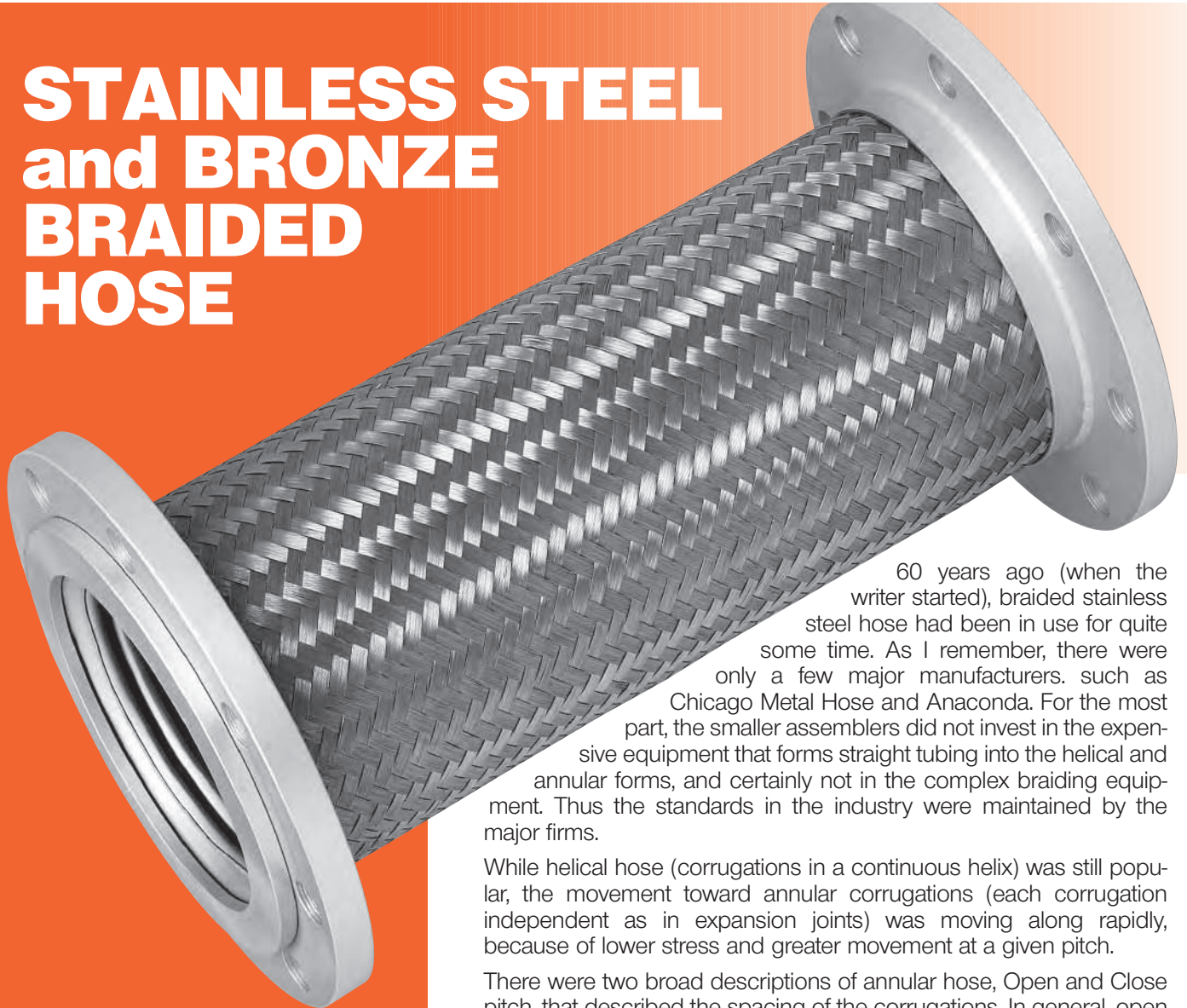




STAINLESS STEEL and BRONZE BRAIDED HOSE

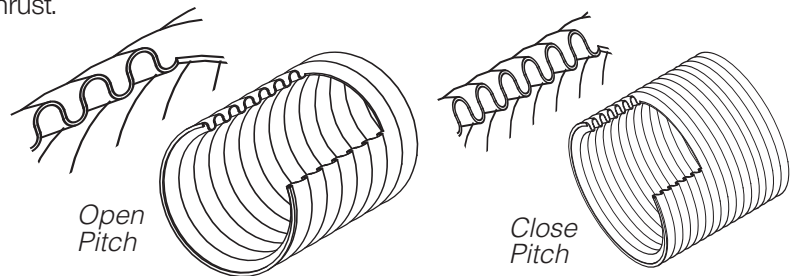


60 years ago (when the writer started), braided stainless steel hose had been in use for quite some time. As I remember, there were only a few major manufacturers, such as Chicago Metal Hose and Anaconda. For the most part, the smaller assemblers did not invest in the expensive equipment that forms straight tubing into the helical and annular forms, and certainly not in the complex braiding equipment. Thus the standards in the industry were maintained by the major firms.

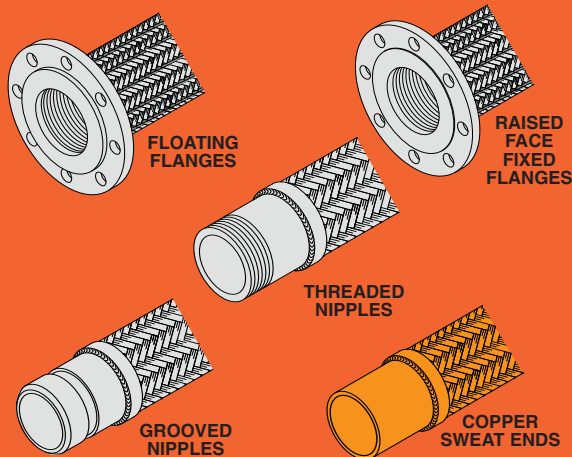
While helical hose (corrugations in a continuous helix) was still popular, the movement toward annular corrugations (each corrugation independent as in expansion joints) was moving along rapidly, because of lower stress and greater movement at a given pitch.

