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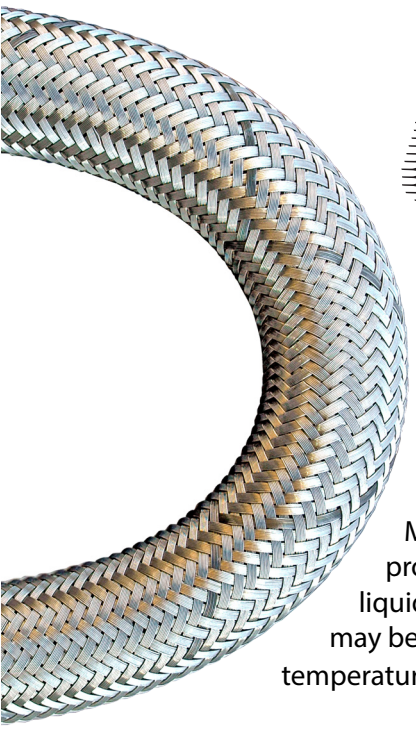
Flexible METAL HOSE



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Is among the nation's leading flexible metal hose manufacturers with over 25 years of experience in the manufacture of metal hose products. We bring solid product and application experience to the table while offering a complete line of braided corrugated metal hose that is designed to cover nearly any application.

WHY METAL HOSE?

Metal hose assemblies are often used where rubber, plastic, PTFE, or other types of hose products are unsuitable. Reinforced corrugated metal hose provides for the transfer of liquids or gases, and is engineered to handle extreme temperature and pressure. Metal hose may be appropriate where other types of hoses are not, such as the transfer of extremely high temperature liquids or gases or transferring extremely cold (cryogenic) liquids.

SERVICE

UNISOURCE is committed to serving our customers with the largest selection of hoses and materials in the corrugated metal hose industry. Whether we are designing specialty hose assemblies for OEM applications or supporting our network of distributors, **UNISOURCE** has the dedication and resources to meet the needs of today's industrial requirements. Our goal is to provide exceptional customer service, quality engineered products and on-time delivery.

TESTING & CERTIFICATIONS

Every single **UNISOURCE** corrugated metal hose assembly is tested for leak integrity. We can offer a variety of other types of testing, with corresponding certifications provided. These tests and certifications include:

- ***Pressure testing*** – Hose assemblies are pressurized pneumatically or hydrostatically to ensure that the hose assemblies do not leak prior to shipping from the factory. The hoses are tested per CGA and NAHAD standards depending on the application. **UNISOURCE** has the ability to cycle test hose assemblies up to 50,000 psi.
- ***Mass Spectrometer*** – **UNISOURCE** has the ability to test hose assemblies using a mass spectrometer to indicate possible leaks when the hoses are to be used for transferring small molecule, high permeation gases.
- ***Destructive testing*** – Hose assemblies are pressurized to burst pressures to ensure that the hose meets the published levels.
- ***Material Test Reports*** – **UNISOURCE** can provide the Material Test Reports for the materials used in the hose manufacturing process upon request. The requirement for the Material Test Reports needs to be indicated at the time of order placement.
- ***Certificate of Conformance*** – A **UNISOURCE** document that verifies the hose has been manufactured per applicable standards. The requirement for the Certificate of Conformance needs to be indicated at the time of order placement.

THE QUALITY PROCESS

UNISOURCE is committed to enhancing the quality of every product we manufacture through continual process improvements. The **UNISOURCE** Quality Team critically evaluates every stage of production, testing and packaging. Our goal is to deliver a product that exceeds our customers' expectations.

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Metal Hose Product Line

UNISOURCE offers one of the most extensive lines of metal hose products to meet a wide range of design requirements. **UNISOURCE** brand metal hoses are mechanically or hydro-formed, stainless steel or bronze, standard or high pressure and meet flexibility and cycle life requirements.

SUPERFLEX
Superflex is our most popular metal hose and the standard of the industry when a 321 or 316L stainless steel hose with a 304L braid is required. It is a medium weight, mechanically formed annular corrugated product that combines durability with impressive flexibility and cycle life. Superflex is stocked in standard sizes ranging from ¼" to 14" diameters. Special orders can be accommodated using 16", 18" and 20" diameters. Single or double braid reinforcement can be supplied in all sizes.

SUPERFLEX HD
Superflex HD is engineered for applications requiring higher pressures. It comes standard in 321 and 316L hose with a 304L stainless steel braid. Superflex HD is a mechanically formed annular corrugated product. While its corrugated wall is heavier than our standard Superflex, it retains a high level of flexibility due to a closer pitch corrugation. Superflex HD is stocked in standard sizes ranging from ¼" to 6" diameters. Single or double braid reinforcement can be supplied in all sizes.

ULTRAFLEX - ISO 10380
Ultraflex is the most flexible metal hose available on the market while conforming to the performance standard ISO 10380. It comes standard in 321 hose with a 304L braid and can be special ordered using 316L hose material. Ultraflex has an annular hydro-formed dissymetrical omega shaped corrugation, giving the hose its ultra flexibility for applications requiring a higher cycle life. Ultraflex is stocked in standard sizes ranging from ¼" to 6". Single or double braid reinforcement can be supplied in all sizes.

BRONZEFLEX
Bronzeflex is a mechanically formed standard pitch corrugated hose constructed using bronze hose and braid. This hose is ideal for applications involving the use of copper piping. Bronzeflex is typically used in water lines and refrigeration applications. It is stocked in sizes ranging from ¼" to 4" diameters. Single or double braid reinforcement can be supplied in all sizes.

SPECIAL PRODUCTS
UNISOURCE can provide hoses constructed from superalloys such as Monel or Inconel. Custom configurations can be fabricated to be used for chlorine transfer lines or as part of a distribution manifold. **UNISOURCE** can also provide more complex hose assemblies such as steam jacketed, lined and traced.

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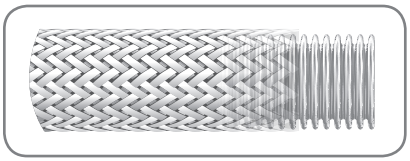
Superflex



Size	Hose Material	Braid Material	Temperature
1/4" through 6"	321 and 316L stainless steel	304L or 316 stainless steel	-321°F to 1500 °F
8" through 12"	321 and 316L stainless steel	304 stainless steel	-321°F to 850°F
14" and larger	Call for specifications	304 stainless steel	-321°F to 850°F

Basic Construction:
Medium-weight annular hose.
Standard pitch design.

Part Numbers:
- SF20 - Unbraided
- SF21 - Single Braided
- SF22 - Double Braided
- SF30 - 316SS Unbraided
- SF31 - 316SS Single Braided
- SF32 - 316SS Double Braided

			Maximum Pressure @ 70°F (PSIG) [1]			Centerline Bend Radius (In)		Weight Per Foot (Lbs)
Nominal I.D. (In)	Number of Braids	Nominal O.D. (In)	W.P.	Test [2]	Nominal Burst	Dynamic [3]	Static [4]	
1/4	0	0.378	200	300	---	4.88	1.97	0.05
	1	0.457	2,500	4,761	10,000			0.15
	2	0.516	4,000	6,000	16,000			0.25
3/8	0	0.559	100	150	---	5.98	1.97	0.07
	1	0.638	1,530	2,295	6,120			0.18
	2	0.697	2,448	3,672	9,792			0.29
1/2	0	0.657	80	120	---	6.89	2.36	0.08
	1	0.736	1,200	1,800	4,800			0.20
	2	0.795	1,920	2,880	7,680			0.32
3/4	0	1.051	70	105	---	7.09	2.76	0.17
	1	1.130	850	1,275	3,400			0.36
	2	1.189	1,360	2,040	5,440			0.55
1	0	1.276	40	60	---	9.02	4.09	0.24
	1	1.354	590	885	2,360			0.47
	2	1.413	944	1,416	3,776			0.70
1-1/4	0	1.622	25	38	---	10.51	4.61	0.34
	1	1.705	540	810	2,160			0.65
	2	1.768	864	1,296	3,456			0.96
1-1/2	0	1.949	20	30	---	11.80	5.10	0.48
	1	2.031	475	712	1,900			0.89
	2	2.094	760	1,140	3,040			1.30
2	0	2.374	15	23	---	12.60	6.30	0.60
	1	2.472	530	795	2,120			1.21
	2	2.551	848	1,272	3,392			1.82
2-1/2	0	3.031	12	18	---	20.00	6.88	0.67
	1	3.110	410	615	1,640			1.43
	2	3.189	656	984	2,624			2.19
3	0	3.583	10	15	---	24.00	9.10	0.77
	1	3.661	335	502	1,340			1.60
	2	3.740	536	804	2,144			2.43
4	0	4.626	8	12	---	29.50	9.84	0.99
	1	4.705	240	360	960			2.11
	2	4.783	384	576	1,536			3.23
5	0	5.866	6	9	---	35.44	12.52	2.60
	1	5.969	192	288	768			3.85
	2	6.071	306	459	1,224			5.10
6	0	7.008	6	8	---	41.35	13.90	2.88
	1	7.110	165	248	660			4.58
	2	7.213	264	396	1,056			6.28
8 [5]	0	9.09	6	9	---	40.00	20.00	5.56
	1	9.19	234	351	934			9.44
	2	9.28	374	561	1,495			13.36
10 [5]	0	11.18	5	7.5	---	50.00	25.00	6.80
	1	11.32	230	345	918			12.90
	2	11.45	367	500.5	1,469			19.00
12 [5]	0	13.23	3	4.5	---	60.00	30.00	9.02
	1	13.37	161	241.5	643			14.83
	2	13.50	257	385.5	1,029			20.64
14 [5]	0	14.37	2.5	4	---	66.00	35.00	10.63
	1	14.62	150	225	600			17.03
	2	14.88	190	285	760			23.43

[1] Pressures listed **have** been reduced (20%) to account for welding as the method of attachment.
[2] Test Pressure: This indicates the industry standard recommendation for the highest pressure that the hose should be tested to either within an installation, or by the factory prior to shipping. Pressure tests prior to shipping are not standard and must be specified by the customer.
[3] Dynamic Bend Radius: The minimum radius to which a hose can be repeatedly bent and render satisfactory flexure life.
[4] Static Bend Radius: Minimum centerline bend radius to which flexible metal hose may be bent for installation.
[5] Braided braid style.

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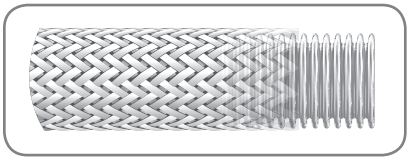
Superflex HD



Hose Material
316L & 321 stainless steel

Braid Material
304L stainless steel

Basic Construction:
Heavy-weight, mechanically formed annular hose. Close pitch design.

Part Numbers:
- SF30HD - 316SS Unbraided
- SF31HD - 316SS Single Braided
- SF32HD - 316SS Double Braided
- SF20HD - 321SS Unbraided
- SF21HD - 321SS Single Braided
- SF22HD - 321SS Double Braided

			Maximum Pressure @ 70°F (PSIG) [1]			Centerline Bend Radius (In)		Weight Per Foot (Lbs)
Nominal I.D. (In)	Number of Braids	Nominal O.D. (In)	W.P.	Test [2]	Nominal Burst	Dynamic [3]	Static [4]	
1/2	0	0.82	80	120	---	8.00	1.50	0.39
	1	0.92	2,194	3,921	8,777			0.63
	2	1.02	3,510	5,265	14,040			0.87
3/4	0	1.21	70	105	---	8.00	2.00	0.48
	1	1.31	1,311	1,967	5,244			0.79
	2	1.41	2,098	3,147	8,392			1.10
1	0	1.50	40	60	---	9.00	3.00	0.79
	1	1.60	1,069	1,604	4,276			1.20
	2	1.70	1,710	2,566	6,840			1.61
1-1/4	0	1.85	33	50	---	10.00	3.25	1.02
	1	1.97	1,110	1,666	4,443			1.66
	2	2.10	1,776	2,665	7,040			2.30
1-1/2	0	2.17	20	30	---	10.00	3.25	1.36
	1	2.30	868	1,302	3,472			2.11
	2	2.43	1,388	2,082	5,552			2.86
2	0	2.51	15	23	---	11.50	5.38	1.60
	1	2.64	810	1,215	3,240			2.56
	2	2.76	1,296	1,944	5,184			3.52
2-1/2	0	3.23	10	15	---	24.00	7.00	2.00
	1	3.36	578	867	2,312			3.12
	2	3.49	925	1,387	3,700			3.30
3	0	3.78	10	15	---	28.00	7.50	2.97
	1	3.91	540	810	2,160			4.42
	2	4.03	864	1,295	3,456			5.87
4	0	4.81	8	12	---	40.00	20.00	3.10
	1	4.93	333	500	1,332			4.55
	2	5.05	533	800	2,132			6.00
6	0	6.87	5	8	---	48.00	24.00	3.85
	1	7.10	266	398	1,062			6.45
	2	7.33	425	638	1,700			9.05

[1] Pressures listed **have** been reduced (20%) to account for welding as the method of attachment.
[2] Test Pressure: This indicates the industry standard recommendation for the highest pressure that the hose should be tested to, either within an installation or by the factory prior to shipping. Pressure tests prior to shipping are not standard and must be specified by the customer.
[3] Dynamic Bend Radius: The minimum radius to which a hose can be repeatedly bent and render satisfactory flexure life.
[4] Static Bend Radius: Minimum centerline bend radius to which flexible metal hose may be bent for installation.

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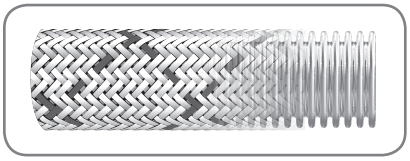
Ultraflex



Hose Material
321 and 316L stainless steel

Braid Material
304L stainless steel

Basic Construction:
Hydro-formed annular hose. Close pitch, dissymmetric omega design.

Characteristics:
Extremely flexible—ISO 10380 conformance and 50,000 cycle rated and pressure rated as per ISO 10380.

