrounding atmospheric temperature is very cold or hot, metal may be the only material that can withstand such temperature extremes.

2. CHEMICAL COMPATIBILITY Metal hose can handle a wider variety of chemicals than most other hose types. If the hose will be exposed to aggressive chemicals (either internally or externally), metal hose should be considered. Here is a great resource to check chemical compatibility.

3. PERMEATION CONCERNS Non-metal hose is susceptible to gas permeation through the hose wall and into the atmosphere. Metal hose, on the other hand, does not allow permeation. If containing the gases inside the hose is important, metal hose may be required.

4. POTENTIAL FOR CATASTROPHIC FAILURE When a metal hose fails, it usually develops small holes or cracks. Other hose types tend to develop larger cracks or come apart completely. If a sudden hose failure is potentially catastrophic, a metal hose may help minimize the effects of a failure by leaking product at a slower rate.

5. ABRASION AND OVERBENDING CONCERNS To prevent abrasion and over-bending, a metal hose can be used as a protective cover over wires or even other hoses.

6. FIRE SAFETY Other hose types will melt when exposed to fire, while metal hose maintains its integrity up to 1300˚ F. (See NAHAD derating chart).

7. ACHIEVING FULL VACUUM Under full vacuum, metal hose maintains its shape while other hose types may collapse.

8. FLEXIBILITY IN FITTING CONFIGURATION
Virtually any type of fitting can be attached to metal hose, while other hose types require special shanks and collars.

Metal Hose Features

Metal hose's versatility and durability makes it very desirable & at times, the go-to when no other hose can handle the material being conveyed. Below are some features that make it unique.

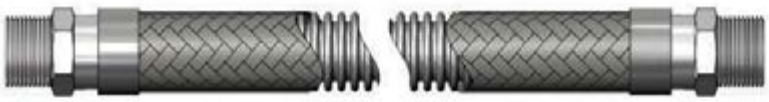
Liner - An interlocked hose or liner is often installed inside a corrugated hose assembly. The liner commonly serves two purposes while still maintaining the full working pressure of the corrugated hose. The first is to protect the hose corrugations from excessive media velocities. Media speeds can induce resonant vibrations in the corrugations, causing rapid fatigue and subsequent fracturing of the hose wall. The liner provides a relatively smooth surface for the media and, by avoiding the media impacting on the corrugation valleys, reduces the chances of harmonic resonance. The second purpose for a liner is abrasion resistance. Even slightly abrasive media flowing at medium -to-high speeds can cause premature wear of the interior surfaces of the corrugated hose. The liner provides a smooth flow path, as well as a relatively thick layer of abrasion-resistant metal between the media and the corrugated hose. The liner will also help reduce pressure loss due to friction between the media and corrugated hose. Proper fit between the hoses is essential for good performance.

Armor/Bend Restrictor - Applications in which the corrugated hose is subjected to external abrasion, molton material splash, or impact damage may require a protective armor or guard along all or a portion of its length. A guard is typically made from interlocked or squarelocked metal hose and is welded to the assembly. Note that the bend restricter has a bend diameter equal-to or greater-than the corrugated hose it is protecting.

Jacket - A jacketed assembly consists of a "hose within a hose." An inner or primary media-conveying hose is enclosed or jacketed by a larger-diameter hose. The hoses are joined at each end by specially designed fittings so that there is no media pathway between the two hoses. Jacketed assemblies are often specified when the primary media must be kept at either an elevated or cryogenic temp. Steam is often circulated through the jacket hose to keep a viscous material in the inner hose hot & easily conveyed. A vacuum can also be pulled on the jacket hose to insulate cryogenic liquids being conveyed in the inner hose.

Tracer - Traced assemblies are similar in concept to jacketed assemblies in that there is an inner, smaller diameter hose encased by a single, larger-diameter hose. Where jacketed assemblies surround the media with heat or cold, traced assemblies have the media surround the hose containing the heating or cooling element. The tracer, or inner hose, may also be installed in a long "U" shaped loop within the outer hose, with the steam inlet & outlet at the same end of the assembly.