There were two broad descriptions of annular hose, Open and Close pitch, that described the spacing of the corrugations. In general, open pitch was used in low pressure applications where the braid was not required, and the hose might be used to take up some axial expansion as in diesel exhaust.

Close pitched hose was always used for transverse movement and applications where the stainless steel braid was required to control thrust.

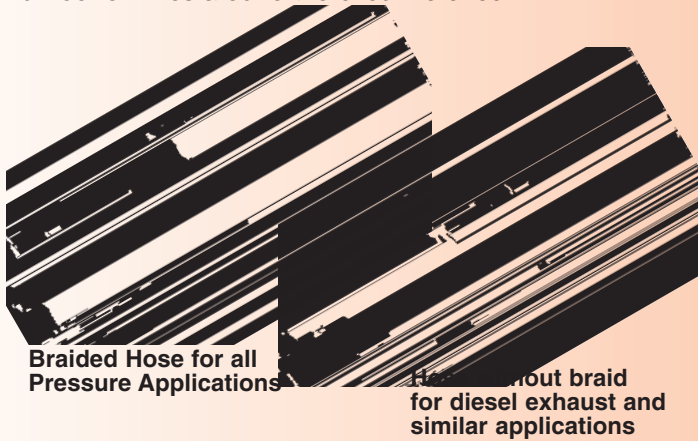


FITTING OPTIONS

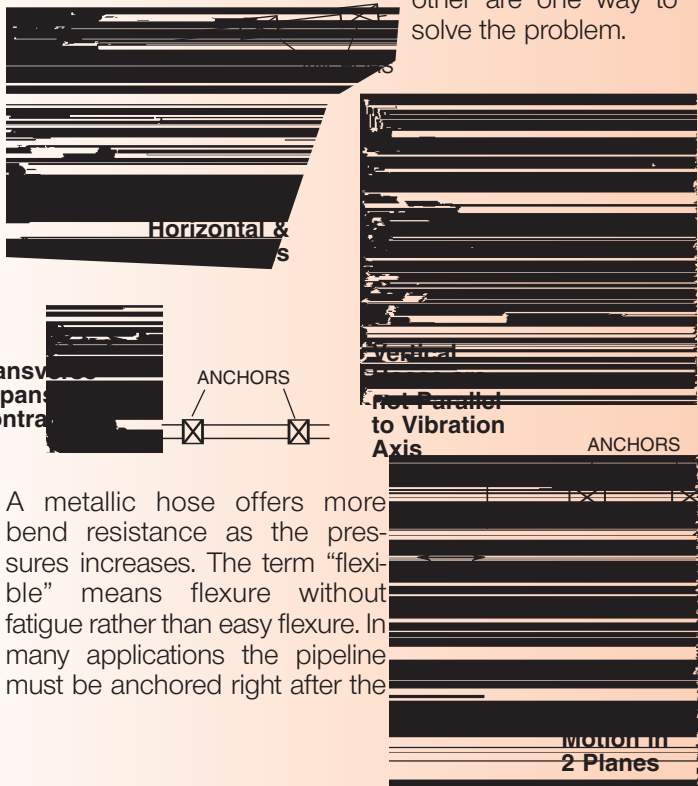


The corrugated hose provides flexibility and prevents leakage, but has virtually no resistance to pressure thrust. In a solid piping system, there is no external thrust, as the pressure on the projected area of the inside of the pipe is equalized by the two ends or bends in the pipe. The force is taken by the pipe wall. Once a flexible hose is inserted, that capability is gone.

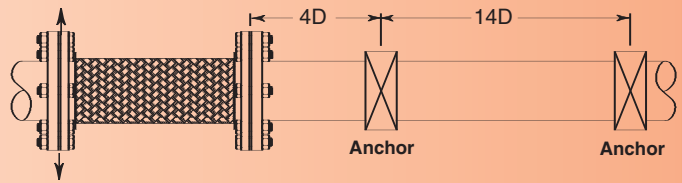
When fluid or gas pressure is applied to each corrugation, it tends to open axially, and this adds to the thrust of the pipe area multiplied by the line pressure. As the thrust pulls on the anchored braid ends, the interwoven bias weave applies inward radial pressure to the corrugations as well. Pressure capability is largely a function of the braid. When higher pressures are needed, it is seldom accomplished by thicker tubing as you would lose flexibility. It is most often accommodated by increasing the strength of the braid, using braid with heavier wire or tighter spacing described as Double or Triple Braid or just multiple braid layers. While braid angle is an influence, a quick comparison of braid strength is to multiply the wire area by the total number of wires around the circumference.



Since the braid is stretched taut by the pressure in the axial direction and kept that way, hoses cannot accept axial motion. All flexibility is at right angles to the axis, so the hose flexes transversely. Most machinery vibrates in a radial direction from the main shaft. Therefore, the hose should be installed parallel to the shaft for best performance, although it seldom is. It must be installed at a 90° angle to the motion in expansion applications. When major motion occurs in two planes, two hoses at right angles to each other are one way to solve the problem.



hose to force the hose to flex or the hose serves little purpose. For best results, one near the hose and the other some distance away provide a better solution, as pipe may pivot through one anchor. Spacing between anchors is a function of pipe diameter.



While we have influenced specifications over the years, our volume had always been very low, because we were not competitive. That has changed.

In setting standards for our new product range, we were dismayed to find that the term "Close Pitch" had almost become meaningless. Competitive literature does not include the number of corrugations per foot nor transverse stiffness. We are publishing pitch on all product pages and transverse stiffnesses on pages 5, 6, 7 & 8, so this bulletin begins to provide direction.

Do not be fooled by the salesman who bends a hose like a reed.

When most people visualize a hose flexing, the image is bending in an arc. Unfortunately, this is not true. When flanged hose is displaced, the rigid pipe flanges remain parallel. The hose remains relatively straight at both ends and takes an open "S" shape between the two ends, as shown below. Nippled hoses act the same way.