Part Numbers:
- UF20 = Unbraided 321 Hose
- UF21 = Single Braided 321 Hose / 304L Braid
- UF30 = Unbraided 316L Hose
- UF31 = Single Braided 316L Hose / 304L Braid

			Maximum Pressure @ 70°F (PSIG)			Centerline Bend Radius (In)		Weight Per Foot (Lbs)
Nominal I.D. (In)	Number of Braids	Nominal O.D. (In)	W.P. [1]	Test [2]	Nominal Burst	Dynamic [3]	Static [4]	
1/4	0	0.39	261	392	---	---	0.35	0.04
	1	0.45	2,030	3,045	11,165	5.50	0.75	0.12
3/8	0	0.63	87	131	348	---	0.55	0.09
	1	0.70	1,450	2,175	8,004	6.00	1.14	0.23
1/2	0	0.73	87	131	348	---	0.83	0.10
	1	0.79	1,160	1,740	6,104	4.88	1.34	0.24
3/4	0	1.11	32	48	128	---	1.26	0.15
	1	1.18	725	1,088	3,509	6.65	2.09	0.36
1	0	1.37	26	39	104	---	1.46	0.20
	1	1.43	580	870	2,755	7.68	2.52	0.44
1-1/4	0	1.71	23	35	92	---	1.81	0.33
	1	1.79	580	870	2,973	8.86	3.11	0.68
1-1/2	0	2.06	17	26	68	---	2.16	0.40
	1	2.14	465	698	2,465	10.04	3.86	0.88
2	0	2.55	15	23	60	---	2.56	0.64
	1	2.65	465	698	2,436	11.54	4.72	1.35
2-1/2	0	3.19	7	11	28	---	3.15	0.79
	1	3.28	363	545	1,871	13.58	5.90	1.74
3	0	3.92	10	15	40	---	3.82	0.94
	1	4.04	290	435	1,595	15.35	7.09	2.30
4	0	4.98	6	9	24	---	4.45	1.12
	1	5.10	218	327	1,247	17.72	8.58	2.71
5	0	5.98	4	6	16	---	5.20	3.04
	1	6.10	232	348	928	25.60	10.04	4.50
6	0	6.85	3	5	12	---	5.98	3.48
	1	6.97	210	315	841	32.08	11.42	5.35

[1] Working pressures rated using dynamic flexing conditions.
[2] Test Pressure: This indicates the industry standard recommendation for the highest pressure that the hose should be tested to either within an installation, or by the factory prior to shipping. Pressure tests prior to shipping are not standard and must be specified by the customer.
[3] Dynamic Bend Radius: The minimum radius to which a hose can be repeatedly bent and render satisfactory flexure life.
[4] Static Bend Radius: Minimum centerline bend radius to which flexible metal hose may be bent for installation.

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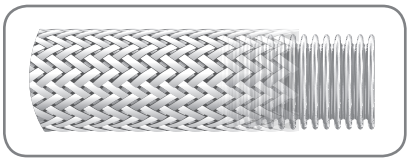
Bronzeflex



Hose Material
Bronze

Braid Material
Bronze

Basic Construction:
Medium-weight mechanically formed annular hose. Standard pitch design.

Part Numbers:
- BF10 = Unbraided
- BF11 = Single Braided
- BF12 = Double Braided

			Maximum Pressure @ 70°F (PSIG) [1]			Centerline Bend Radius (In)		Weight Per Foot (Lbs)
Nominal I.D. (In)	Number of Braids	Nominal O.D. (In)	W.P.	Test [2]	Nominal Burst	Dynamic [3]	Static [4]	
1/4	0	0.46	120	180	---	6.00	2.00	0.12
	1	0.52	934	1,401	3,735			0.22
	2	0.57	1,242	1,863	4,968			0.32
3/8	0	0.61	60	90	---	6.00	2.00	0.16
	1	0.67	704	1,056	2,815			0.29
	2	0.73	936	1,404	3,744			0.42
1/2	0	0.76	50	75	---	7.00	2.25	0.23
	1	0.81	566	849	2,265			0.38
	2	0.87	753	1,130	3,012			0.53
3/4	0	1.05	30	45	---	8.00	2.50	0.33
	1	1.10	468	701	1,870			0.55
	2	1.16	622	933	2,487			0.77
1	0	1.35	26	39	---	9.00	3.00	0.41
	1	1.42	334	501	1,335			0.68
	2	1.50	444	666	1,776			0.95
1-1/4	0	1.66	16	24	---	10.00	3.50	0.71
	1	1.74	306	459	1,225			1.15
	2	1.82	407	611	1,629			1.59
1-1/2	0	1.89	15	22.5	---	10.00	4.00	0.93
	1	1.96	297	445	1,187			1.47
	2	2.03	395	592	1,579			2.01
2	0	2.48	10	15	---	11.00	6.00	1.00
	1	2.57	210	315	840			1.62
	2	2.66	279	419	1,117			2.24
2-1/2	0	3.30	8	12	---	16.00	8.50	1.70
	1	3.45	194	291	775			2.68
	2	3.57	258	387	1,031			3.66
3	0	3.88	5	8	---	20.00	10.00	2.10
	1	4.01	166	249	665			3.30
	2	4.13	221	332	884			4.50
4	0	4.84	3	4.5	---	24.00	12.00	2.31
	1	4.99	145	217	580			3.77
	2	5.19	192	288	770			5.39

[1] Pressures listed **have** been reduced (20%) to account for welding as the method of attachment.
[2] Test Pressure: This indicates the industry standard recommendation for the highest pressure that the hose should be tested to either within an installation, or by the factory prior to shipping. Pressure tests prior to shipping are not standard and must be specified by the customer.
[3] Dynamic Bend Radius: The minimum radius to which a hose can be repeatedly bent and render satisfactory flexure life.
[4] Static Bend Radius: Minimum centerline bend radius to which flexible metal hose may be bent for installation.

Special Hose Assembly Fabrication

Jacketed Assembly

Jacketed assemblies are normally used in one of the following applications:

- As a heated transfer line for those products, such as sulfur, which must be maintained at an elevated temperature in order to flow readily. Steam or hot oil is circulated through the jacket, which in turn heats the product being conveyed in the core hose.
- As a cryogenic transfer line. Maintaining a high vacuum in the jacket effectively insulates cryogenic liquids being conveyed in the core hose.

Traced Assembly

Traced hose assemblies are used when the product being conveyed must be heated in order to flow freely. Steam or hot oil circulated through the inner tracer hose heats the product in order to maintain the correct temperature.

Lined Assembly

Product being conveyed through an unlined corrugated metal hose at high velocity can set up resonant vibration within the hose causing it to prematurely fail. This may be eliminated by adding a liner to the hose.

Guarded Assembly

Guarded assemblies are used when a corrugated metal hose could easily be damaged by rough handling, abrasion, or flexing past its minimum bend radius.

Fire Jacket

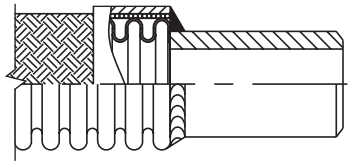
Fire jackets are used in applications where hot media is being conveyed through the hose and a possibility of skin contact exists. They can also be used to insulate the media being conveyed from either high or low ambient temperatures that can have a negative effect on the product or its flow through the hose.

Spring Guard

Spring guards can be installed on hoses without armor in situations when there is a significant risk of damage to hose in service. Spring guards consist of a metal spring that is attached behind the fitting.

Fittings for Metal Hose

Welded Pipe End with 37-1/2 Degree Bevel



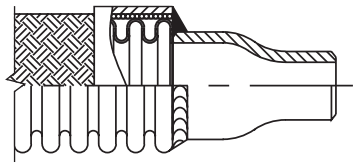
Size Availability: 1/4" diameter to 14" diameter

Material Availability: Carbon Steel, T304 Stainless Steel, T321 Stainless Steel, T316 Stainless Steel

Schedule Availability: 5, 10, 40, 80, 160

Note: Not all sizes and schedules are available in combination. Consult **UNISOURCE** for details.

Welded Concentric Reducer



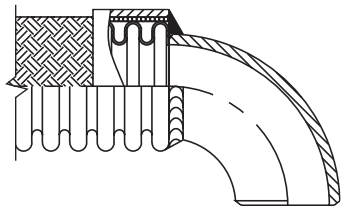
Size Availability: 1/2" diameter to 14" diameter and combinations thereof

Material Availability: Carbon Steel, T304 Stainless Steel, T321 Stainless Steel, T316 Stainless Steel

Schedule Availability: 5, 10, 40, 80, 160

Note: Not all sizes and schedules are available in combination. Consult **UNISOURCE** for details.

Welded Long Radius 90 Degree Elbow



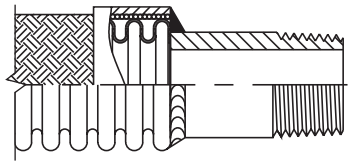
Size Availability: 1/2" diameter to 14" diameter

Material Availability: Carbon Steel, T304 Stainless Steel, T321 Stainless Steel, T316 Stainless Steel

Schedule Availability: 5, 10, 40, 80, 160

Note: Not all sizes and schedules are available in combination. Short radius, 45's and other angles are available. Consult **UNISOURCE** for details.

Welded NPT Male Nipple



Size Availability: 1/4" diameter to 6" diameter

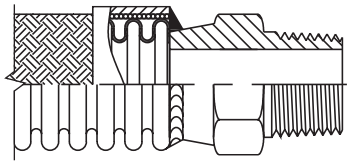
Material Availability: Carbon Steel, T304 Stainless Steel, T321 Stainless Steel, T316 Stainless Steel

Schedule Availability: 5, 10, 40, 80, 160

Note: Not all sizes and schedules are available in combination. Consult **UNISOURCE** for details.

Fittings for Metal Hose

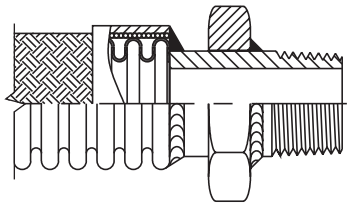
NPT Male Nipple with Integral Hex Nut



Size Availability:	1/4" diameter to 2" diameter
Material Availability:	Carbon Steel, T304 Stainless Steel, T321 Stainless Steel, T316 Stainless Steel
Schedule Availability:	5, 10, 40, 80, 160

Note: Not all sizes, schedules and materials are available in combination. Consult **UNISOURCE** for details.

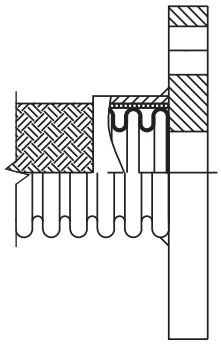
NPT Male with Welded on Hex Nut



Size Availability:	2-1/2" diameter to 4" diameter
Material Availability:	Carbon Steel, T304 Stainless Steel, T321 Stainless Steel, T316 Stainless Steel
Hex Material:	Carbon Steel
Schedule Availability:	5, 10, 40, 80, 160

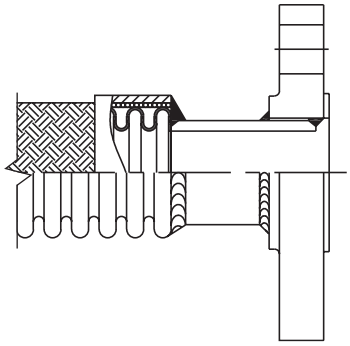
Note: Not all sizes and materials are available in combination. Consult **UNISOURCE** for details.

Welded Plate Flange ANSI Class 150 Drilling



Size Availability:	3/4" Diameter to 14" Diameter
Material Availability:	Carbon Steel, T304 Stainless Steel, T316 Stainless Steel

Raised Face Slip-On Flange on Pipe End

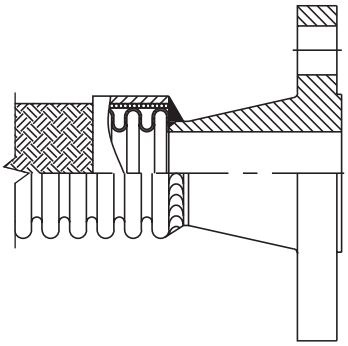


Size Availability:	3/4" Diameter to 14" Diameter
Material Availability:	Carbon Steel, T304 Stainless Steel, T321 Stainless Steel, T316 Stainless Steel
Schedule Availability:	5, 10, 40, 80, 160
ANSI Class Ratings:	150, 300, 600

Note: Not all sizes and schedules are available in combination. Consult **UNISOURCE** for details.

Fittings for Metal Hose

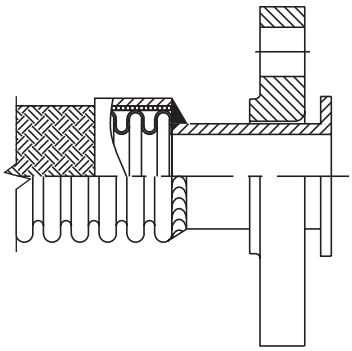
Welded Raised Face Weldneck Flange



Size Availability:	3/4" Diameter to 14" Diameter
Material Availability:	Carbon Steel, T304 Stainless Steel, T321 Stainless Steel, T316 Stainless Steel
Schedule Availability:	5, 10, 40, 80, 160
ANSI Class Ratings:	150, 300, 600

Note: Not all sizes and schedules are available in combination. Consult **UNISOURCE** for details.

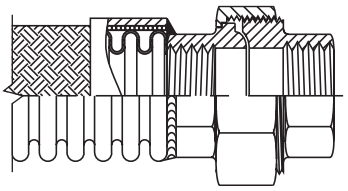
Floating Flange with Type "C" Stub End



Size Availability:	3/4" Diameter to 14" Diameter
Material Availability:	Carbon Steel, T304 Stainless Steel, T321 Stainless Steel, T316 Stainless Steel
Schedule Availability:	5, 10, 40, 80, 160
ANSI Class Ratings:	150, 300, 600

Note: Not all sizes and schedules are available in combination. Lap joint flanges w/ Type "A" stub end also available.

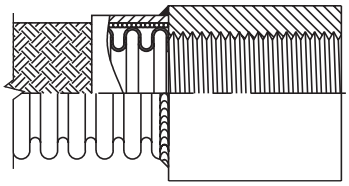
Welded Female Union



Size Availability:	1/2" Diameter to 4" Diameter
Material Availability:	Carbon Steel, T304 Stainless Steel, T316 Stainless Steel
Pressure:	150, 300, 3000 pounds

Note: Not all sizes and schedules are available in combination.

Welded Female NPT Half Pipe Coupling

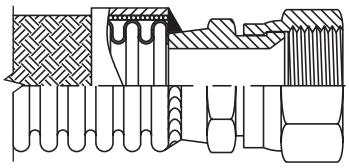


Size Availability:	1/2" diameter to 4" diameter
Material Availability:	Carbon Steel, T304 Stainless Steel, T316 Stainless Steel
Pressure:	150, 300, 3000 pounds

Note: Not all sizes and pressures are available in combination. Female NPT Full Pipe Coupling is also available. Consult **UNISOURCE** for details.

Fittings for Metal Hose

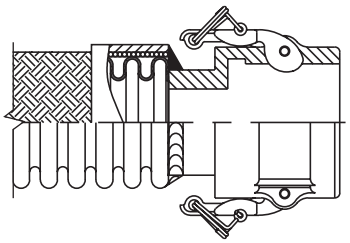
Welded JIC Swivel Female



Size Availability: 1/4" diameter to 2" diameter

Material Availability: Carbon Steel, T304 Stainless Steel, T316 Stainless Steel

Welded Quick Disconnect Female Part "D" Coupler

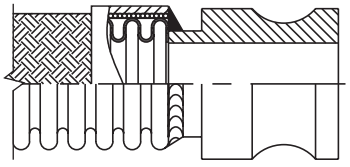


Size Availability: 1/2" diameter to 8" diameter

Material Availability: Carbon Steel, T316 Stainless Steel
Other materials are available - Consult **UNISOURCE** for details.