Assembly Components



In order to produce an assembly, we will need answers to the following five questions.

1. Hose (type, alloy, and size)
2. Fittings (type, alloy, and size for each end)
3. Length of the Assembly (either overall length or live length)
4. Fabrication Options
5. Accessories

If you have the answers to these questions,we will be able to make your custom assembly. If you do not have the answers to all five questions, you will need to obtain them. Using the S.T.A.M.P.E.D. form to help you obtain the information is necessary to determine the correct assembly for your application.

Hose Performance Chart

HOSE TYPE	Number of Braids	Inside Diameter (in.)																													
		1/4		5/16		3/8		1/2		3/4		1		1 1/4		1 1/2		2		2 1/2		3		4		5		6		8	
		Working Pressure (psi)	Dynamic Bend Radius (in.)	Working Pressure (psi)	Dynamic Bend Radius (in.)	Working Pressure (psi)	Dynamic Bend Radius (in.)	Working Pressure (psi)	Dynamic Bend Radius (in.)	Working Pressure (psi)	Dynamic Bend Radius (in.)	Working Pressure (psi)	Dynamic Bend Radius (in.)	Working Pressure (psi)	Dynamic Bend Radius (in.)	Working Pressure (psi)	Dynamic Bend Radius (in.)	Working Pressure (psi)	Dynamic Bend Radius (in.)	Working Pressure (psi)	Dynamic Bend Radius (in.)	Working Pressure (psi)	Dynamic Bend Radius (in.)	Working Pressure (psi)	Dynamic Bend Radius (in.)	Working Pressure (psi)	Dynamic Bend Radius (in.)	Working Pressure (psi)	Dynamic Bend Radius (in.)	Working Pressure (psi)	Dynamic Bend Radius (in.)	
ANNUFLEX Standard Product T321, T316L, T304L	0 1 2	90 1800 2700	4.5	n/a	n/a	70 1558 2336	5.0	70 1186 1779	5.5	43 898 1347	8.0	43 718 1077	9.0	43 645 968	10.0	28 531 797	11.0	14 449 674	13.0	14 417 626	16.0	14 346 519	18.0	14 299 449	22.0	14 275 412	28.0	11 210 315	32.0	3 250 300	29.0
MASTERFLEX Most Flexible T321, T316L, T304L	0 1 2	90 1800 2700	3.7	n/a	n/a	70 1558 2336	4.0	70 1186 1779	4.4	43 898 1347	6.4	43 718 1077	7.1	43 645 968	7.9	28 531 797	8.7	14 449 674	10.3	14 417 626	12.8	14 346 519	14.5	14 299 448	17.4	14 275 412	21.9	11 210 315	25.0	n/a	n/a
PRESSUREFLEX HP High Pressure T321 & T316L	0 1 2	450 3000 4000	5.5	n/a	n/a	400 2400 3300 n/a n/a	8.5	400 2400 3200	10.0	220 1100 1650	8.0	190 1000 1400	9.0	200 900 1350	12.0	90 750 1200	13.0	105 800 1150	15.0	46 575 900	17.0	36 550 800	20.0	23 425 575	25.0	28 331 n/a	34.0	23 285 n/a	40.0	n/a	n/a
PRESSUREMAX HP® Ultra-High Pressure T321 & T316L	0 1 2 3 4	500 5000 6000 n/a n/a	4.5	n/a	n/a	400 3500 5000 n/a n/a	7.0	200 2700 4500 n/a n/a	8.0	250 2650 3600 n/a n/a	4.5 10.0 10.0 n/a n/a	180 2500 3000 n/a n/a	7.0 11.0 11.0 n/a n/a	190 1775 2600 3000 n/a	9.5 12.5 12.5 14.0 n/a	110 1450 2200 n/a n/a	11.5 13.0 13.0 n/a n/a	100 1100 1675 n/a n/a	12.0 14.0 14.0 n/a n/a	46 700 1050 n/a n/a	14.5 16.0 16.0 n/a n/a	36 600 900 1200 n/a	16.0 20.0 20.0 76.0 n/a	23 525 875 1200 n/a	19.0 25.0 25.0 n/a 95.0	n/a	n/a	n/a	n/a	n/a	n/a
CHEMKING® Chemical Resistance 276	0 1 2	n/a	n/a	n/a	n/a	n/a	n/a	70 1186 1779	5.5	43 898 1347	8.0	43 718 1077	9.0	n/a	n/a	28 531 797	11.0	14 449 674	13.0	n/a	n/a	14 346 519	18.0	14 299 448	22.0	14 275 412	28.0	11 210 315	32.0	n/a	n/a
FORMAFLEX Stay-Put Application T321, T316L	0 1 2	90 900 n/a	n/a	n/a	n/a	70 900 n/a	n/a	70 665 n/a	n/a	43 360 n/a	n/a	43 355 n/a	n/a	43 280 n/a	n/a	28 264 n/a	n/a	14 221 n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
BRONZEFLEX Bronze Alloy	0 1 2	n/a	n/a	n/a	n/a	60 704 936	6.0	50 596 753	7.0	30 468 622	9.0	26 334 444	10.0	16 306 407	12.0	15 297 395	13.5	10 210 279	17.0	8 194 258	22.0	5 166 221	24.0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
EXTRAFLEX Helical/Flexible T321	0 1 2	71 1778 2489	2.2	43 1422 1991	2.4	36 1138 1707	2.8	28 910 1422	3.1	14 711 1138	5.1	11 569 910	5.3	9 455 711	7.9	7 356 569	9.4	6 284 455	11.0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
HYDRAFLEX Helical/High-Pressure T316L	0 1 2	n/a 4600 5800	5.0	n/a 4000 4800	5.1	n/a 3800 4000	5.5	n/a 2600 3700	5.7	n/a 2000 2200	6.5	n/a 1500 2000	7.9	n/a 1100 1600	9.4	n/a 1000 1500	12.2	n/a 750 1100	14.6	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Fittings