"S" Shaped Hose

Our hose has a safety factor of 4 times the rated pressure. When comparing allowable operating pressures with other manufacturers, ask for burst pressure. It may be they are working at a lower safety factor. We prefer not to.

All stainless steel hose loses strength at higher temperatures. In the interests of safety and good engineering, use the correction factors to lower ratings when lines are hot.

We arrived at our standards of corrugations per foot by buying samples from approximately six of the well known manufacturers. The variation was more than a factor of two. Our pitch matches the best of the competitors. Some other firms may have a tighter pitch, but our spacing ranks among the "quality suppliers" and makes the hose very flexible.

The question comes up as to why others do not use a tighter pitch. The answer is the fewer the corrugations, the shorter the length of the original tubing to arrive at a finished length, and the faster the forming process. This decreases cost in direct proportion to the shorter length of the original tubing. Flexibility suffers but the product is cheaper.

Our sales representatives already have a full sized photo comparing our braided copper sweat end hoses with a well known competitor's as shown below.

Our 4" live length is 68% longer than their 23/8". We stripped the braid and counted the corrugations. Their product, sold as "close pitched", had 5 active corrugations. We have 22 or 4.4 times as many.

That is why specifications and published information are so important. It is the end user's only protection.

For the past 50 years, we have based our vibration control mountings, hanger and pad recommendations on field experience. Rubber expansion joints have been tested acoustically and constantly improved for reliability. Since proper seismic restraint not only prevents property damage but more importantly saves lives, all of our seismic products are destruction tested for confirmation after design. We would not be living up to our self imposed standards without the same intense engineering attention to Stainless Steel Hose.

Based on visits to jobsites, we knew that very short hose lengths, the typical "plumbers helper", did nothing but possibly reduce misalignment stress. Holding both ends of the hose provided a sense of equal vibration with no reduction from one end to the other. Even double lengths seemed to act about the same way.

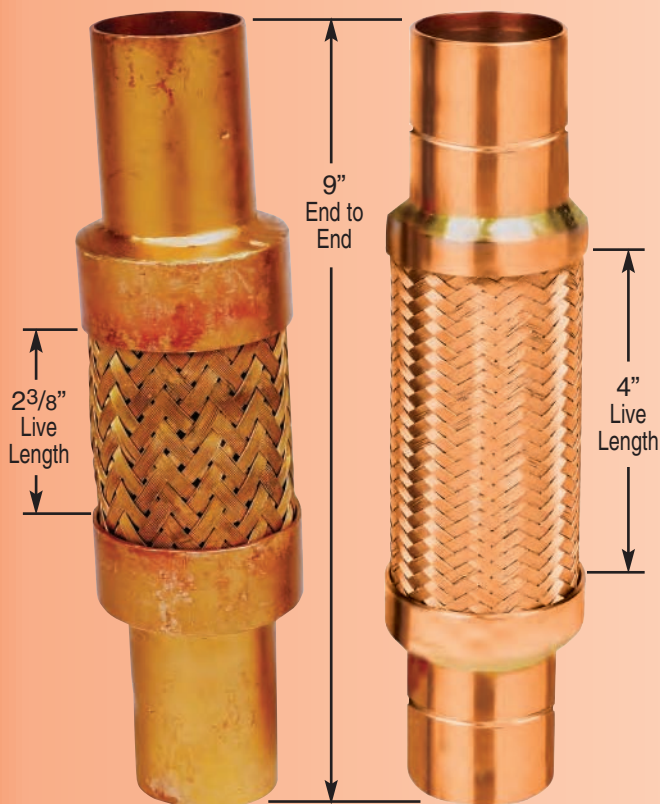
Experience always provides background for the next step. In machinery vibration control a theoretical isolator often failed to perform because the structure was not as stiff as the isolator. We solved the problem by producing isolators with lower stiffness than the structure.

We started this study by calculating transverse schedule 40 pipe stiffness. This is important as the hose faces this resistance.

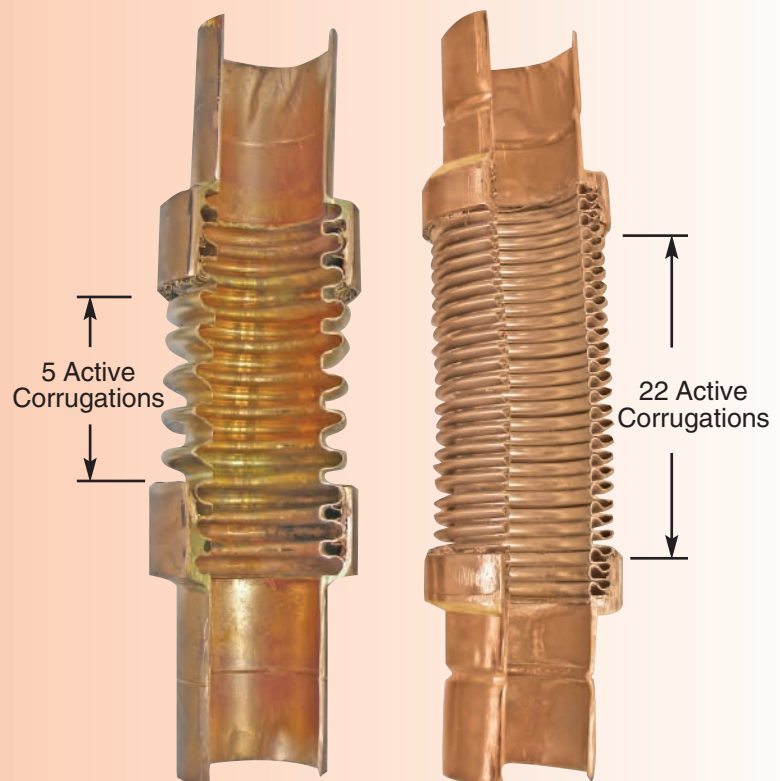
There are many manuals that provide hose designs for misalignment, misalignment and vibration amplitude or straight connectors for vibration only. However, we could find no information on the force required to move a hose transversely— the key factor in selecting a hose to reduce vibration transmission.