Note: Not all sizes and materials are available in combination. Consult **UNISOURCE** for details.

Welded Quick Disconnect Male Part "A" Camlock



Size Availability: 1/2" diameter to 8" diameter

Material Availability: Carbon Steel, T316 Stainless Steel - Other materials available - Consult **UNISOURCE** for details

Note: Not all sizes and materials are available in combination. Consult **UNISOURCE** for details.

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Understanding Metal Hose Part Numbers

Hose Style	–	Size	–	End #1	–	End #2	–	Overall Length	–	Accessories
	–		–		–		–		–	

Hose Style

Superflex - Stainless
SF20 - Unbraided
SF21 - Single Braid
SF22 - Double Braid
SF20HD - 321SS Unbraided
SF21HD - 321SS Single Braid
SF22HD - 321SS Double Braid
SF30 - T316 Unbraided
SF31 - T316 Single Braid
SF32 - T316 Double Braid
SF30HD - 316SS Unbraided
SF31HD - 316SS Single Braid
SF32HD - 316SS Double Braid

Ultraflex - Stainless
UF20 - Unbraided
UF21 - Single Braid
UF22 - Double Braid

Bronzeflex - Bronze
BF10 - Unbraided
BF11 - Single Braid
BF12 - Double Braid

Size Nominal

025 - 1/4"
038 - 3/8"
050 - 1/2"
075 - 3/4"
100 - 1"
125 - 1-1/4"
150 - 1-1/2"
200 - 2"
250 - 2-1/2"
300 - 3"
400 - 4"
500 - 5"
600 - 6"
800 - 8"
1000 - 10"
1200 - 12"
1400 - 14"
1600 – 16"
1800 – 18"

Ends - Carbon Steel

40 - MPT Sch 40
41 - MPT Hex Sch 40
42 - Weld End Sch 40
43 - Union 150#
44 - Half Cplg 150#
45 - FJIC
47 - Plate Flg 150#
47F - Floating Plate Flg 150#
48 - RFSO Flg 150#
48F - Floating RFSO Flg 150#
49 - RFWN Flg 150#
50 - MPT Sch 80
51 - MPT Hex Sch 80
52 - Weld End Sch 80
53 - Union 3000#
54 - Half Cplg 3000#
55 - Grooved
58 - RFSO Flg 300#
58F - Floating RFSO Flg 300#
59 - RFWN Flg 300#
99 - Special CS Ftting

Ends - 304 & 316 Stainless Steel

20 - MPT Sch 40
21 - MPT Hex Sch 40
22 - Weld End Sch 40
22T - Tube Ends
23 - Union 150#
24 - Half Cplg 150#
25 - FJIC
27 - Plate Flg 150#
27F - Floating Plate Flg 150#
28 - RFSO Flg 150#
28F - Floating RFSO Flg 150#
29 - RFWN Flg 150#
30 - MPT Sch 80
31 - MPT Hex Sch 80
32 - Weld End Sch 80
33 - Union 3000#
34 - Half Cplg 3000#
35 - Grooved
38 - RFSO Flg 300#
38F - Floating RFSO Flg 300#
39 - RFWN Flg 300#
99S - Special CS Fitting

Ends - Copper

11 - MPT Hex
12T - Tube Ends
12 - Sweat
13 - Brass Union

Accessories

Armor Casing
A - Full Armor - SS
A18 - 18" E/E - SS Armor Cuffs

Liner
L - Interlock Liner - SS

Example:

SF21 - 200 - 40 - 40 - 24.0" - A

The above hose represents 2" single braid Superflex with carbon steel MPT ends, 24" in overall length, with full armor casing.

Example:

SF31 - 200 - 20(316) - 20(316) - 24.0"

Note: For 316SS Ends add (316) following the "END" denotation.

Basic Construction & Velocity Limits

Basic Construction of Flexible Metal Hose

Corrugated Hose

The corrugated hose begins as a flat sheet of stainless steel or bronze that is formed into a tube and longitudinally welded. This tube is then formed into corrugations that can be either annular or helical in design. Annular corrugations on a hose are a series of complete circles or rings located at right angles to the longitudinal axis of the hose. Corrugations are necessary for the hose to achieve flexibility without kinking. The hose corrugations can be formed either mechanically or hydro-formed. The corrugation profile can be short or tall, "U" or omega shaped, standard or close pitched. The corrugation method and profile will determine the flexibility and cycle-life of the hose.

Braid Reinforcing

The braid is a sleeve of woven wires that cover the exterior of the corrugated hose. The primary reason for the braid is to reinforce the inner hose. The braid will also provide some protection against external damage. The braid prevents elongation while decreasing the amount of transmitted vibration. Different styles and sizes of hose will utilize different braid angles, size and number of wires and braid coverage to allow different design pressures. The use of a double braid or a second layer of braid allows for increased working pressures. If the increased weight and bulk of a double braid is not acceptable, a braided braid can be used to increase the working pressure. The braided braid uses a series of pre-braided wires to construct the braided sleeve.

Corrugated Hose Velocity Limits

Velocity is defined as the speed at which the media flows through the hose. The media can be either liquid or gas. If media velocity reaches critical levels, a resonant frequency vibration can occur, possibly causing premature failure of the hose. In the design of the hose, media velocity should be considered and mitigated prior to the manufacture of the hose. If the velocity becomes an issue, the hose diameter can be increased or an interlocked metal hose liner can be added to remove the velocity problem.

Hose Bending Configuration	Maximum Product Velocity (Feet/Second)			
	Unbraided		Braided	
	Dry Gas	Liquid	Dry Gas	Liquid
Straight Run	100	50	150	75
45 Degree Bend	75	40	115	60
90 Degree Bend	50	25	75	40
180 Degree Bend	25	12	38	19

Selecting The Correct Metal Hose Assembly

Your selection of a flexible metal hose assembly for a particular application should be influenced by six primary considerations:

- Media
- Pressure
- Temperature
- Size
- End Fittings
- Expected Motion

In order to choose the best flexible metal hose product for an application, review all of the relevant operating factors against the listed properties of the various choices of metal hose.

Media

What is the exact media being conveyed through the hose? Metal hoses can be corroded both by internal media being conveyed and by an external environment where the hose has been placed.

Pressure

What pressures are expected in your intended application? Pressure ratings of flexible metal hose will vary by type, material, size, and braid coverage. Specific pressure ratings for each type of **UNISOURCE** flexible metal hose are found in this catalog. Under actual working conditions, pressure ratings are affected by many factors such as temperature, pulsating conditions and bending stresses.

Temperature

The strength of metal alloys is highly affected by temperature. Pressure rating of a hose will be reduced as internal or external temperature rises.

The correct selection of hose material will provide a hose that will remain flexible throughout a wide temperature range. The **Metal Hose Temperature Factors and Conversions** section of the catalog describes the main limiting factors for metal hose assemblies. The metal hose temperature limit is predicated by metal alloy, end fittings and method of fitting attachment.

Selecting The Correct Metal Hose Assembly

Size

Existing piping will normally dictate the size of metal hose for a particular application. The size of flexible metal hose is specified by the nominal diameter (typically the inside diameter of the hose). Flow rate, velocity and pressure drop may also influence selection of the hose size.

End Fittings

Flexible metal hose has a virtually unlimited selection of end fittings that can be attached. End fittings may be male or female pipe threads, unions, flanged, flared tube fittings or other specially designed connectors. End fittings are attached by welding and silver brazing, depending on the type of hose and the alloy.

Expected Motion

Flexible metal hose is generally used in four types of applications:

- To correct problems of misalignment.
- To provide flexibility in manual handling operations.
- To compensate for constant movement.
- To absorb vibration.

The expected motion of the hose will determine the metal hose product, the assembly configuration and the live length. Care should be taken to choose a hose with appropriate flexibility, an assembly with sufficient live length and motion that will not subject the hose to torque or twist.

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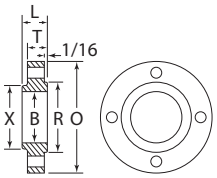
Pipe Flange Dimensions

ASA 150 LB. FLANGE

(Conforms to ANSI B 16.5 Class 150 Specifications)

Raised-Face Slip-On Forged Flange



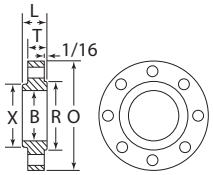
Nominal Pipe Size (In)	O	T[1]	R	X	No. [2]/ Dia. Of Holes	Bolt Circle Diameter	L[1]	B
1	4.25	.56	2.00	1.94	4 - 0.62	3.12	.69	1.36
1-1/4	4.62	.62	2.50	2.31	4 - 0.62	3.50	.81	1.70
1-1/2	5.00	.68	2.88	2.56	4 - 0.62	3.88	.88	1.95
2	6.00	.75	3.62	3.06	4 - 0.75	4.75	1.00	2.44
2-1/2	7.00	.88	4.12	3.56	4 - 0.75	5.50	1.12	2.94
3	7.50	.94	5.00	4.25	4 - 0.75	6.00	1.19	3.57
4	9.00	.94	6.19	5.31	8 - 0.75	7.50	1.31	4.57
5	10.00	.94	7.31	6.44	8 - 0.88	8.50	1.44	5.66
6	11.00	1.00	8.50	7.56	8 - 0.88	9.50	1.56	6.72
8	13.50	1.12	10.62	9.69	8 - 0.88	11.75	1.75	8.72
10	16.00	1.19	12.75	12.00	12 - 1.00	14.25	1.94	10.88
12	19.00	1.25	15.00	14.38	12 - 1.00	17.00	2.19	12.88
14	21.00	1.38	16.25	15.75	12 - 1.12	18.75	2.25	14.14
16	23.50	1.44	18.50	18.00	16 - 1.12	21.25	2.60	16.16
18	25.00	1.56	21.00	19.88	16 - 1.25	22.75	2.69	18.18
20	27.50	1.69	23.00	22.00	20 - 1.25	25.00	2.88	20.20

[1] 1/16 in. raised face included in dimensions T and L.
[2] Bolt hole diameter 1/8 in. larger than bolt diameter

ASA 300 LB. FLANGE

(Conforms to ANSI B 16.5 Class 300 Specifications)

Raised-Face Slip-On Forged Flange



Nominal Pipe Size (In)	O	T[1]	R	X	No. [2]/ Dia. Of Holes	Bolt Circle Diameter	L[1]	B
1	4.88	0.69	2.00	2.12	4 - 0.75	3.50	1.06	1.36
1-1/4	5.25	0.75	2.50	2.50	4 - 0.75	3.88	1.06	1.70
1-1/2	6.12	0.81	2.88	2.75	4 - 0.88	4.50	1.19	1.95
2	6.50	0.88	3.62	3.31	8 - 0.75	5.00	1.31	2.44
2-1/2	7.50	1.00	4.12	3.94	8 - 0.88	5.88	1.50	2.94
3	8.25	1.12	5.00	4.62	8 - 0.88	6.62	1.69	3.57
4	10.00	1.25	6.19	5.75	8 - 0.88	7.88	1.88	4.57
5	11.00	1.38	7.31	7.00	8 - 0.88	9.25	2.00	5.66
6	12.50	1.44	8.50	8.12	12 - 0.88	10.62	2.06	6.72
8	15.00	1.62	10.62	10.25	12 - 1.00	13.00	2.44	8.72
10	17.50	1.88	12.75	12.62	16 - 1.12	15.25	2.62	10.88
12	20.50	2.00	15.00	14.75	16 - 1.25	17.75	2.88	12.88
14	23.00	2.12	16.25	16.75	20 - 1.25	20.25	3.00	14.14
16	25.50	2.25	18.50	19.00	20 - 1.38	22.50	3.25	16.16
18	28.00	2.38	21.00	21.00	24 - 1.38	24.75	3.50	18.18
20	30.50	2.50	23.00	23.12	24 - 1.38	27.00	3.75	20.20

[1] 1/16 in. raised face included in dimensions T and L.
[2] Bolt hole diameter 1/8 in. larger than bolt diameter

Pipe & Tube Dimensions

Carbon Steel Pipe Data - Schedule 40 & Schedule 80

Nominal Size (In)	Pipe O.D. (In)	Schedule Number	Wall Thickness (In)	Inside Diameter (In)	Pipe Lbs./Ft.
1/4	0.540	40ST 80XS	0.088 0.119	0.364 0.302	0.424 0.535
3/8	0.675	40ST 80XS	0.091 0.126	0.493 0.423	0.567 0.738
1/2	0.840	40ST 80XS	0.109 0.147	0.622 0.546	0.850 1.087
3/4	1.050	40ST 80XS	0.113 0.154	0.824 0.742	1.130 1.470
1	1.315	40ST 80XS	0.133 0.179	1.049 0.957	1.680 2.170
1-1/4	1.660	40ST 80XS	0.140 0.191	1.380 1.278	2.270 2.990
1-1/2	1.900	40ST 80XS	0.145 0.200	1.610 1.500	2.720 3.630
2	2.375	40ST 80XS	0.154 0.218	2.067 1.939	3.650 5.020
2-1/2	2.875	40ST 80XS	0.203 0.276	2.469 2.323	5.790 7.660
3	3.500	40ST 80XS	0.216 0.300	3.068 2.900	7.570 10.250
4	4.500	40ST 80XS	0.237 0.337	4.026 3.826	10.780 14.970
6	6.625	40ST 80XS	0.280 0.432	6.065 5.761	18.960 28.550
8	8.625	40ST 80XS	0.322 0.500	7.981 7.625	28.530 43.350
10	10.750	40ST 80	0.365 0.593	10.020 9.564	40.450 64.280

Dimensions of Copper Tube & Copper Couplings (Sweat Couplings)

Nominal Size (In)	Copper Coupling w/ Stop O.D. Size (in)	Copper Tube Type K Dimensions			Copper Tube Type L Dimensions		
		O.D. (In)	I.D. (In)	Wall Thickness (In)	O.D. (In)	I.D. (In)	Wall Thickness (In)
1/4	3/8	.375	.305	.035	.375	.315	.030
3/8	1/2	.500	.402	.049	.500	.430	.035
1/2	5/8	.625	.527	.049	.625	.545	.040
5/8	3/4	.750	.652	.049	.750	.666	.042
3/4	7/8	.875	.745	.065	.875	.785	.045
1	1-1/8	1.125	.995	.065	1.125	1.025	.050
1-1/4	1-3/8	1.375	1.245	.065	1.375	1.265	.055
1-1/2	1-5/8	1.625	1.481	.072	1.625	1.505	.060
2	2-1/8	2.125	1.959	.083	2.125	1.985	.070
2-1/2	2-5/8	2.625	2.435	.095	2.625	2.465	.080
3	3-1/8	3.125	2.907	.109	3.125	2.945	.090
3-1/2	3-5/8	3.625	3.385	.120	3.625	3.425	.100
4	4-1/8	4.125	3.857	.134	4.125	3.905	.110

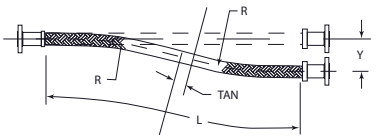
Offset Chart & Determining Live Lengths

After the hose is selected for an application, the live length and overall length of an assembly must be determined to complete the design. The live length is the flexible portion of an assembly and can be determined for a class of motion from the motion diagrams.
After the live length has been determined, the overall length is calculated by adding the dimensions for the end fittings.