Metal hose is more versatile than other hose in that virtually any fitting can be attached to it. This versatility also means that multiple fittings can be welded together to make custom solutions for difficult applications.

Selecting the proper fittings for an application is largely determined by the mating them to the hose assembly will be attached. Once the mating fittings have been identified, the hose fittings should complement in type, size, & alloy. Ensure that the fittings are chemically compatible and are able to withstand the pressure & temperatures of both the media & the surrounding environment.

Male Pipe Nipple
Alloys: T304 & 316 SS, Carbon Steel, 276
Size Range: 1/8" - 12"
Schedules: 40, 80

Hex Male
Alloys: T304 & 316 SS, Carbon Steel, Brass
Size Range: 1/4 - 4"
Schedules: n/a

Grooved-End Fitting
Alloys: T304 & 316 SS, Carbon Steel
Size Range: 1" - 12"
Schedules: 40

LiveLink Swivel Fitting
Alloys: T304 Stainless Steel
Size Range: 1/4" - 2"
Schedules: Consult McGill for Pressure Rating

Female Union (Threaded/Socket Weld)
Alloys: T304 & 316 SS, Carbon Steel, Malleable Iron, Brass
Size Range: 1/4" - 4"
Class: 125#, 150#, 300, 3000#,
(depending on alloy)

Female Half Coupling (Threaded Socket Weld)
Alloys: T304 SS, Carbon Steel
Size Range: 1/4" - 4"
Schedules: 150#, 3000#

1, 2, 3 Piece SAE (JIC)
Alloys: T316 SS, Carbon Steel, Brass (nut only)
Size Range: 1/4" - 2"
Schedules: n/a