Pipeline vibration reduction is based on hose length, pressure and the bending resistance of the steel piping it is attached to. While a vibration amplitude of $\pm 1/8$ " would be unacceptably high, our study is based on that displacement as $\pm 1/8$ " is the industries' "Pump Connector" standard. When comparing the stiffnesses of straight pipe lengths versus flexible hoses, if the flexible hose has a transverse stiffness greater than the pipe it is connected to, there is no reason why it would reduce vibration transmission. There is the influence of the system's inertia based on the mass provided by check and shutoff valves, strainers, etc., as well as the mass of the pipe filled with water directly after the flexible hose, but that is a variable. While it must help, it is an unknown.

1 1/2" x 9" Copper Fitted Hoses



1 1/2" x 9" Cross Section of Copper Fitted Hoses (Braid Removed to Reveal Active Corrugations)



TEST DISCUSSION

Our in house capability does not include dynamic measurement. However, the following static data is the first publicized attempt to measure displacement forces as a basis for specifications. Despite recommendations to the contrary, the average pump installation has the hoses installed vertically.

The disturbing force is radial to the pump rotor. Since the hose is vertical, it is most effective when the unbalance is parallel to the floor and least when the force is vertical, as the hose is rigid in that direction. However, when the force is vertical, it is pushing or pulling the riser and in general, the riser and header are stiffer in that direction.

We continue to suggest two hoses at right angles to each other, or when only one hose is used, installed parallel to the axis of the pump, chiller, compressor, etc. While proper suggestions, we recognize piping restrictions often make it impossible.

The test results on pages 5 & 6 are the forces required to displace straight hose lengths 1/8" at three common pressures. These forces are compared to the resistance to 1/8" movement

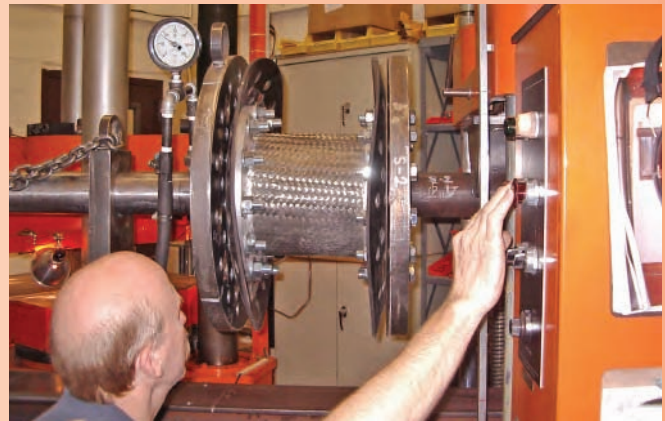
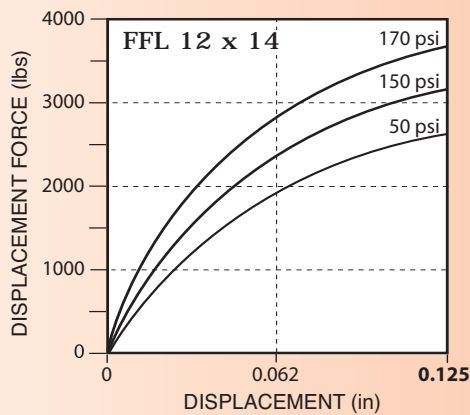
provided by 10', 8' and 6' lengths of schedule 40 Steel Pipe.

We used our computerized Baldwin Universal Tester so we could test two hoses in parallel to prevent machine distortion. Long lengths of pipes were bolted to the flanges at each end and guided through rigid rollers, so the flanges were held parallel as in the field. Water pressure was introduced by a hydraulic pump and measurements taken at 0, 50, 100, 150, 200 and 250psi. All readings were divided by 2 for single hose values. Since our hoses are all very close pitched and flexible, we believe competitive products would prove stiffer.

We tested a few hoses from the same lot and found variations. Therefore, our tabulations are only in the order of magnitude. We anticipated very large forces, but not as large as they turned out to be. Testing rig deflections lowered the 1/8" displacement values. 12" and larger data was not usable. 12", 14" and 16" numbers are extrapolations. We are rebuilding these jigs heavier and will publish corrected test information in the future. Similarly, very small sizes dropped below the testing machine's sensitivity, but they are in the proper direction.

We do not Recommend Industry Pump Connector Length.

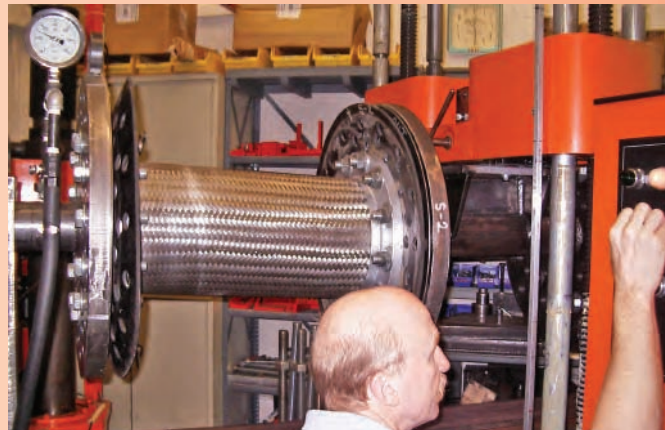
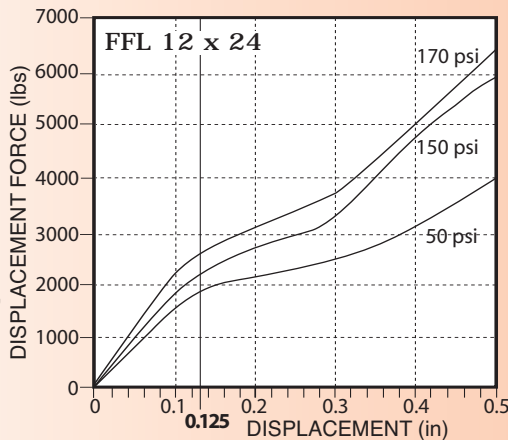
Displacement Force is 3690 lbs./0.125" at 170 psi.