The values shown are minimum live lengths for most centerline bend radii and total offset travel combinations. If the exact radius or travel are not shown on the chart, use the next largest value or the lateral offset formula. The values as shown in the shaded portion are applicable to static bends only. **Dynamic offset motion should never be greater than ¼ (25%) of the centerline bend radius.**

Lateral Offset Motion

Centerline Bend Radius (In.)*	Intermittent Offset Motion													
	1/8″	1/4″	3/8″	1/2″	3/4″	1″	1-1/2″	2″	3″	4″	5″	6″	8″	10″
2	1-1/4	1-3/4	2-1/4	2-1/2	3-1/4	3-3/4	4-1/4	5-1/4	6-3/4	8	9-1/4	10-1/2	11-3/4	15
4	1-3/4	2-1/2	3	3-1/2	4-1/2	5	6-1/4	7-1/4	9	10-3/4	12	13-1/2	16	18-1/2
6	2-1/4	3-1/4	3-3/4	4-1/4	5-1/4	6-1/4	7-1/2	8-3/4	10-3/4	12-3/4	14-1/4	16	19	21-1/2
8	2-1/2	3-1/2	4-1/4	5	6	7	8-3/4	10	12-1/2	14-1/2	16-1/4	18	21-1/4	24-1/4
10	2-3/4	4	4-3/4	5-1/2	6-3/4	8	9-3/4	11-1/4	13-3/4	16	18	20	23-1/2	26-1/2
12	3	4-1/4	5-1/4	6	7-1/2	8-1/2	10-1/2	12-1/4	15	17-1/2	19-1/2	21-1/2	25-1/2	28-3/4
14	3-1/4	4-3/4	5-3/4	6-1/2	8	9-1/4	11-1/4	13-1/4	16-1/4	18-3/4	21	23-1/2	27-1/4	30-3/4
16	3-1/2	5	6	7	8-1/2	10	12-1/4	14	17-1/4	20	22-1/2	25	29	32-3/4
18	3-3/4	5-1/4	6-1/2	7-1/2	9	10-1/2	13	15	18-1/4	21-1/4	24	26	30-1/2	34
20	4	5-1/2	6-3/4	7-3/4	9-1/2	11	13-1/2	15-3/4	19-1/4	22-1/2	25	27-1/2	32-1/4	36-1/2
25	4-1/2	6-1/4	7-1/2	8-3/4	10-3/4	12-1/4	15	17-1/2	21-1/2	25	28	30-1/2	35-3/4	40
30	4-3/4	6-3/4	8-1/4	9-1/2	11-3/4	13-1/2	16-1/2	19	23-1/2	27-1/4	30-1/2	33-1/2	39	43-3/4
35	5-1/4	7-1/4	9	10-1/4	12-1/2	14-1/2	18	20-3/4	26-1/4	29-1/2	32-3/4	36	42	47
40	5-1/2	7-3/4	9-1/2	11	13-1/2	15-1/2	19	22	27	31-1/4	35	38-1/2	44-3/4	50
45	6	8-1/4	10	11-3/4	14-1/4	16-1/2	20-3/4	23-1/2	28-1/2	33-1/4	37	41	47-1/2	53
50	6-1/4	8-3/4	10-3/4	12-3/4	15	17-1/2	21-1/4	24-1/2	30	35	39	43	50	56
60	6-3/4	9-1/2	11-3/4	13-1/2	16-1/2	19	23-1/4	27	33	38-1/4	43	47	54-1/4	61
70	7-1/4	10-1/4	12-3/4	14-3/4	17-3/4	20-1/2	25-1/4	29	35-1/2	41-1/2	46	51	58-3/4	65-3/4
80	7-3/4	11	13-1/2	15-1/2	19	22	27	31	38	44	49-1/2	54	62-3/4	70
90	8-1/4	11-3/4	14-1/4	16-1/2	20-1/4	23-1/2	28-1/2	33	40-1/2	46-3/4	52	57-1/4	66-1/4	74-1/4
100	8-3/4	12-1/4	15	17-1/2	21-1/4	24-1/2	30	35	42-1/2	49-1/4	55	60-1/2	69-3/4	78-1/4
110	9-1/4	13	15-3/4	18-3/4	22-1/2	25-3/4	31-3/4	36-1/2	44-3/4	51-1/2	58	63-1/4	73-1/4	82
120	9-1/2	13-1/2	16-1/2	19	23-1/4	27	33	38-1/4	46-3/4	54	60-1/2	66	76-1/2	85-1/2
130	10	14	17-1/4	20	24-1/4	28	34-3/4	39-3/4	48-1/2	56	62-3/4	68-3/4	79-1/2	89



$$L = \sqrt{6YR + Y^2}$$

L = Hose Live Length (inches)
R = Bend Radius (inches)
Y = Offset Motion to one side of centerline (inches)

Lateral Offset Motion

Motion that occurs when one end of the hose is deflected in a plane perpendicular to its longitudinal axis with the ends remaining parallel.

Note: Where Offset Motion "Y" occurs, both sides of centerline, the Hose Live Length should be based on Total Travel or 2 times Y. For Intermittent Flexing, the offset motion should never be greater than 25% of the centerline bend radius.

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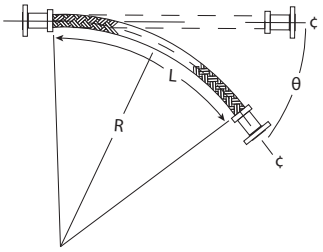
Angular Offset & Live Lengths

Angular Offset Motion

Angular motion is defined as the bending of the hose so that the ends are no longer parallel. In this case, the amount of movement is measured in degrees from centerline of the hose if it were installed straight.



Degree of Angular Motion = θ

$$L = \frac{\pi R \theta}{180}$$

L = Live hose length (inches)
π = 3.1416
R = Minimum centerline bend radius for constant flexing (inches)
θ = Angular deflection (degrees)

Centerline Bend Radius (in.) = R	10	15	20	25	30	40	50	60	70	80	90	120	150	180
2	0.4	0.6	0.7	0.9	1.1	1.4	1.8	2.1	2.5	2.8	3.2	4.2	5.3	6.3
3	0.6	0.8	1.1	1.4	1.6	2.1	2.7	3.2	3.7	4.2	4.8	6.3	7.9	9.5
4	0.7	1.1	1.4	1.8	2.1	2.8	3.5	4.2	4.9	5.6	6.3	8.4	10.5	12.6
5	0.9	1.4	1.8	2.2	2.7	3.5	4.4	5.3	6.2	7.0	7.9	10.5	13.1	15.8
6	1.1	1.6	2.1	2.7	3.2	4.2	5.3	6.3	7.4	8.4	9.5	12.6	15.8	18.9
7	1.3	1.9	2.5	3.1	3.7	4.9	6.2	7.4	8.6	9.8	11.0	14.7	18.4	22.0
8	1.4	2.1	2.8	3.5	4.2	5.6	7.0	8.4	9.8	11.2	12.6	16.8	21.0	25.2
9	1.6	2.4	3.2	4.0	4.8	6.3	7.9	9.5	11.0	12.6	14.2	18.9	23.6	28.3
10	1.8	2.7	3.5	4.4	5.3	7.0	8.8	10.5	12.3	14.0	15.8	21.0	26.2	31.5
11	2.0	2.9	3.9	4.8	5.8	7.7	9.6	11.6	13.5	15.4	17.3	23.1	28.8	34.6
12	2.1	3.2	4.2	5.3	6.3	8.4	10.5	12.6	14.7	16.8	18.9	25.2	31.5	37.7
13	2.3	3.5	4.6	5.7	6.9	9.1	11.4	13.7	15.9	18.2	20.5	27.3	34.1	40.9
14	2.5	3.7	4.9	6.2	7.4	9.8	12.3	14.7	17.2	19.6	22.0	29.4	36.7	44.0
15	2.7	4.0	5.3	6.6	7.9	10.5	13.1	15.8	18.4	21.0	23.6	31.5	39.3	47.2
16	2.8	4.2	5.6	7.0	8.4	11.2	14.0	16.8	19.6	22.4	25.2	33.6	41.9	50.3
17	3.0	4.5	6.0	7.5	9.0	11.9	14.9	17.9	20.8	23.8	26.8	35.7	44.6	53.5
18	3.2	4.8	6.3	7.9	9.5	12.6	15.8	18.9	22.0	25.2	28.3	37.7	47.2	56.6
19	3.4	5.0	6.7	8.3	10.0	13.3	16.6	19.9	23.3	26.6	29.9	39.8	49.8	59.7
20	3.5	5.3	7.0	8.8	10.5	14.0	17.5	21.0	24.5	28.0	31.5	41.9	52.4	62.9
22	3.9	5.8	7.7	9.6	11.6	15.4	19.2	23.1	26.9	30.8	34.6	46.1	57.6	69.2
24	4.2	6.3	8.4	10.5	12.6	16.8	21.0	25.2	29.4	33.6	37.7	50.3	62.9	75.4
26	4.6	6.9	9.1	11.4	13.7	18.2	22.7	27.3	31.8	36.4	40.9	54.5	68.1	81.7
28	4.9	7.4	9.8	12.3	14.7	19.6	24.5	29.4	34.3	39.1	44.0	58.7	73.4	88.0
30	5.3	7.9	10.5	13.1	15.8	21.0	26.2	31.5	36.7	41.9	47.2	62.9	78.6	94.3
35	6.2	9.2	12.3	15.3	18.4	24.5	30.6	36.7	42.8	48.9	55.0	73.4	91.7	110.0
40	7.0	10.5	14.0	17.5	21.0	28.0	35.0	41.9	48.9	55.9	62.9	83.8	104.8	125.7
45	7.9	11.8	15.8	19.7	23.6	31.5	39.3	47.2	55.0	62.9	70.7	94.3	117.9	141.4
50	8.8	13.1	17.5	21.9	26.2	35.0	43.7	52.4	61.1	69.9	78.6	104.8	130.9	157.1
60	10.5	15.8	21.0	26.2	31.5	41.9	52.4	62.9	73.4	83.8	94.3	125.7	157.1	188.5
70	12.3	18.4	24.5	30.6	36.7	48.9	61.1	73.4	85.6	97.8	110.0	146.7	183.3	220.0
80	14.0	21.0	28.0	35.0	41.9	55.9	69.9	83.8	97.8	111.8	125.7	167.6	209.5	251.4
90	15.8	23.6	31.5	39.3	47.2	62.9	78.6	94.3	110.0	125.7	141.4	188.5	235.7	282.8
100	17.5	26.2	35.0	43.7	52.4	69.9	87.3	104.8	122.2	139.7	157.1	209.5	261.8	314.2

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Metal Hose Temperature Factors & Conversions

Working Pressure Derating Factors Due to Temperature

The strength of metal alloys decreases as internal or external temperature increases. Maximum allowable working pressures of metal hose will decrease when temperatures increase. The pressure ratings shown in the **UNISOURCE** specification tables for hose are valid at 70°F. Higher operating temperatures will decrease these pressure ratings by the factors shown in the chart below for the alloy used in the braid wire. The maximum working temperature of the end fittings, the corrugated hose, and their method of attachment must also be considered.

For example, to calculate the maximum working pressure for:
1" ID Superflex 321 stainless steel corrugated hose
With single-braided, 304L braid
At 700°F.

From the Superflex hose specification table, the maximum working pressure at 70°F is 571 PSIG. Multiply 571 PSIG by 0.74. The maximum working pressure at 700°F is 422 PSIG.

Temperature Adjustment Factor Based on Braid Alloy

Temperature (°F)	304/304L Stainless Steel	316 L Stainless Steel	321 Stainless Steel	Carbon Steel	Monel	Bronze
70	1.00	1.00	1.00	1.00	1.00	1.00
150	.95	.93	.97	.99	.93	.92
200	.91	.89	.94	.97	.90	.89
250	.88	.86	.92	.96	.87	.86
300	.85	.83	.88	.93	.83	.83
350	.81	.81	.86	.91	.82	.81
400	.78	.78	.83	.87	.79	.78
450	.77	.78	.81	.86	.77	.75
500	.77	.77	.78	.81	.73	
600	.76	.76	.77	.74	.72	
700	.74	.76	.76	.66	.71	
800	.73	.75	.68	.52	.70	
900	.68	.74	.62			
1,000	.60	.73	.60			
1,100	.58	.67	.58			
1,200	.53	.61	.53			
1,300	.44	.55	.46			
1,400	.35	.48	.42			
1,500	.26	.39	.37			

Fahrenheit to Celsius Temperature Conversion

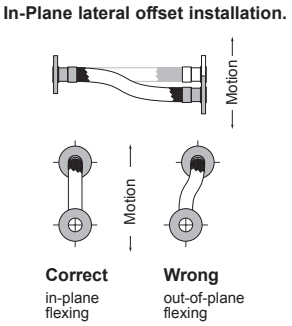
From	To	Multiply By
°F	°C	(°F-32)/1.8
°C	°F	(°Cx1.8)+32

Installation Guidelines

UNISOURCE corrugated metal hose is designed to provide maximum service life when the hose assembly is properly installed. Reduction of the service life or even premature failure of the hose can result when the assembly is improperly installed, incorrectly flexed, or carelessly handled. The installation and handling guidelines below should be followed to achieve optimum performance and service life from your corrugated metal hose assembly.

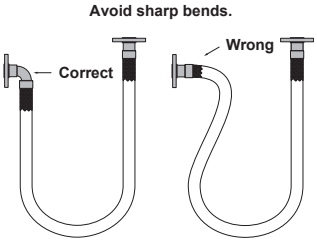
Avoid Torque

It is extremely important not to twist the hose assembly during installation when aligning the bolt holes in a flange or in making up pipe threads. The utilization of lap joint (floating) flanges or pipe unions will minimize this condition. It is also recommended that two wrenches be used in making the union connection; one to prevent the hose from twisting and the other to tighten the coupling.