45 & 90 SAE (JIC)
Alloys: SS, Carbon Steel,
Size Range: 1/2" - 2"
Schedules: n/a

Sanitary Flange
Alloys: T304 & 316 Stainless Steel
Size Range: 1/2" - 3"
Schedules: n/a

Slip-On Flange
Alloys: T304 & 316 SS, Carbon Steel
Size Range: 1/2" - 12"
Schedules: 150#, 300#

Plate Flange
Alloys: T304 & 316 SS, Carbon Steel
Size Range: 1/2" - 12"
Schedules: 150#

Weld Neck Flange
Alloys: T304 & 316 SS, Carbon Steel
Size Range: 1/2" - 6"
Schedules: 150#, 300#

TTMA Flange
Alloys: T316 SS, Carbon Steel
Size Range: 2" - 6"
Schedules: n/a

C-Stub with Floating Flange
Alloys: T304 & 316 Stainless Steel
Size Range: 1/2" - 10"
Schedules: 10

A-Stub with Lap Joint Flange
Alloys: T304 & 316 SS, Carbon Steel, 276
Size Range: 1/2 - 8"
Schedules: 10, 40

TTMA C-Stub Swivel
Alloys: T304 & 316 Stainless Steel
Size Range: 4-6"
Schedules: 10

Part A & Part D (Cam-Lock)
Alloys: T316 SS, Aluminum, Brass
Size Range: 1/2" - 8"
Schedules: n/a

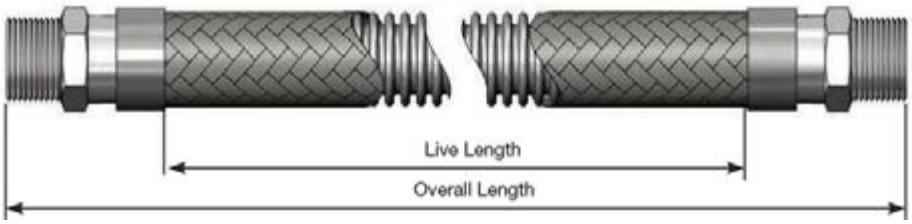
Tube End
Alloys: T304, T316, & T321 SS, Carbon Steel
Size Range: 1/8" - 12" (seamless or welded)
Schedules: Various

Short & Long Radius Elbows (45 & 90)
Alloys: T304 & 316 SS, Carbon Steel, 276
Size Range: 1/4" - 12"
Schedules: Various

Ground Joint Female
Alloys: Carbon Steel
Size Range: 1/2" - 4"
Schedules: n/a

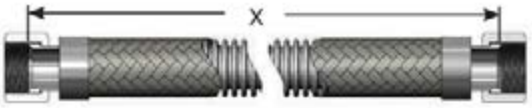
Specialty Gas Nuts
Alloys: Brass
Size Range: A, B, C, & D
Schedules: SAE & BSP

Hose Lengths

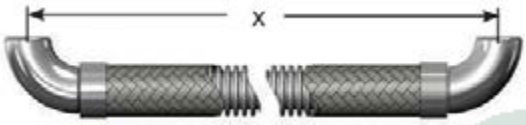


To calculate the proper length of a hose assembly, you need to:

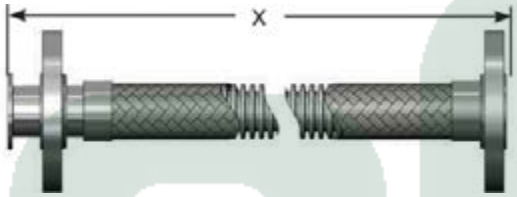
1. Verify installation is properly designed - Don't torque, overbend, or compress the hose
2. Calculate live length of the assembly - Active hose in assembly (between braid collars)
3. Calculate overall length of assembly - Equal to live length + collars and fittings



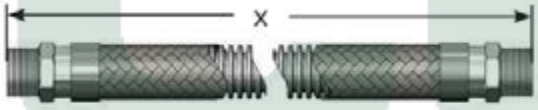
JIC/SAE Type Fittings:
Measured from the seat of the fitting.