Typical Short Industry Pump Connector 12" x 14" at Maximum 0.125" Offset

We also do not recommend 12 x 24 length.

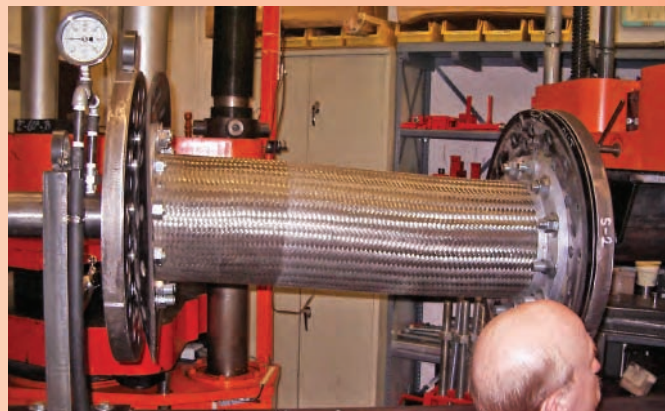
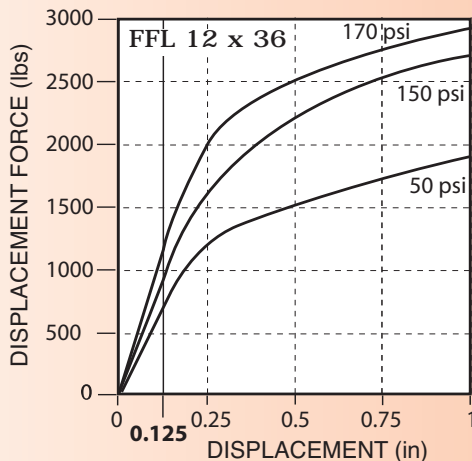
It is better than 12 x 14, but Displacement Force is still too high—2650 lbs./0.125" at 170 psi.



FFL 12 x 24 at 0.5" Offset

Recommended Length

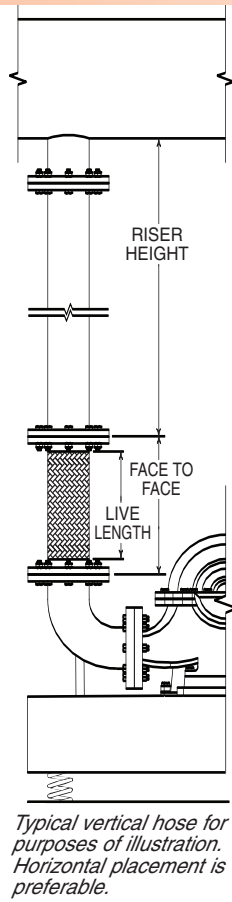
Displacement Force drops to 1150 lbs./0.125" at 170 psi.



FFL 12 x 36 at 1" Offset

In addition to corrugation count and configuration, live length rather than overall length is the stiffness control. All of our tables include this information. We have kept nipples as short as possible to maximize the flexible hose portion, but notice that a 1/2" x 6 1/2" MN has only 2 3/4" of live length, 1 1/4" x 8 1/2" only 3 1/4", 4" x 12" only 5". That is why the forces needed to move these "Pump Connector" lengths are so excessive. The live hose is so short that the connector has difficulty or finds it impossible to assume the shape shown in the center photograph on page 4.

The lengths suggested in our specifications are based on experience. The height of equipment rooms controls the length of the risers. The pressure depends on the height of the building. It is hard to visualize 1/2" through 2" threaded hoses that would be connected to pumps or other equipment with long risers that go to the ceiling. They might not be connected to risers at all. Small lines seldom operate at more than 150psi, because they service low buildings. Therefore, we are suggesting overall 24" lengths at 150psi. These selections show the forces needed to flex the hose are all below the stiffness of the pipe. The vibrating energy of small sized equipment is also lower and minimizes risk of serious transmission problems.



The same logic applies to the 2" through 4" sizes if we continue with the assumption that the pressure remains at 150psi. However, at 250psi, the hose stiffness increases dramatically. On virtually all major projects, the specifications allow for threaded nipples only through 2" diameter. So while we provide the force information for 2 1/2", 3" and 4" threaded nipple ends, our recommended lengths are based on flanged hoses in diameters of 2 1/2" and larger.

We have included copper pipe rather than ignoring it. However, copper tubing is both light and soft. Copper flexible hoses are better suited to allowing for thermal movement than reducing vibration.

Moving on to the larger diameter 2 1/2" through 16", we have to assume both higher pressures and longer risers. Typically a 4" pipe 8' long offers 90 lbs resistance to 1/8" movement. A 4" x 24" flanged hose at 150 psi has a resistance of 105 lbs., so it is too stiff. At 36" long, it drops to 50 lbs. and even at 250psi, 80 lbs., and still lower than the pipe stiffness. This sort of comparison is reasonable down through the study. A 36" FF length is about as long as practical because of valve heights and other problems. We are still synthesizing a great deal of information, so establishing one fixed length of 36" for 2 1/2" through 16" diameter appears to be a proper engineering choice at this time rather than an oversimplification.