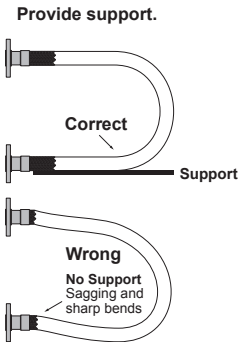
Installation A – In-Plane Lateral Offset

Torque or twist may also occur as the result of out-of-plane flexing in an installation. This should be avoided by installing the hose so that the flexing takes place in only one plane. This plane must be the plane in which the bending occurs.



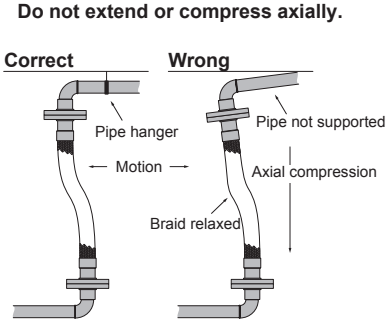
Installation B – Avoid Sharp Bends

Sharp bends should always be avoided in the installation of the hose assembly. In the event of loops, sharp bends can be avoided by using elbows near the end fittings. (See diagram).



Installation C – Hose Sag and Support

When installing the assembly in a horizontal loop, provide support for the arms to prevent the hose from sagging. When a hose sags, it can create over-bending near the end fitting, and torque can also occur if application motion is in a different plane than the flex caused by sagging.

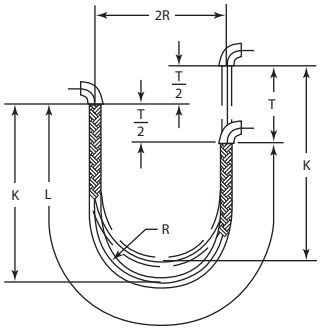


Installation D – Avoid Compressing or Extending the Hose

The hose assembly should never be used to absorb the weight of a piping system. Always support the piping to prevent excessive weight from compressing the hose and relaxing the braid tension.

Installation Guidelines

Vertical Travel



$L = 4R + {}^{T}/_{2}$

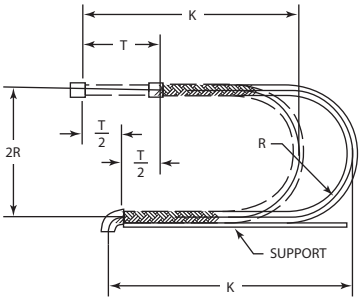
$K = 1.43R + {}^{T}/_{2}$

Installation E – Traveling Loop Guidelines

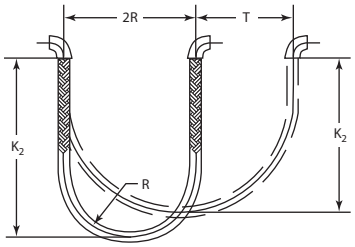
Traveling loops are designed to accommodate radial movement. This type of movement will occur when hose assemblies are bent in a 180 degree arc, i.e. a vertical or horizontal loop. Traveling loops are classified as Class "A", where one end of the hose moves parallel to the other and the bend radius remains constant; and Class "B" where the ends move perpendicular to each other in a U-shaped configuration so as to enlarge or decrease the width of the loop. If traveling loops are in a horizontal position (see diagram), the bottom leg of the hose must be supported to avoid bending and pull on the end of the hose. Further, the weight of the hose and media will reduce the pressure capability of the hose.

L = Hose Live Length (inches)
T = Total Travel (inches)
R = Bend Radius (inches)
K = Loop Length (inches)

Horizontal Travel



Horizontal Travel



$L = 4R + 1.5T$

$K_1 = 1.43R + .78T$

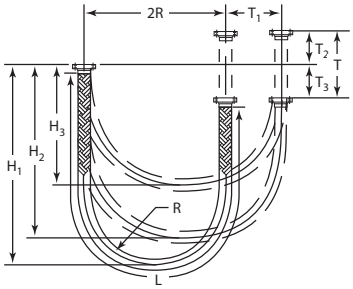
$K_2 = 1.43R + {}^{T}/_{2}$

Installation F – Traveling Loop With Travel in Two Directions

Travel in the two directions shown in this diagram can be accommodated with a flexible metal hose assembly. The minimum live length and loop configuration should be determined as shown in the diagram and formula below.

Equations:

L (inches) = Nominal Minimum Live Length Required For Travel (T)
R (inches) = Bend Radius From The Dynamic Minimum Centerline Bend Radius Column
T (inches) = Total Vertical Travel
T1 (inches) = Horizontal Travel
T2 (inches) = Upward Vertical Travel
T3 (inches) = Downward Vertical Travel
H1 (inches) = Maximum Drop Of 180° Bend Without Horizontal Travel (T1)
H2 (inches) = Maximum Drop Of 180° Bend With Horizontal Travel (T1)
H3 (inches) = Minimum Drop Of 180° Bend With Horizontal Travel (T1)
B (inches) = Fitting Length



T = T2 + T3
L = 4R + 1.57T1 + T/2
H1 = 1.43R + 0.785T1 + T/2
H2 = 1.43R + T1/2
H3 = 1.43R - T1/2
Developed Length = L+2B
Note: Use the largest value of T2 or T3 if either is greater than T/2.

Installation Guidelines

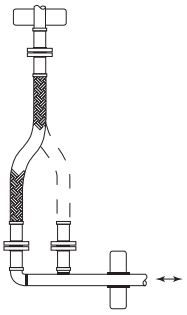


Diagram A

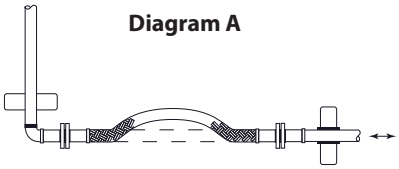
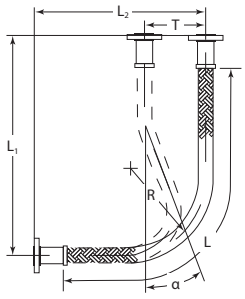


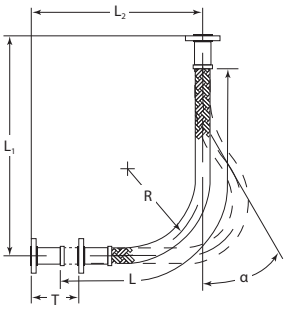
Diagram B (Incorrect Installation)

Installation G – Thermal Expansion

Lateral movement or intermittent offset is permissible as long as the proper live length of the hose is used (see diagram A). The movement should be 90° to the hose. The hose should not be installed in the same direction as the expected pipe expansion (see diagram B). This type of installation will place the hose in compression and/or extension, which is not allowed and could result in a failure of the hose.



Horizontal Travel in Vertical Leg



Horizontal Travel in Horizontal Leg

Installation H – 90 Degrees For Thermal Expansion

To utilize a flexible metal hose assembly to take up thermal expansion in piping systems, the following formula and diagram should be used to determine live length and configuration.

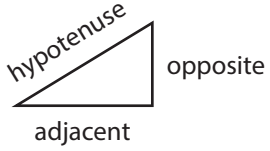
Equations:

L (inches) = Nominal Minimum Live Length Required For Expansion
L1 (inches) = Vertical Centerline To End Length
L2 (inches) = Horizontal Centerline To End Length
R (inches) = Bend Radius From Dynamic Minimum Centerline Bend Radius
T (inches) = Total Travel
B (inches) = Fitting Length (See End Fitting Tables)
α (degrees) = Bend Angle (α Should Be Less Than 60°)
$\alpha = T/R$
$L = .035R\alpha + 1.57R$
$L1 = R + 2R\sin\alpha$
$L2 = R + R(0.035\alpha - 2\sin\alpha)$
Developed Length = L+ 2B

Additional Installation Guidelines

- Install flexible connectors so that the bend is as close to the center of the connector as possible.
- Observe the minimum bend radius as specified in the catalog.
- Use a flexible connector of proper length to suit the installation.
- Only wrench on the fitting hex flats as provided.
- Use pipe wrenches on both mating hexes to avoid twisting the hose.
- Check for leaks before covering the installation.
- Make sure the pressure rating of the connector is not exceeded.

$$\sin = \frac{\text{opposite}}{\text{hypotenuse}}$$



Common Causes of Hose Failure

There are many factors that can affect the service life of flexible metal hose. It is important to evaluate these factors for each hose application. Each individual application can be different than generally outlined applications. Shortened service life and even catastrophic failure can be avoided if the application conditions and individual hose assembly are well matched. The typical reasons for hose failure have been provided for design purposes.

Uniform Corrosion

Uniform corrosion would describe a uniform corrosion attack throughout the entire corrugated assembly. The chemical attack will be affected by the chemical concentration and the alloy of the corrugated hose. The bottom of the corrugation and the weld heat affected zone are prone to attack by corrosion. Hose alloy selection should encompass the review of the media to be transferred and the environmental conditions where the hose will be put into service to ensure correct compatibility. Consulting the Chemical Resistance Chart found on pages 29-33 will aid in the selection of the correct **UNISOURCE** flexible metal hose alloy. These are general guidelines and may not apply to a particular application. Additional compatibility information is available from the National Association of Corrosion Engineers.

Stainless alloys form a protective film of stable oxides on the surface when exposed to oxygen. During moderate temperatures, a thin film of oxide is formed on the alloy surface. This oxidation will progress more rapidly in conditions of higher temperatures. The oxides that form on copper or nickel alloys are of a nonporous oxide formation. This nonporous oxide formation will provide a protective layer on the surface. If the oxide layer is removed, no protection is provided to the underlying metal.

Pitting Corrosion

Pitting corrosion is a form of localized corrosion that leads to a pinhole failure in the material. The area affected may have a surface defect like an inclusion or removal of the protective oxide layer. Typical pitting corrosion is usually the action of a galvanic reaction occurring in the pit of the corrosion. The damage usually occurs to the body of the material and is usually covered by the corrosion byproduct on the surface. The use of an alloy higher in Molybdenum 316L will typically increase the pitting resistance.

Intergranular Corrosion

Intergranular corrosion occurs in a metal alloy's grain boundaries when they are more susceptible to corrosion than the larger inner grains. The grain boundaries become susceptible to corrosion due to a depleting mechanism that results in the formation of chromium carbide. The depletion of the chromium causes a once resistant metal to be affected by corrosion. Intergranular corrosion can also occur in the alloys of stainless steel when they are held at elevated temperatures exceeding 1000°F ~ 1562°F for an extended period of time. The use of the stabilized stainless steel 321 or lower carbon stainless steels like 304L and 316L help increase the resistance to intergranular corrosion.

Stress Corrosion Cracking

The presences of tensile stresses and a chemical that is moderately corrosive to a particular alloy can lead to corrosion cracking. Parts can appear to be shiny and new in appearance while being filled with

Common Causes of Hose Failure - Continued

microscopic cracks. Stress corrosion can progress rapidly leading to catastrophic cracking ending up in failure of the part. Stress corrosion is more common in metal alloys than metals in their pure form. Failures due to stress corrosion cracking can be reduced by annealing parts after manufacturing to relieve any residual stress that may exist.

Fatigue

Fatigue is one of the most common causes of hose failure. It can be described as progressive damage due to the flexing of the corrugations. Stress generated by flexure, pulsation, torsion, vibration and flow induced vibration are some causes for fatigue failure. Fatigue cracks often begin at small imperfections, such as non-metallic inclusions, within the metal. Stress will concentrate at the crack and further cycling will increase the size of the crack until a complete fracture occurs. Fatigue damage can usually be seen as a circumferential crack at the top or bottom of the corrugation. Using a hose with a more favorable bend radius will decrease the stress level in the corrugations.

High Velocity of Media

As stated in **Corrugated Hose Velocity Limits** within this catalog, flow of a liquid or gas above certain velocity levels can result in premature fatigue failure. The high flow velocity causes the corrugations to vibrate at a high frequency. If the vibration is near the natural frequency of the hose, failure will occur very quickly. This type of failure is identified by spiderweb-type cracks and fractured pieces of metal breaking from the corrugations. Solutions would include reducing the velocity by increasing the hose diameter, reducing the bend of the hose or the use of an interlocked-type liner for smooth flow.

Vibration

Vibration damage starts as very small or irregular cracks close to vibration source. The cracks are typically located in the outer circumference of the corrugation. The cracks may propagate towards the walls of the corrugation in a shape of a "Y". Signs of braid abrasion on the inner hose from excessive braid movement will be present. If the vibration frequency occurs at the natural frequency of the hose, failure will occur rapidly.

Pressure Rupture

Pressure rupture can occur when metal hose assemblies are subjected to constant or pulsating pressures greater than the design pressure of the hose. In cases of hose rupture, the braid fails and the inner hose is forced through the opening until the hose reaches its stress limits causing a tear or hole in the material. Hose selection should consider the temperature and pressure ranges the hose will be subjected to during service.

Caution must be used when unbraided metal hose assemblies are used in low-pressure applications. Proper installation practices utilizing piping guides and anchors must be observed to prevent premature damage of the metal hose assembly. The addition of braid should be considered for vibration attenuation.

Formulas & Conversions

International Pressure Terms Conversions

Pressure

1 Kilogram Per Sq. Millimeter = 1422.32 Lbs. Per Sq. Inch
1 Kilogram Per Sq. Centimenter = 14.223 Lbs. Per Sq. Inch
1 Kilogram Meter = 7.233 Foot Lbs.
1 Pound Per Sq. Inch = 0.0703 Kilograms Per Sq. Centimeter

From	To	Multiply By
Atmospheres (ATM)	PSI	14.7
N/m^2	PSI	0.000145
Pascal (Pa)	PSI	0.000145
Kilopascal (kPa)	PSI	0.14504
Megapascal (mPa)	PSI	145.04
Bar	PSI	14.504
In. Water (InWc)	PSI	0.03613
In. Mercury (InHg)	PSI	0.4912
Torr	PSI	0.01934
Kg/cm^2	PSI	14.223
Kg/m^2	PSI	0.00142
Dynes/cm^2 (dy/cm^2)	PSI	0.000014
Lb/ft^2	PSI	0.00694
PSI	Atmospheres (ATM)	0.06804
PSI	N/m^2	6894.8
PSI	Pascal (Pa)	6894.8
PSI	Kilopascal (kPa)	6.895
PSI	Megapascal (mPa)	0.006895
PSI	Bar	0.06895
PSI	In. Water (InWc)	27.684
PSI	In. Mercury (InHg)	2.036
PSI	Torr	51.715
PSI	Kg/cm^2	0.07031
PSI	Kg/m^2	703.067
PSI	Dynes/cm2 (dy/cm^2)	68947.6

Linear Conversions

From	To	Multiply By
In.	mm	25.4
In.	cm	2.54
In.	m	0.0254
Ft.	mm	304.8
Ft.	cm	30.48
Ft.	m	0.3048

Formulas & Conversions

Linear Conversions - Continued

From	To	Multiply By
Yd.	mm	914.4
Yd.	cm	91.44
Yd.	m	0.9144
mm	In.	0.03937
mm	Ft.	0.00328
mm	Yd.	0.00109
cm	In.	0.3937
cm	Ft.	0.0328
cm	Yd.	0.01094
m	In.	39.37
m	Ft.	3.281
m	Yd.	1.094

Maximum Service Temperature of Materials

Alloy	Maximum Temp °F
Inconel 625	1800
AISI Stainless Steel Type:	
321	1500
316 ELC	1500
304L	1500
304	850
302	850
Mild Steel	850
Malleable Iron	800
Monel	800
Bronze	450
Copper	400

Alloy	Maximum Temp °F
Brazing (RCuZn-C or BCuP-2)	
Bronze Hose	450
Steel Hose	850
Silver Brazing	
(AWS-Bag-2)	600
Asbestos Packing Grade	
Commercial Asbestos	400
Underwriters Asbestos	450
Aluminum 52S-0 (5052-0)	600
Galvanizing	450
Soft Solder (Pb: 60, Sn: 40)	250
(Pb: 95, Sn: 5)	350

Consult **UNISOURCE** whenever service conditions necessitate consideration of the influence of long time exposure at elevated termperatures.