Elbows & Fittings w/radius:
Measured from the center-line of the fitting.



Hose w/Flanges:
Measured from flange face or stub face if one is used.



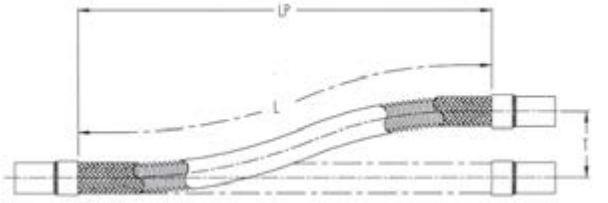
Threaded Fittings:
Measured to the end of the fitting.

For the drawings shown use the key for the following formulas:

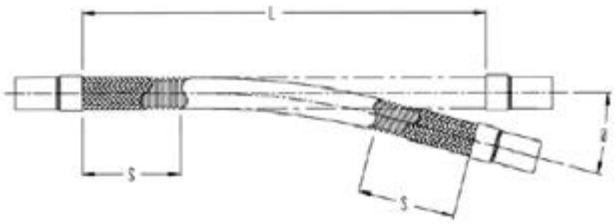
L= live length of hose (inches)
T= Travel (inches)
S= Hose outside diameter

Verify the installed radius is greater than the stated Minimum Bend Radius for the hose at the required working pressure.

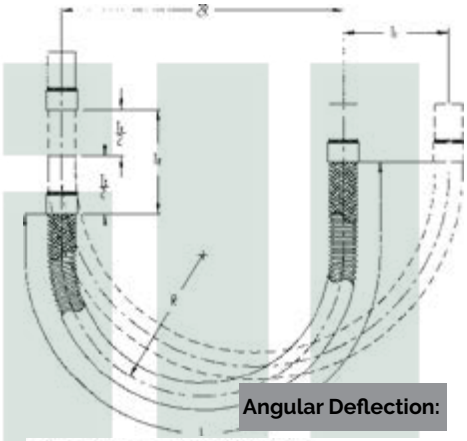
Verify that the centerline of the hose remains in the same plane during cycling to prevent twisting the assembly.



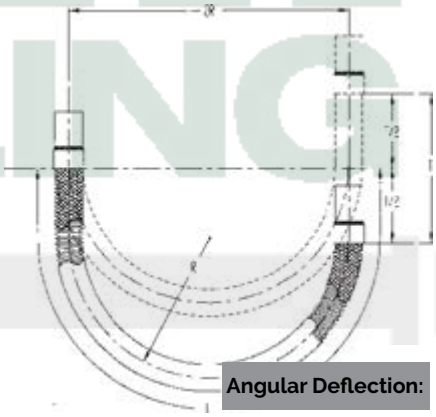
Lateral Offset: Formula: $L = \sqrt{20R \times T}$ $L_p = \sqrt{L^2 - T^2}$
R = Hose minimum bend radius in this formula



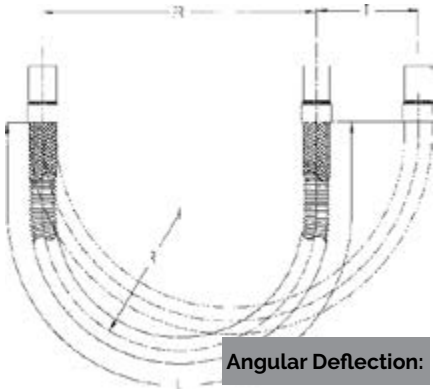
Angular Deflection: Formula: L = 2S + (θ/57.3)R
R = Hose minimum bend radius in this formula



Angular Deflection: Formula: L = 2S + (θ/57.3)R
R = Hose minimum bend radius in this formula



Angular Deflection: Formula: L = 2S + (θ/57.3)R
R = Hose minimum bend radius in this formula