BALDWIN TESTER REPORT ON FORCE REQUIRED TO DISPLACE 1/2" - 4" NIPPLED HOSES 1/8"
Information provided as a general guide to magnitude

THREADED NIPPLE HOSES (British Units)

MN Hose Dia. (in)	Length to End† (in)	Live Length (in)	Corrugations per foot	Force Required for 1/8" displacement (lbs)															
				Hoses Water Pressure (psi)			Steel Pipe Schedule 40 Riser Length (feet)												
				50	150	250	6	8	10										
1/2	6 1/2	2 3/4	92	6.0	14.0	20.0													
1/2	12	8 1/4	92	0.8	0.8	1.0	0.5	0.2	0.1										
1/2	18	14 1/4	92	1.0	1.0	1.0	lbs	lbs	lbs										
1/2	24	20 1/4	92	*0.3	0.4	0.5													
3/4	7	3 1/4	80	10.0	18.0	25.0													
3/4	12	8 1/4	80	1.5	2.5	3.8	1.1	0.5	0.2										
3/4	18	14 1/4	80	0.4	2.0	4.0	lbs	lbs	lbs										
3/4	24	20 1/4	80	* -	1.0	1.5													
1	8	3 3/4	72	13.0	30.0	50.0													
1	12	7 3/4	72	2.0	4.0	12.0	2.5	1.1	0.6										
1	18	13 3/4	72	0.5	1.5	2.5	lbs	lbs	lbs										
1	24	19 3/4	72	*0.5	1.0	1.5													
1 1/4	8 1/2	3 1/4	67	5.0	11.0	18.0													
1 1/4	12	6 3/4	67	3.5	15	20	6	2.4	1.2										
1 1/4	18	12 3/4	67	1.5	4	6.5	lbs	lbs	lbs										
1 1/4	24	18 3/4	67	-	2.5	3.5													
1 1/2	9	3 3/4	63	120	250	310													
1 1/2	12	6 3/4	63	20	60	105	9	4	2										
1 1/2	18	12 3/4	63	5	15	23	lbs	lbs	lbs										
1 1/2	24	18 3/4	63	3	6	8													
2	10 1/2	4 1/2	58	180	360	460													
2	12	6	58	120	265	400	20	8	4										
2	18	12	58	20	60	90	lbs	lbs	lbs										
2	24	18	58	6	15	23													
2 1/2	12	5	48	220	360	475	45	20	10										
2 1/2	18	11	48	30	80	120	lbs	lbs	lbs										
2 1/2	24	17	48	10	25	40													
3	12	5	46	350	600	750	90	35	20										
3	18	11	46	100	190	250	lbs	lbs	lbs										
3	24	17	46	35	70	110													
4	12	5	32	500	825	900													
4	18	11	32	150	305	400	210	90	45										
4	24	17	32	110	175	260	lbs	lbs	lbs										

*Adjusted for testing sensitivity.

THREADED NIPPLE HOSES (Metric Units)

MN Hose Dia. (mm)	Length to End† (mm)	Live Length (mm)	Corrugations per meter	Force Required for 3mm displacement (kg)															
				Hoses Water Pressure (kg/cm2)			Steel Pipe Schedule 40 Riser Length (m)												
				3.4	10.3	17.2	1.8	2.4	3										
15	165	70	302	2.7	6.4	9.1													
15	305	210	302	0.4	0.4	0.5	.23	.09	.05										
15	457	362	302	0.5	0.5	0.5	kg	kg	kg										
15	610	514	302	*0.1	0.1	0.1													
20	178	83	262	4.5	8.2	11.3													
20	305	210	262	0.7	1.1	1.7	0.5	0.2	0.1										
20	457	362	262	0.2	0.9	1.8	kg	kg	kg										
20	610	514	262	* -	0.5	0.7													
25	203	95	236	5.9	13.6	22.7													
25	305	197	236	0.9	1.8	5.4	1.1	0.5	0.3										
25	457	349	236	0.2	0.7	1.1	kg	kg	kg										
25	610	502	236	*0.2	0.5	0.7													
32	216	83	220	23	50	82													
32	305	171	220	2	7	9	2.7	1.0	0.5										
32	457	234	220	1	2	3	kg	kg	kg										
32	610	476	220	-	1	2													
40	229	95	207	54	113	141													
40	305	171	207	9	27	48	4	2	9										
40	457	234	207	2	7	10	kg	kg	kg										
40	610	476	207	1	3	4													
50	267	114	190	82	163	209													
50	305	152	190	54	120	181	9	4	2										
50	457	305	190	9	27	41	kg	kg	kg										
50	610	457	190	3	7	10													
65	305	127	157	100	163	216													
65	457	279	157	14	36	54	20	9	4										
65	610	432	157	5	11	18	kg	kg	kg										
75	305	127	151	159	272	340													
75	457	279	151	45	86	113	40	17	9										
75	610	432	151	16	32	50	kg	kg	kg										
100	305	127	105	227	374	408													
100	457	279	105	68	138	181	96	40	21										
100	610	432	105	50	79	118	kg	kg	kg										

BALDWIN TESTER REPORT ON FORCE REQUIRED TO DISPLACE 1 1/2" - 16" FLANGED HOSES 1/8"

Information provided as a general guide to magnitude

FLANGED END HOSES (British Units)

FFL Hose Dia. (in)	Length Face to Face (in)	Live Length (in)	Corrugations per foot	Force Required for 1/8" displacement (lbs)					
				Hoses Water Pressure (psi)			Steel Pipe Schedule 40 Riser Length (feet)		
				50	150	250	6	8	10
1 1/2	9	67/8	63	20	55	85	9	4	2
1 1/2	12	97/8	63	8	27	42	lbs	lbs	lbs
1 1/2	18	157/8	63	3	10	16			
1 1/2	24	217/8	63	2	6	6			
2	9	61/8	58	60	125	185	20	8	4
2	12	91/8	58	22	57	95	lbs	lbs	lbs
2	18	151/8	58	6	18	29			
2	24	211/8	58	3	10	15			
2 1/2	9	61/8	48	145	275	380	45	20	10
2 1/2	12	91/8	48	45	100	140	lbs	lbs	lbs
2 1/2	18	151/8	48	15	45	75			
2 1/2	24	211/8	48	7	25	35			
3	9	61/8	46	225	475	575	90	35	20
3	12	91/8	46	105	245	320	lbs	lbs	lbs
3	18	151/8	46	30	105	130			
3	24	211/8	46	15	55	80			
				50	100	200			
4	9	61/8	32	490	620	700	210	90	45
4	12	91/8	32	220	385	505	lbs	lbs	lbs
4	18	151/8	32	65	155	210			
4	24	211/8	32	40	105	155			
4	36	331/8	32	20	50	80			
5	12	87/8	29	440	650	750	440	190	95
5	18	147/8	29	190	355	420	lbs	lbs	lbs
5	24	207/8	29	85	195	225			
5	36	327/8	29	65	135	150			
6	12	87/8	25	675	950	1050	820	350	180
6	18	147/8	25	445	670	750	lbs	lbs	lbs
6	24	207/8	25	170	450	505			
6	36	327/8	25	70	155	180			
				50	150	180			
8	12	85/8	23	1200	1450	1680	2110	890	455
8	18	145/8	23	710	1250	1290	lbs	lbs	lbs
8	24	205/8	23	325	750	850			
8	36	325/8	23	155	400	425			
				50	150	170			
10	13	95/8	21	1870	2200	2590	4690	1980	1010
10	18	145/8	21	1345	1580	1860	lbs	lbs	lbs
10	24	205/8	21	900	1060	1250			
10	36	325/8	21	570	680	800			
12	*14	105/8	20	2670	3140	3690	8130	3430	1755
12	*24	205/8	20	1920	2250	2650	lbs	lbs	lbs
12	*36	325/8	20	830	980	1150			
14	*14	105/8	18	3970	4675	5500	10900	4600	2300
14	*36	325/8	18	2370	2780	3270	lbs	lbs	lbs
16	*16	125/8	16	5200	6120	7200	16400	6900	3500
16	*36	325/8	16	2860	3370	3960	lbs	lbs	lbs