Media Volume to Velocity Conversion

Volume	Velocity
gph: gallons per hour	(gph / ID^2) x 0.0068
gpm: gallons per minute	(gpm / ID^2) x 0.4083
cfh: cubic feet per hour	(cfh / ID^2) x 0.0509
cfm: cubic feet per minute	(cfm / ID^2) x 3.0558
cfs: cubic feet per second	(cfs / ID^2) x 183.35

ID = Nominal hose size in inches.
Example: A 4" nominal hose size @ 400 gallons per minute flow of water = 10.21 ft./second flow velocity.

Formulas & Conversions

Saturated Steam Pressure to Temperature Conversion

Saturated Steam Pressure (PSIG)	Temperature (°F.)
0	212
10	238
20	259
30	274
40	287
50	298
60	307
75	320
80	324
90	331
100	338
125	353
150	366
175	377
200	388
225	397
250	406
275	414

Saturated Steam Pressure (PSIG)	Temperature (°F.)
300	422
325	429
350	436
375	442
400	448
425	454
450	460
475	465
500	470
550	480
600	489
700	505
800	520
900	534
1000	546
1250	574
1500	606
2500	669

Pressure Drop in Metal Hose

The pressure drop through a straight metal hose is, as a rule of thumb, about three times as much as for black pipe. Consult **UNISOURCE** for more accurate calculations, and when hoses are installed in a bent condition. Where the amount of pressure drop through longer lengths of hose is a significant factor, a larger diameter hose may be required.

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Chemical Resistance Chart

Chemical Resistance Chart Legend

I. < .00035 inches in penetration/month.....
.00035 - .0035 inches of penetration/month.....
> .0035 inches of penetration/month.....

II. *Subject to decomposition (forming HCl) in presence of moisture
**Subject to pitting at air line or when allowed to dry
***Subject to attack in presence of H^2SO^4

Resistance:
G = Good
L = Limited
P = Poor

Chemical	Temperature °F	Stainless Steel		Mild Steel	Brass(80-20)	Bronze (Phos.)	Monel
		304 304L 321	316 316L				
Acetic Acid 5%-20% Agitated or Aerated	70°	G	G	P	P	P	L
50%	70°	G	G	P	P	P	P
50%-80%	Boiling	P	L	P	P	P	P
80%	70°	G	G	P	P	P	G
100%	70°	G	G	P	P	P	G
100%	Boiling	P	L	P	P	P	L
100% - 150 lbs. pressure	400°	P	P	P	P	P	L
Acetic Anhydride	70°	G	G	P	P	P	L
	Boiling	G	G	P	P	P	L
Acetic Acid Vapors, 30%	Hot	P	L	P	P	P	P
100%	Hot	P	P	P	P	P	L
Acetone	Boiling	G	G	L	G	G	G
Acetyl Chloride	Cold	L	L	P	L	L	G
	Boiling	L	L	P	L	L	P
Acetylene Concentrated	70°	G	G	G	P	P	G
Commercially Pure	70°	G	G	G	P	P	G
Acid Salt Mixture							
10% H_2SO_4 Sp. G. 1.07 +							
10% $CuSO_4 \cdot 5 H_2O$	Boiling	G	G	P	P	P	P
Acid Salt Mixture							
10% H_2SO_4 Sp. G. 1.07 +							
2% $FeSO_4 \cdot 7 H_2O$	Boiling	G	G	P	P	P	P
Alcohol, Ethyl, 70° & Boiling	70°	G	G	G	G	G	G
Alcohol, Methyl	70°	G	G	G	G	G	G
	(150°)						
	Boiling	P**	L	P	G	G	G
Aluminum, Molten	1400°	P	P	P	P	P	P
Aluminum Acetate, Saturated	70° & Boiling	G	G	P	P	P	G
Aluminum Chloride							
10% Quiescent	70°	P	P	P	P	P	L
25% Quiescent	70°	G	G	P	P	P	L
Aluminum Fluoride	70°	P	P	P	P	P	L
Aluminum Hydroxide, Saturated	70°	G**	G	G**	G	G	G

Chemical	Temperature °F	Stainless Steel		Mild Steel	Brass(80-20)	Bronze (Phos.)	Monel
		304 304L 321	316 316L				
Aluminum Sulphate, 5%	150°	G**	G	P	P	P	G
10%	70°	G**	G	P	P	P	G
10%	Boiling	L**	G	P	P	P	G
Saturated	70°	G**	G	P	P	P	G
Saturated	Boiling	L**	G	P	P	P	G
Aluminum Potassium Sulphate (Alum) 2% - 10%	70°	G	G	P	L	L	L
10%	Boiling	L	G	P	P	P	L
Saturated	Boiling	P	L	P	P	P	L
Ammonia (Anhydrous)							
All Concentrations	70°	G	G	G	G	G	G
Gas	Hot	P	P	P	P	P	
Ammonia Liquor	70°	G	G	P	P	P	P
	Boiling	G	G	P	P	P	P
Ammonium Bicarbonate	70°	G	G	P	P	P	L
	Hot	G	G	P	P	P	L
Ammonium Bromide	70°	L	G	P	P	P	L
Ammonium Carbonate 1 & 5%	70°	G	G	G	P	P	P
Ammonium Chloride 1%	70°	G	G	L	P	P	G
10%	Boiling	G**	G**		P	P	L
28%	Boiling	L**	G**		P	P	L
50%	Boiling	L**	G**		P	P	L
Ammonium Hydroxide							
All Concentrations	70°	G	G	L	P	P	P
Ammonium Monophosphate	70°	G	G	L	P	P	L
Ammonium Nitrate							
All Concentrate Agitated	70°	G	G	P	P	P	L
All Concentrate Aerated	70°	G	G	P	P	P	L
All Concentrate Saturated	Boiling	G	G	P	P	P	L
Ammonium Oxalate 5%	70°	G	G	L	P	P	
Ammonium Perchlorate 10%	Boiling	G	G	L	P	P	
Ammonium Persulphate 5%	70°	G	G		P	P	P
Ammonium Phosphate 5%	70°	G	G	L	P	P	P
Ammonium Sulphate							
1% Aerated or Agitated	70°	G	G	P	P	P	L

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Chemical Resistance Chart

Chemical	Temperature °F	Stainless Steel		Mild Steel	Brass(80-20)	Bronze (Phos.)	Monel
		304 304L 321	316 316L				
Ammonium Sulphate	70°	G	G	P	P	P	L
5% Aerated & Agitated	70°	G	G	P	P	P	L
10% Saturated	Boiling	L**	G**	P	P	P	L
Ammonium Sulphite, 70° &							
Boiling	70°	G	G	P	P	P	P
Amyl Acetate Concentrate	70°	G	G	L	G	G	G
Amyl Chloride	70°	G	G	P	L	L	L
Aniline 3%	70°	G	G	L	P	P	L
Aniline Concentrated Crude	70°	G	G	G	P	P	L
Aniline Hydrochloride	70°	P	P		P	P	P
Antimony Trichloride	70°	P	P	P	P	P	P
Barium Carbonate	70°	G	G	L	G	G	L
Barium Chloride 5% & Saturated	70°	G	G	P	L	L	L
Barium Hydroxide							
Aqueous Solution	Hot	G	G	L	G	G	L
Barium Nitrate							
Aqueous Solution	Hot	G	G	L			
Barium Sulphate							
(Barytes-Blanc Fixe)	70°	G	G		G	G	L
Barium Sulfide							
Saturated Solution	70°	G	G	P	P	P	
Beer (Barley Malt & Hops)	70°	G	G	P	G	G	G
3.5% - 4.5% Alcohol	160°	G	G	P	G	G	G
Benzene (Benzol) 70° or Hot	70°	G	G	L	G	G	L
Benzoic Acid	70°	G	G	G	G	G	
Blood (Meat Juices)	Cold	G**	G	P			L
Borax 5%	Hot	G	G	L	G	G	L
Boracic Acid 5%	Hot or Cold	G	G				
Boric Acid 5% Solution, 70° / Hot	70°	G	G	P	G	G	L
5% Solution	Boiling	G	G**	P	L	G	L
Saturated Solution	70°	G**	G**	P	P	L	L
Saturated Solution	Boiling	G**	G**	P	P	P	L
Bromine, Bromine Water	70°	P	P	P	P	P	P
Buttermilk	70°	G	G	P	P	P	L
Butyl Acetate		G	G	L			L
Butyric Acid 50%	70° - 150°	G	G	P	L	L	L
Aqueous Soln. Sp. G. .964	Boiling	G	G	P	P	P	L
Calcium Carbonate	70°	G	G	G			G
Calcium Chlorate	70° or						
Dilute Solution	Hot	G	G	L			L
Calcium Chloride							
Dilute or Concentrated Solution	70°	L**	G**	P	L	L	P
Calcium Chlorohypochlorite							
(Bleaching Powder) 1%	70°	P	P	P	L	L	P
5%	70°	P	P	P	L	L	P
Calcium Hypochlorite, 2%	70°	L**	G**	P	L	L	P
Calcium Hydroxide, 10-20%	Boiling	G	G	P	G	G	G
Calcium Sulphate, Saturated	70°	G	G	P	G	G	L

Chemical	Temperature °F	Stainless Steel		Mild Steel	Brass(80-20)	Bronze (Phos.)	Monel
		304 304L 321	316 316L				
Carbonic Acid Saturated Soln.	70°	G	G	P	P	G	P
Carbolic Acid C.P.	70°/Boiling	G	G	P	L	L	G
Carbonated Water		G	G	P	L	L	P
Carbon Bisulfide	70°	G	G	L	G	L	L
Carbon Monoxide Gas	1400° -						
	1600°	G	G	G	P	P	G
Carbon Tetrachloride C.P.	70°	G	G	L	G	G	G
Dry C.P.	Boiling	G	G	L	G	G	L
Commercial + 1% Water		P**	P	P	L	L	L
Carnallite - Cold Saturated Soln.							
($KCl \cdot MgCl_2 \cdot 6H_2O$)	Boiling	P	G**				
Cellulose		G	G				G
Chloracetic Acid	70°	P	P	P	L	L	L
Chlorbenzol Conc. Pure Dry	70°	G	G	L	L	L	L
Chloric Acid	70°	P	P	P	P	P	P
Chlorine Gas (Dry)	70°	P	L	L	G	G	L
(Moist)	70°	P	P	P	P	P	P
Chlorinated Water, Saturated	P**	L**	P				L
Chloroform	70°	G	G	G	G	G	G
Chromic Acid 5% C.P.	70°	G	G	P	P	P	P
10%	70°	P	L	P	P	P	P
Chromic Acid 10% C.P.	Boiling	P	L	P	P	P	P
50% C.P.	70°	P	L	P	P	P	P
50% C.P.	Boiling	P	P	P	P	P	P
Commercial 50% (Cont. SO_3)	70°	P	P	P	P	P	P
Commercial 50% (Cont. SO_3)	Boiling	P	P	P	P	P	P
Chromium Plating Bath	70°	G	G	L			P
Cidar	70°	G	G	P	G	G	G
Citric Acid, 5% Still	70° - 150°	G	G	P	L	G	L
15% Still	70°	G	G	P	P	L	L
15%, or Concentrated	Boiling	L	G	P	P	L	P
Coca-Cola Syrup (Pure)	70°	G	G	P			L
Coffee	Boiling	G	G	P	G	G	G
Copper Acetate (Sat. Sol.)	70°	G	G	P			L
Copper Carbonate (Sat. Sol.)							
in 50% NH_4OH		G	G		P	P	
Copper Chloride, 1% Agitated	70°	L**	G**	P	P	P	P
1% Agitated	158°	P	P	P	P	P	P
1% Aerated	70°	L**	G**	P	P	P	P
5% Agitated	70°	P**	L**	P	P	P	P
5% Aerated	70°	P**	P**	P	P	P	P
Copper Cyanide (Sat. Sol.)	Boiling	G	G		P	P	L
Copper Nitrate							
1% Still, Agitated & Aerated	70°	G	G	P	P	P	P
5% Still, Agitated or Aerated	70°	G	G	P	P	P	P
50% Aqueous Solution	Hot	G	G	P	P	P	P

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Chemical Resistance Chart

Chemical	Temperature °F	Stainless Steel		Mild Steel	Brass(80-20)	Bronze (Phos.)	Monel
		304 304L 321	316 316L				
Copper Sulphate							
5% Agitated Still or Aerated	70°	G	G	P	L	L	P
Saturated Solution	Boiling	G	G	P	L	L	P
Creosote (Coal Tar)	Hot	G	G	L	G	G	L
Creosote Oil	Hot	G	G	L	L	L	L
Cyanogen Gas	70°	G	G				
Dichloroethane (Dry)	Boiling	G	G	P	P	P	L
Dinitrochlorobenzene							
Melted & Solidified	70°	G	G	P			
Distillery Wort	70°	G	G				
Developing Solutions	70°	G	G				
Dyewood Liquor	70°	G***	G	P			L
Epsom Salt (Magnesium Sulfate)	Hot & Cold	G	G	P	G	G	L
Ethers	70°	G	G	L	G	G	L
Ethyl Acetate (Conc. Sol.)	70°	G	G	L	G	G	L
Ethyl Chloride	70°	G	G	L	L	L	G
Ethylene Chloride	70°	G	G	L	L	L	G
Ethylene Glycol	70°	G	G	L	G	G	G
Ferric Chloride 1% Solution Still	70°	L**	G**	P	P	P	P
1% Solution Boiling	P	P	P	P	P	P	P
5% Solution, Agitated, Aerated	70°	P	P	P	P	P	P
Ferric Hydroxide							
(Hydrated Iron Oxide)	70°	G	G	P			L
Ferric Nitrate							
1%-5% Quiescent or Agitated	70°	G	G	P	P	P	P
1%-5% Aerated	70°	G	G	P	P	P	P
Ferric Sulphate							
1%-5% Quiescent or Agitated	70°	G**	G	P	P	P	P
1%-5% Aerated	70°	G**	G	P	P	P	P
10%	Boiling	G**	G	P	P	P	P
Ferrous Chloride Saturated Sol.	70°	P	G	P	L	L	
Ferrous Sulphate Dilute Solution	70°	G	G	P	L	L	P
Fluorine (Gas) Moist	70°	P	P	P	P	P	P
Formaldehyde 40% Solution		G**	G**	L	G	G	G
Formic Acid, 5% Still	70°	L	G	P	L	L	L
5% Still	150°	L	G	P	L	L	P
Fruit Juices	70°	G	G	P	L	L	L
Fuel Oil	Hot	G	G	L	G	G	L
Containing Sulphuric Acid		P	L		P	P	L
Furfural	70°	G	G	L	G	G	L
Gallic Acid, 5%	70° - 150°	G	G	P			L
Saturated	212°	G	G	P			L
Gasoline	70°	G	G	L	G	G	G
Gelatin		G	G	P	G	G	G
Glue Dry	70°	G	G	G	L	L	L
Solution - Acid	70°-140°	L**	G	L	P	P	L
Glycerine	70°	G	G	L	G	G	G