Angular Deflection: Formula: L = 2S + (θ/57.3)R
R = Hose minimum bend radius in this formula

Fabrication Options

Corrugated metal hose is used in a very broad spectrum of applications. Just as the hose, fittings, and other assembly parts must be tailored to suit the demands of the service, so too must the methods of joining these components. While standard production joining methods work very well for the majority of service demands, the following extremes may dictate special joining or fabrication techniques:

1. Pressures
2. Temperatures
3. Corrosion
4. Other conditions

Our hose manufacturer has developed specialized welding, brazing, joining, and fabrication procedures to assure the integrity and servicability of metal hose assemblies in even the most extreme applications.

The fabrication options and services to be considered are:

1. Specialized attachment techniques
2. Testing options
3. Additional cleaning requirements
4. Packaging

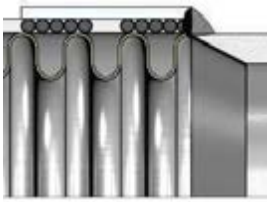
Industry Standard - ***used unless other method specified**

Standard Fabrication of an assembly generally consists of:

1. Cutting the hose and braid through a hose corrugation valley
2. Installing a braid collar over each end of the hose
3. Trimming of any excess braid
4. "Cap" welding the hose, braid, and braid collar together
5. Cleaning the cap weld surface
6. Placement and alignment of a fitting on the cap weld
7. "Attachment" welding the fitting to the cap weld *Silver brazing also available

Half-Corrugation

Standard fabrication sometimes leaves a portion of the cut corrugation, or corrugation "lip," just under the base of the fitting, In specialized applications, this residual lip may not be desirable. To prevent any exposed corrugation edges from causing damage, the hose can be specially prepared for welding by cutting the corrugation on the crest, rather than in the valley, therby removing the lip

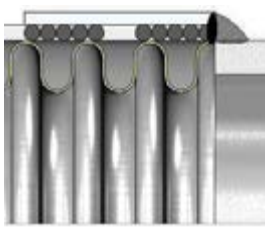


Smooth Transition Weld

For applications in which corrosion is a concern, all crevices and fissures must be minimized. Specialized hose and fitting preparation, in conjunction with proprietary welding techniques, is available to provide a full penetration hose-to-fitting weld that is smooth and crevice free.

Braid-Over Construction

Assemblies operating at upper limits of their rated working pressure, or in severe service, may benefit from braid-over. The fitting is first expanded & then welded to the unbraided hose. Then the braid is drawn over the end of the hose & welded to the side of the fitting. This technique reduces the amount of heat introducted into the braid wires, nearly eliminates the heat-affected zones of the cap & attachment welds, & maximizes the wire strength. This may also be used for specific high-cycle applications.



Testing Methods

Standard Leak Testing

Every corrugated hose assembly is leak tested prior to shipment. Standard testing consists of pressurizing the assembly with air and then submerging the entire assembly under water. This method is reliable and sufficient for the majority of applications.

Hydrostatic Testing

While the standard test is designed to detect leaks, hydrostatic testing is designed to test the assembly's strength. Testing of an assembly to its full permissible test pressure can be economically and accurately accomplished by filling the assembly with liquid while concurrently evacuating all air. The assembly is then hydrostatically pressurized using high-pressure pumps and the test pressure is maintained for a predetermined period of time.

High Pressure Gas

Testing with air under water, at pressures of up to 2500 psi, is available for specialized applications. For a more sensitive test, the use of gases, such as nitrogen or helium, can be requested.

Helium Mass Spectrometer

This is the most sensitive leak detection method generally available. The standard test method is to attach the assembly to a mass spectrometer and generate a very high vacuum in the assembly. The exterior of the assembly is then flooded with helium. The relatively tiny helium atoms penetrate even very small openings and are drawn into the mass spectrometer where they are detected and the leak size is quantified. Helium Mass Spectrometer testing can be modified to satisfy customer of regulatory agency requirements

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