*Not tested— Best estimates based on 10" tests.

FLANGED END HOSES (Metric Units)

FFL Hose Dia. (mm)	Length Face to Face (mm)	Live Length (mm)	Corrugations per meter	Force Required for 3mm displacement (kg)					
				Hoses Water Pressure (kg/cm2)			Steel Pipe Schedule 40 Riser Length (m)		
				3.4	10.3	17.2	1.8	2.4	3
40	229	175	207	9	25	39	4	2	1
40	305	251	207	4	12	19	kg	kg	kg
40	457	403	207	1	5	7			
40	607	556	207	1	2	2			
50	229	156	190	27	57	84	9	4	2
50	305	232	190	10	26	43	kg	kg	kg
50	457	384	190	3	8	13			
50	610	537	190	1	5	7			
65	229	156	157	66	125	173	21	9	5
65	305	232	157	20	45	64	kg	kg	kg
65	457	384	157	7	20	34			
65	610	537	157	3	11	16			
75	229	156	151	102	215	261	40	17	9
75	305	232	151	48	111	145	kg	kg	kg
75	457	384	151	14	48	59			
75	610	537	151	7	25	36			
				3.4	6.9	13.8			
100	229	156	105	222	281	318	96	41	21
100	305	232	105	100	175	229	kg	kg	kg
100	457	384	105	30	70	96			
100	610	537	105	18	48	70			
100	*914	841	105	9	23	36			
125	305	225	95	200	295	340	201	85	44
125	457	378	95	86	161	191	kg	kg	kg
125	610	530	95	39	89	102			
125	914	835	95	30	61	68			
150	305	225	82	306	431	476	371	157	81
150	457	378	82	202	304	340	kg	kg	kg
150	610	530	82	76	204	229			
150	914	835	82	32	70	82			
				3.4	10.3	12.4			
200	305	219	75	544	658	760	958	405	207
200	457	371	75	322	567	585	kg	kg	kg
200	610	524	75	147	340	386			
200	914	829	75	70	181	193			
				3.4	10.3	11.7			
250	330	244	69	848	998	1175	2128	898	460
250	457	371	69	610	717	844	kg	kg	kg
250	610	524	69	408	481	567			
250	914	829	69	259	308	363			
300	*256	270	66	1211	1424	1674	3688	1556	797
300	*610	524	66	871	1021	1202	kg	kg	kg
300	*914	829	66	376	445	522			
350	*256	270	59	1801	2121	2495	4930	2080	1065
350	*914	829	59	1075	1261	1483	kg	kg	kg
400	*406	321	52	2359	2776	3266	7430	3134	1605
400	*914	829	52	1297	1529	1796	kg	kg	kg

SPECIFICATION

Flexible stainless steel hoses with a safety factor of 4 shall be manufactured using type 304 stainless steel braided hose with one fixed and one floating raised face carbon steel plate flange. Sizes 2 1/2" (65mm) and smaller may have threaded nipples. Copper sweat ends, 4" (100mm) and smaller. Grooved ends may be used in sizes 2" (50mm) through 12" (300mm). Welding is not acceptable. Minimum lengths, minimum live lengths and minimum number of convolutions per foot to assure flexibility are as tabulated. Shorter lengths are not acceptable.

Hoses shall be installed on the equipment side of the shut off valves horizontal and parallel to the equipment shafts wherever possible.

Submittals shall include fittings, type of stainless steel, live lengths, number of corrugations per foot and safety factor at pressure ratings. Hoses shall be type **BSS**, as manufactured by Mason Industries, Inc.

Pipe or Tubing Size (in)	FLANGED ENDS		SWEAT OR THREADED ENDS		GROOVED ENDS		Min. Convolutions per (foot)
	Face to Face (in)	Live Length (in)	End to End (in)	Live Length (in)	End to End (in)	Live Length (in)	
1/2	-	-	24	193/4	-	-	92
3/4	-	-	24	193/4	-	-	80
1	-	-	24	193/4	-	-	72
1 1/4	-	-	24	183/4	-	-	67
1 1/2	24	217/8	24	183/4	-	-	63
2	24	211/8	24	18	24	18	58
2 1/2	24	211/8	24	17	24	18	48
3	36	331/8	*36	29	36	30	46
4	36	331/8	*36	29	36	28	32
5	36	327/8	-	-	36	28	29
6	36	327/8	-	-	36	28	25
8	36	325/8	-	-	36	28	23
10	36	325/8	-	-	36	26	21
12	36	325/8	-	-	36	26	20
14	36	325/8	-	-	-	-	18
16	36	325/8	-	-	-	-	16