Chemical	Temperature °F	Stainless Steel		Mild Steel	Brass(80-20)	Bronze (Phos.)	Monel
		304 304L 321	316 316L				
Hydrochloric Acid							
All Concentrations	70°	P	P	P	P	P	P
Hydrocyanic Acid	70°	G	G	P	P	P	L
Hydrofluoric Acid	70°	P	P	P	P	P	G
Hydrofluosilicic Acid	70°	P	P	P	L	L	L
Hydrogen Peroxide	70°	G***	G	P	P	P	L
	Boiling	L***	G	P	P	P	L
Hydrogen Sulphide (Dry)	70°	G	G	L	G	G	P
(Wet)	70°	L***	G***	P	P	P	P
Hyposulphite Soda (Hypo)		G	G				
Ink	70°	L***	G	P	P	P	G
Iodine	70°	P	P	P	P	P	P
Iodoform	70°	G	G	P			L
Kerosene	70°	G	G	L	G	G	L
Ketchup, Quiescent	70° - 150°	G**	G	P			L
Lactic Acid, 1%	70°	G	G	P	L	L	L
1%	Boiling	G	G	P	P	P	L
5%	70°	G	G	P	L	L	L
5%	150°						
	Boiling	L	G	P	P	P	L
10%	70°	L	G	P	L	L	L
10%	150°						
	Boiling	P	L	P	P	P	L
Concentrated	70°	L	G	P	L	L	L
Concentrated	Boiling	P	L	P	P	P	L
Lard	70°	G	G				G
Lead (Molten)	750°	L	L		P	P	P
Lead Acetate 5%	Boiling	G	G	P			L
Linseed Oil	70°	G	G	L	L	L	G
Plus 3% H_2SO_4	390°	L	G	P	P	P	G
Magnesium Chloride							
1% Quiescent	70°	G**	G	P	L	L	G
1% Quiescent	Hot	P	L**	P	L	L	G
5% Quiescent	70°	G**	G	P	L	L	G
5% Quiescent	Hot	P	L**	P	L	L	G
Magnesium Oxychoride	70°	P	L**	P			
Magnesium Sulphate	Hot & Cold	G	G	P	G	G	G
Malic Acid	Hot & Cold	L	G	P			L
Mash	Hot	G	G				L
Mayonnaise	70°	G**	G	P			L
Mercury		G	G	G	P	P	P
Mercuric Chloride Dilute Sol.	70°	P	P	P	P	P	P
Methanol (Methyl Alcohol)		G	G	L	G	G	G
Milk, Fresh or Sour	70°	G	G	P	G	G	L
	Boiling	G	G	L	G	G	L
Mixed Acids							
53% H_2SO_4 + 45% HNO_3	Cold	G	G	P	P	P	P
Molasses		G	G	L	L	G	G

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Chemical Resistance Chart

Chemical	Temperature °F	Stainless Steel		Mild Steel	Brass(80-20)	Bronze (Phos.)	Monel
		304 304L 321	316 316L				
Muriatic Acid	70°	P	P	P	P	P	L
Mustard	70°	G**	G**	P			L
Naptha, Crude	70°	G	G	L	L	L	G
Naptha, Pure	70°	G	G	L	L	L	G
Napthalene Sulfonic Acid	70°	G	G	P			G
Nickel Chloride Solution	70°	G**	G**	P	P	L	L
Nitrating Solutions	Cold & Hot	L	L		P	L	P
Nickel Sulphate	Cold & Hot	G	G	P	P	G	G
Niter Cake	Fused	L	G	P			L
Nitric Acid 5%-50%-70%	Boiling	G	G	P	P	P	P
65%	70°	G	G	P	P	P	P
65%	Boiling	L	L	P	P	P	P
Concentrated	70°	G	G	P	P	P	P
Concentrated	Boiling	P	P	P	P	P	P
Fuming Concentrated	70°-110°	G	G	P	P	P	P
Fuming Concentrated	Boiling	P	P	P	P	P	P
Nitrous Acid 5%	70°	G	G	P	P	P	P
Oils, Crude	Cold & Hot	G***	G***		L	L	G
Oils, Vegetable, Mineral	Cold & Hot	G***	G		L	L	G
Oleic Acid	70°-400°	G**	G	L	L	L	L
Oxalic Acid 5%-10%	70°/Boiling	G	G	P	P	L	L
10%	Boiling	P	P	P	P	L	L
25%-50%	Boiling	P	P	P	P	L	G
Paraffine	Cold & Hot	G	G	L	G	G	G
Phenol (See Carbolic Acid)							
Petroleum Ether		G	G	L			L
Phosphoric Acid 1%	70°	G*	G*	P	P	P	L
1%	Boiling	G	G	P	P	P	L
1% - 45 lbs. Pressure	284°	G	G	P	P	P	L
5% Quiescent, or Agitated	70°	G	G	P	P	P	L
5% Aerated	70°	G	G	P	P	P	L
10% Quiescent	70°	P	G	P	P	P	L
10% Agitated or Aerated	70°	P	L	P	P	P	L
10%-50%	Boiling	G	G	P	P	P	P
80%	70°	P	P	P	P	P	L
80%	230°	P	P	P	P	P	P
85%	Boiling	P	P	P	P	P	P
Picric Acid	70°	G	G	P	P	P	P
Potassium Bichromate, 25%	70°	G	G		P	P	L
25%	Boiling	G	G		P	P	L
Potassium Bromide	70°	L**	G**	P	L	L	L
Potassium Carbonate 1%	70°	G	G	L	L	L	G
Potassium Carbonate	Hot	G	G	L	P	P	G
Potassium Chlorate Sat. at 212°	Boiling	G	G	L	P	P	P
Potassium Chloride							
1% Quiescent	70°	G**	G**	P	P	L	G
1% Agitated or Aerated	70°	G	G	P	P	L	G
5% Quiescent	70°	G**	G**	P	P	L	G

Chemical	Temperature °F	Stainless Steel		Mild Steel	Brass(80-20)	Bronze (Phos.)	Monel
		304 304L 321	316 316L				
Potassium Chloride							
5% Agitated or Aerated	70°	G	G	P	P	L	G
5%	Boiling	G	G	P	P	L	G
Potassium Chromium Sulfate							
5%	70°	G**	G	P	P	L	
Sp. G. 1.6	Boiling	P	P	P	P	P	
Potassium Cyanide	70°	G	G	L	P	P	L
Potassium Ferricyanide, 5%-25%	70°	G	G	P			L
25%	Boiling	G	G	P			L
Potassium Ferrocyanide, 5%	70°	G	G	P			L
Potassium Hydroxide, 5%	70°	G	G	L†	P	L	G
27%	Boiling	G	G	L†	P	L	G
50%	Boiling	L	G	P	P	L	G
Potassium Hypochlorite	70°	L	L	P	P	P	P
Potassium Nitrate							
1%-5% Still or Agitated	70°	G	G	P	L	L	G
1%-5% Aerated	70°	G	G	P	L	L	G
50%	70°	G	G	P	L	L	G
50%	Boiling	G	G	P			G
Molten	1022°	G	G	P			
Potassium Oxalate		G	G				
Potassium Permanganate, 5%	70°	G	G	L			P
Potassium Sulphate							
1%-5% Still or Agitated	70°	G	G	L	L	G	L
1%-5% Aerated	70°	G	G	L	L	G	L
	Hot	G	G	P	L	G	L
Potassium Sulphide (Salt)		G	G	P			
Pyrogallic Acid		G	G	L			
Quinine Bisulphate (Dry)		L	G	P			
Quinine Sulphate (Dry)		G	G	P	L	L	L
Rosin	Molten	G	G	P	G	G	G
Sea Water	70°	G**	G**	P	L	L	G
Sewage		G***	G***		G	G	G
Silver Bromide		L**	G**	P	P	P	
Silver Chloride		P	P	P	P	P	P
Silver Nitrate		G	G	P	P	P	P
Soap	70°	G	G	L	G	G	G
Sodium Acetate (Moist)		G**	G	P			L
Sodium Bicarbonate							
All Concentrations	70°	G	G	P	L	L	G
5% Still	150°	G	G	P	L	L	G
Sodium Bisulphate, Solution	70°	G***	G***	P	P	L	L
Saturated Solution	70°	P	P	P	P	L	L
2 g. + 1 g. H_2SO_4 liter	68°	P	G***	P	P	L	L
Sodium Carbonate, 5%	70°-150°	G	G	L	L	L	G
5% - 50%	Boiling	G	G	L	L	L	G
Molten	1650°	P	P	P	P	P	G

† Mild steel severely stressed subject to caustic embrittlement

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Chemical	Temperature °F	Stainless Steel		Mild Steel	Brass(80-20)	Bronze (Phos.)	Monel
		304 304L 321	316 316L				
Sodium Carbonate	70°-150°	G	G	L	L	L	G
5%-50%	Boiling	G	G	L	L	L	G
Molten	1650°	P	P	P	P	P	G
Sodium Chloride, 5% Still	70°-150°	G**	G	P	P	L	G
20% Aerated	70°	G**	G	P	P	L	G
Saturated	70°	G**	G	P	P	L	G
Saturated	Boiling	L**	G	P	P	L	G
Sodium Cyanide	70°	G	G	L	P	P	
Sodium Fluoride, 5% Solution	70°	L**	G**	P	G	G	G
Sodium Hydroxide	70°	G	G	L	P	L	G
Sodium Hypochlorite, 5% Still		L**	G**	P	P	L	P
Sodium Hyposulfite	70°	G***	G	P			G
Sodium Nitrate	Fused	G	G	L	G	G	L
Sodium, Perchlorate, 10%	70°	G	G				
	Boiling	G	G				
Sodium Phosphate	70°	G	G	L	L	L	L
Sodium Sulphate, 5% Still	70°	G	G	P	G	G	G
All Concentrations	70°	G	G	P	G	G	G
Sodium Sulphide, Saturated		L**	G	P	P	P	L
Sodium Sulphite, 5%	70°	G	G	P	P	L	L
10%	150°	G	G	P	P	L	L
Sodium Thiosulphate							
Saturated Solution	70°	G	G***	P	P	P	G
Acid Fixing Bath (Hypo)	70°	G	G	P	P	P	L
25% Solution	70°/Boiling	G	G***	P	P	P	L
Stannic Chloride Solution							
Sp. G. 1.21	70°/Boiling	P	P	P	P	P	P
Stannous Chloride, Saturated		P	G	P			P
Steam		G	G	P	L	G	G
Stearic Acid	70°	G	G	P	P	L	L
Starch, Aqueous Solution		G	G				L
Strontium Hydroxide		G	G				
Strontium Nitrate Solution	Hot	G	G	P			L
Sulphur, Moist	70°	L**	G**	P	P	P	L
Molten	266°	G	G	P	P	P	G
Molten	833°	P	P	P	P	P	P
Sulphur Chloride (Dry)		P	P	P	G	G	L
Sulphur Dioxide Gas (Moist)	70°	L	G	P	L	L	P
Gas (Dry)	575°	G	G	P	G	G	L
Sulphuric Acid							
5%-10%	70°	P	L	P	P	L	P
5%-10%	Boiling	P	P	P	P	P	P
50%	70°	P	P	P	P	P	P
50%	Boiling	P	P	P	P	P	P
Concentrated	70°	G	G	P	P	L	P
Concentrated	Boiling	P	P	P	P	L	P
Concentrated	300°	P	P	P	P	L	P
Fuming	70°	P	L	P	P	L	P

Chemical	Temperature °F	Stainless Steel		Mild Steel	Brass(80-20)	Bronze (Phos.)	Monel
		304 304L 321	316 316L				
Sulphurous Acid, Saturated	70°	P	L	P	P	L	P
Saturated - 60 lb. Pressure	250°	P	L	P	P	L	P
Saturated - 70-125 lb. Pressure	310°	P	L	P	P	L	P
150 lbs. Pressure	375°	P	L	P	P	L	P
Sulphurous Spray	70°	P	P	P	P	P	P
Tannic Acid	70°	G	G	P	L	G	P
	150°	G	G		L	G	P
Tanning Liquor	70°	G	G				G
Tar		G	G	L	G	G	L
Tartaric Acid, 10%	70°	G	G	P	L	G	L
10%-50%	Boiling	L	G	P	L	G	L
Tin	Molten	P	P	P	P	P	
Trichloracetic Acid	70°	P	P	P	P	L	P
Trichlorethylene (Dry)	70°	G**	G	P	G	G	G
(Moist)					L	L	
Varnish	70°	G	G	L	G	G	G
Vegetable Juices		G	G	L	P	L	L
Vinegar Fumes		L	G	P	P	L	P
Vinegar, Still, Agitated or Aerated	70°	G	G	P	P	L	P
Water		G	G	L	G	G	G
Whiskey		G	G	P	L	P	P
Wine - All Phases of Processing							
and Storing	75°	G	G	P	P	P	L
Yeast		G	G		P	P	G
Zinc	Molten	P	P	P	P	P	P
Zinc Chloride, 5% Still	70°	G**	G**	P	P	P	L
	Boiling	L**	L**	P	P	P	L
Zinc Cyanide, Moist	70°	G	G	P			
Zinc Nitrate, Solution	Hot	G	G	P			
Zinc Sulphate, 5%	70°	G	G	P	P	L	L
25%	Boiling	G	G	P	P	L	L
Saturated	70°	G	G	P	P	L	L

Glossary

Abrasion
External damage to a hose assembly caused by its being rubbed on a foreign object; a wearing away by friction.

Ambient Temperature
The temperature of the atmosphere or medium surrounding an object under consideration.

Ambient/Atmospheric Conditions
The surrounding conditions, such as temperature, pressure, and corrosion, to which a hose assembly is exposed.

Amplitude of Vibrations and/or Lateral Movement
The distance a hose assembly deflects laterally to one side from its normal position, when this deflection occurs on both sides of the normal hose centerline.

Anchor
A restraint applied to eliminate motion and restrain forces.

Angular Displacement
Displacement of two parts defined by an angle.

Annular
Refers to the convolutions on a hose that are a series of complete circles or rings located at right angles to the longitudinal axis of the hose (sometimes referred to as "bellows").

Application
The service conditions that determine how a hose assembly will be used.

Armor Casing
A protective cover slid over and affixed to a hose assembly; used to prevent over bending or for the purpose of protecting hose from severe external environmental conditions such as hot materials, abrasion or traffic.

Assembly
A general term referring to any hose coupled with end fittings of any style attached to one or both ends.

Attachment
The method of securing an end fitting to a hose (e.g., welding, brazing, banding, crimping, swaging, or screw-together-2 piece or 3 piece-style-reusable fittings).

Axial Movement
Compression or elongation along the longitudinal axis.

Basket Weave
A braid pattern in which the plaits of wire alternately cross over and under two strands (two over-two under).

Glossary

Beamed Braid
Braid construction in which the wires in a carrier are parallel.

Bend Radius
The radius of a bent section of hose measured to the innermost surface of the curved portion.

Bend Radius, Minimum
The smallest radius at which a hose can be used. For Metal Hose: - the radius of a bend measured to the hose centerline, as recommended by the manufacturer.

Bend Radius, Dynamic
The radius at which constant or continuous flexing occurs.

Bend Radius, Static
The smallest fixed radius to which a hose can be subjected.

Braid
The outer, woven portion of a hose made of metal and used as reinforcement to increase pressure rating and add resistance against abrasion and other types of damage.

Braid Angle
The relative angle of the braid carriers to the longitudinal centerline of the hose.

Braid Coverage
The relative amount of braid material covering a hose expressed as a percent.

Braid Sleeve/Ring/Ferrule
A ring made from tube or metal strip placed over the ends of a braided hose to contain the braid wires for attachment of fitting and ferrule, and to immobilize heat affected corrugations.

Braid Wear
Motion between the braid and corrugated hose, which normally causes wear on the outside diameter of the corrugation and the inside diameter of the braid.

Braided Braid
Braid where the strands of wire on each carrier of the braiding machine are braided together, and then braided in normal fashion.

Brazing
A process of joining metals using a non-ferrous filler metal having a melting point that is lower than the "parent metals" to be joined, typically over +800ºF.

Butt Weld
Process in which the edges or ends of metal sections are butted together and joined by welding.

Casing
See Armor.

Glossary

Controlled Flexing
Occurs when the hose is being flexed regularly, as in the case of connections to moving components (e.g., platen presses, thermal growth in pipe work).

Certificate of Conformance
A Certificate of Conformance is a statement by the supplier that the hose assembly(ies) or its fabrication method conforms to specific standards or documents. A Certificate of Conformance should always include the following: 1) Customer's name, address, and purchase order, 2) Supplier name and address, 3) Complete description of the hose assembly including type of hose, I.D., length, fittings and accessories, 4) Date and 5) Supplier's authorized signature. In addition, the C of C should also identify the standard or document to which the C of C is being supplied; and contain a statement by the supplier that the assembly(ies) conform to the specified standard or document.

Close Pitch
Less spacing between the corrugations per foot, thereby giving the longest fatigue life and minimum bend radius.

Convolution/Corrugation
The annular or helical flexing member in corrugated hose.

Corrosion
The process of material degradation by chemical or electrochemical means.

Cycle-Motion
Movement from normal to extreme position and return.

Developed Length
See Overall Length.

Diamond Weave
Braid pattern in which the strands alternately cross over one and under one of the strands (one over-one under); also known as "plain weave."

Displacement
The amount of motion applied to a hose defined as inches for parallel offset and degrees for angular misalignment.

Dog-Leg Assembly
Two hose assemblies joined by a common elbow.

Double Braided
A corrugated metal hose covered by two layers of braid.

Duplex Assembly
An assembly consisting of two hose assemblies - one inside the other, and connected at the ends; also known as "jacketed assemblies."

Glossary

Dye Penetrant Test
A visual, non-destructive inspection method for detecting leaks and surface defects that uses a colored dye capable of highlighting them.

Dynamic Motion
Non-continuous or intermittent controlled motion such as the result of thermal expansion.

Effective Thrust Area - Hose
Cross-sectional area described by the mean diameter of the hose.

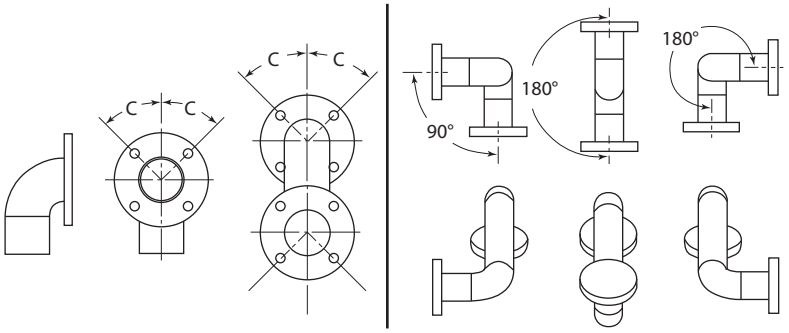
Elastic/Intermittent Flexure
The smallest radius that a given hose can be bent to without permanent deformation to the metal in its flexing members (convolutions or corrugations).

Fatigue
Damage of the hose assembly due to excessive flexing of the corrugations.

Ferrule
A metal cylinder placed over a hose end to affix the fitting to the hose. See braid sleeve, interlocking ferrule, and sleeve.

Fitting/Coupling
A device attached to the end of the hose to facilitate connection.

Fitting Orientation
Some fittings (e.g. fixed flanges, elbows, etc.) require specific orientation on the hose assembly in order to be properly installed into the piping system. These fittings should be oriented according to the following illustrations unless otherwise specified:



Bolt Hole Alignment Angular Fitting Orientation

Standard Fitting Orientations

Flow Rate
Volume of media being conveyed in a specific time period such as gallons per minute, cubic feet per second or pounds per hour.

Glossary

Fluid
A gas or liquid medium.

Free Length
The lineal measurement of hose between fittings or couplings.

Frequency
The rate of vibration or flexure in a given time period.

Galvanic Corrosion
Corrosion that occurs on the less noble of two dissimilar metals in direct contact with each other in an electrolyte such as water, sulfuric acid or sodium chloride solution.

GMAW
Gas Metal Arc Weld.

GTAW
See Tig Weld/GTAW.

Guide (for piping)
A device that supports a pipe radially in all directions, but directs movement.

Helical Wire Armor/Spring Guard
An abrasion resistance device.

Helical
Used to describe a type of corrugated hose in which a corrugation spirals the length of the hose, similar to a screw thread.

Helium Leak Testing
The most accurate way of evaluating leakage (but not strength). Assemblies designed for critical applications should be leak tested with this method. All tested assemblies shall have a leak rate less than 1×10^{-3} std/cc/sec. Helium mass spectrometer testing to smaller leak rates may be available. Consult **UNISOURCE** for details.

I.D.
The abbreviation for inside diameter.

Interlocked Hose
Formed from profiled strip and wound into flexible metal tubing with no subsequent welding, brazing, or soldering; may be made pressure-tight by winding in strands of packing.

ISO 10380
ISO 10380 is a standard that specifies performance requirements for the design, manufacture, and testing of corrugated metallic hose and hose assemblies. Being qualified to ISO 10380 means that the metal hose will last a specified number of cycles at published pressure, bend radius, and temperature. The metal hose has been tested and certified by an independent laboratory to the ISO 10380 specification and conforms in every respect.

Glossary

Jacket
A seamless tubular braided or woven ply generally on the outside of a hose.

Kinking
A temporary or permanent distortion of the hose induced by bending beyond the minimum bend radius.

Lap Seam
A seam made by placing the edge of one piece of material extending flat over the edge of the second piece of material.

Lap Weld (LW)
Type of weld in which the ends or edges of the metal overlap each other.

Liner
Flexible sleeve used to line the inside diameter of hose when conveying a high velocity media, also prevents erosion.

Live Length
The lineal measurement of hose between fittings or couplings.

Loop Installation
The assembly is installed in a loop or "U" shape, and is most often used when frequent and/or large amounts of motion are involved.

Material Test Report
This report shows that the materials for which the report was requested meet the customer's specifications. Typically, MTR's are copies of the raw material MTRs that were supplied to the assembly provider by their raw materials vendor along with the pertinent information regarding the customer, supplier, purchase order and item ordered.

Mean Diameter
The midpoint between the inside diameter and the outside diameter of a corrugated/convoluted hose.

Mechanical Fitting/Reusable Fitting
A fitting attached to a hose, which can be disassembled and used again.

Media, Medium
The substance(s) being conveyed through a system.

Metal Hose
Thin wall metal tubing formed into flexible hose with helical or annular ridges and grooves, often braided with stainless steel to increase the operating pressure capability. With fittings welded on, assemblies are used in applications outside temperature range of rubber, thermoplastic and fluoroplastic.

Glossary

Misalignment
A condition where two parts do not meet true.

Nominal
A size indicator for reference only.

OAL
See overall length.

O.D.
The abbreviation for outside diameter.

Offset-Lateral, Parallel
The distance that the ends of a hose assembly are displaced in relation to each other as the result of connecting two misaligned terminations in a system, or intermittent flexure required in a hose application.

Open Pitch
Fewer corrugations per foot which limits motion and bend radius.

Operating Conditions
The pressure, temperature, motion, and environment to which a hose assembly is subjected.

Overall Length (OAL)
The total length of a hose assembly, which consists of the free hose length plus the length of the coupling(s).

Assembly Overall Length Tolerances

Hose I.D.	Overall Length of Assembly					
	0″ thru <8″	8″ thru <18″	18″ thru <3′	3′ thru <6′	6′ thru <12′	≥ 12′
< 1″	+/- 1/4″	+/- 5/16″	+/- 3/8″	+/- 1/2″	+/- 1″	+/- 1%
1″ thru <4″	+/- 3/8″	+/- 1/2″	+/- 5/8″	+/- 3/4″	+/- 1-1/4″	+/- 1.5%
4″ thru 12″	+3% -1.5%	+3% -1.5%	+3% -1.5%	+3% -1.5%	+3% -1.5%	+3% -1.5%

Penetration (Weld)
The percentage of wall thickness of the two parts to be joined that is fused into the weld pool in making a joint.

Pitch
(1) The distance from one point on a helix to the corresponding point on the next turn of the helix, measured parallel to the axis; (2) the distance between the two peaks of adjacent corrugation or convolution.

Ply
An individual layer in hose construction.

Glossary

Pneumatic Test
A test performed with the hose assembly under water. Low pressure air is pumped into the assembly to determine the leak integrity of the hose.

Pressure
Force over unit area. For purposes of this document, refers to PSIG (pounds per square inch gauge).

Pressure, Burst
The pressure at which rupture occurs.

Pressure, Deformation
The pressure at which the convolutions of a metal hose become permanently deformed.

Pressure, Gauge
Relative pressure between inside and outside of an assembly.

Pressure, Maximum Allowable Working
The maximum pressure at which a hose or hose assembly is designed to be used.

Pressure, Maximum Test
This indicates the industry standard recommendation for the highest pressure that the hose should be tested to either within an installation, or by the factory prior to shipping. It is established at 150% of the maximum working pressure with the hose installed straight. Hydrostatic field tests of hose assemblies installed in varying degrees of radial bend or parallel offset should be limited to 120% of the maximum rated working pressure at 70°F. or 150% of the actual operating pressure, whichever is lower. Pressure testing is not standard procedure and must be specified by the customer.

Pressure, Pulsating
A rapid change in pressure above and below the normal base pressure, usually associated with reciprocating type pumps.

Pressure, Rated Working
See pressure, maximum allowable working.

Pressure, Shock/Spike
The peak value of a sudden increase of pressure in a hydraulic or pneumatic system producing a shock wave.

Pressure, Working
The maximum pressure to which a hose will be subjected, including the momentary surges in pressure, which can occur during service. Abbreviated as WP.

Profile
Used in reference to the contour rolled into strip during the process of manufacturing strip wound hose, or the finished shape of a corrugation/convolution.

Glossary

PSI
Pounds per square inch.

Radial Motion
Radial motion occurs when the centerline of a hose assembly is bent in a circular arc. In industrial applications, radial motion is most commonly found in traveling loops.

Random Motion
The uncontrolled motion of a metal hose, such as occurs in manual handling.

Reusable Fitting/Coupling
A fitting designed to be attached and unattached to a hose, allowing all or most of the fitting to be reused.

Safety Factor
A ratio used to establish the working pressure of the hose, based on the burst strength of the hose.

Scale
The oxide in a hose assembly brought about by surface conditions or welding.

Splice
A method of joining two sections of hose.

Squirm
A form of failure where the hose is deformed into an "S" or "U" bend, as the result of excessive internal pressure being applied to unbraided corrugated hose while its ends are restrained or in a braided corrugated hose which has been axially compressed.

Static Bend
A non-moving or fixed radius bend in a hose assembly used to compensate for misalignment.

Stress Corrosion
A form of corrosion in metal.

Stripwound (Interlocked) Hose
Formed from profiled strip and wound into flexible metal tubing with no subsequent welding, brazing, or soldering; may be made pressure-tight by winding in strands of packing.

Test Report
A test report is issued at a customer's request to document that the assembly(ies) has passed a specific test. A test report should always include the following: 1) Customer's name, address, and purchase order, 2) Supplier name and address, 3) Complete description of the hose assembly including type of hose, I.D., length, fittings and accessories, 4) Date and 5) Supplier's authorized signature. In addition, the test report should identify the test to which the assembly(ies) was tested giving a detailed explanation of the test and testing procedure; and contain a statement by the supplier that the assembly(ies) has been tested and pass the test.

Glossary

Traced Assembly

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 and outlet at the same end of the assembly.

Traveling Loop, Class A Loop

An application wherein the radius remains constant and one end of the hose moves parallel to the other end.

Traveling Loop, Class B Loop

A condition wherein a hose is installed in a U-shaped configuration and the ends move perpendicular to each other so as to enlarge or decrease the width of the loop.

Tig Weld/GTAW

The gas tungsten arc welding process sometimes referred to a "shielded arc" or "heliarc."

Vacuum

Negative pressure created by the difference of internal and external pressures; suction.

Velocity

Distance travelled over time in a specific direction; speed of movement.

Velocity Resonance

Vibration due to the buffeting of a high velocity gas or liquid flow.

Vibration

Amplitude motion occurring at a given frequency.

WP

The abbreviation for working pressure.

Notes

Notes

UNISOURCE MFG.

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