Pipe or Tubing Size (mm)	FLANGED ENDS		SWEAT OR THREADED ENDS		GROOVED ENDS		Min. Convolutions per (meter)
	Face to Face (mm)	Live Length (mm)	End to End (mm)	Live Length (mm)	End to End (mm)	Live Length (mm)	
15	-	-	600	501	-	-	302
20	-	-	600	501	-	-	262
25	-	-	600	494	-	-	236
30	-	-	600	469	-	-	220
40	600	469	600	469	-	-	207
50	600	450	600	450	600	450	190
65	600	425	600	425	600	450	157
75	900	841	*900	737	900	750	151
100	900	841	*900	737	900	700	105
125	900	822	-	-	900	700	95
150	900	822	-	-	900	700	82
200	900	816	-	-	900	700	75
250	900	816	-	-	900	650	69
300	900	829	-	-	900	650	66
350	900	829	-	-	-	-	59
400	900	829	-	-	-	-	52

PRODUCT TABLES

The following tables cover stock lengths. We describe capability in terms of allowable offset and normal vibration. Normal vibration is the amplitude you would expect at pump, chiller, air compressor connections, etc. These lengths do not describe what is needed for seismic motion on isolated machinery. We would be more than pleased to design to requirements for any special lengths, but the basic rule is the longer the length, the lower the transmitted vibration.

Of all fittings used with stainless steel hoses, the most common are two threaded ends or two flanges. Flexibility depends not on

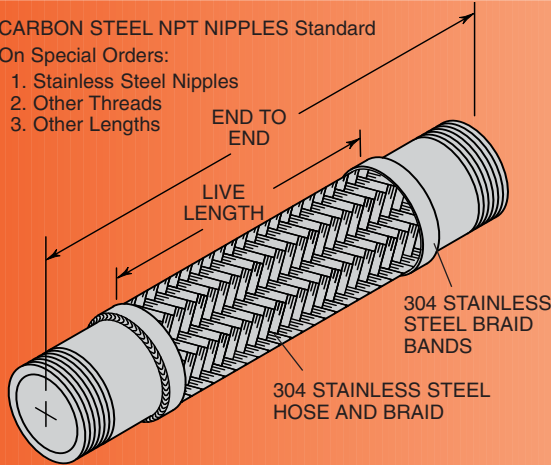
the overall length, but on the working length of hose between the braid rings. In terms of vibration transmission and allowable movement, flanged connectors of the same length are superior to nipple ends of one kind or another. The nipples are longer than the flanges are thick, and the same braid ring is used in both cases. So for a given length, flanged hose has longer free hose. It is important that you know the free length you are buying, so this information is included in all of our descriptive tables.

All ratings are extremely conservative. We sometimes allow more motion for a given length when we know specifics.

CARBON STEEL NPT NIPPLES Standard

On Special Orders:

1. Stainless Steel Nipples
2. Other Threads
3. Other Lengths



Sizes in **RED** are Minimum Recommended Lengths at Equipment Connections to Reduce Vibration Transmission. See discussion on pages 3 - 6.

Safety Factor is 4X Rated Pressure.
Max. Vacuum—30" Hg 762mm Hg

MN- Braided Hose with Threaded Nipples

Our steam service ratings are very low in the interest of safety although our 70°F 21°C pressure ratings are as high or higher than our competitors. All locations where failure could lead to personal injury or suffocation must be avoided. In dangerous locations we suggest housed expansion joints, solid loops, ball joints, packed devices etc. rather than thin walled flexible products regardless of manufacturer.

Consult factory with full location description as well as service conditions for higher pressure or temperature applications.

304 SS can be used up to 850°F 454°C in applications such as engine exhaust.

RATED PRESSURES @ ELEVATED TEMPERATURES (psi) (kg/cm²)

Hose Size (in) (mm)	250°F 121°C Factor 0.92	350°F 176°C Factor 0.86	450°F 232°C Factor 0.81
1/2 15	1010 69	950 59	890 61
3/4 20	640 44	600 41	570 39
1 25	530 36	500 34	470 32
1 1/4 32	442 30	413 28	389 27
1 1/2 40	410 29	387 27	365 25
2 50	330 23	310 21	290 20
2 1/2 65	270 19	250 17	235 16
3 80	260 18	240 16	230 16
4 100	207 15	194 14	182 13

SATURATED STEAM RECOMMENDED PRESSURE LIMITS

Size (in) (mm)	Max Gauge (psi) (kg/cm²)	Temp Reference (°F) (°C)
1/2 15	200 14	387 197
3/4 20	200 14	387 197
1 25	150 11	362 183
1 1/4 32	150 11	362 183
1 1/2 40	150 11	362 183
2 50	150 11	362 183
2 1/2 65	125 9	355 179
3 80	125 9	355 179
4 100	125 9	355 179

STOCK SIZES and LENGTHS

MN DIMENSIONS AND PRESSURE RATINGS (British Units)

Type	Pipe Size & End to End† (in)	Live Length (in)	Corrugations per foot	Maximum Lateral Offset** (in)	Force Req'd for Max. Offset at 250psi or lower Rated Pressure (lbs)	Rated Pressure @70°F (psi)
MN	1/2 x 6 1/2*	2 1/4	92	1/8	20	1100
MN	1/2 x 12	7 3/4	92	1 1/4	9	1100
MN	1/2 x 18	13 3/4	92	2 1/2	7	1100
MN	1/2 x 24	19 3/4	92	3 1/2	6	1100
MN	3/4 x 7*	2 3/4	80	1/8	25	700
MN	3/4 x 12	7 3/4	80	1	12	700
MN	3/4 x 18	13 3/4	80	2 1/4	9	700
MN	3/4 x 24	19 3/4	80	3 1/4	8	700
MN	1 x 8*	3 3/4	72	1/8	50	580
MN	1 x 12	7 3/4	72	3/4	25	580
MN	1 x 18	13 3/4	72	2	9	580
MN	1 x 24	19 3/4	72	3	8	580
MN	1 1/4 x 8 1/2*	3 1/4	67	1/8	180	480
MN	1 1/4 x 12	6 3/4	67	5/8	35	480
MN	1 1/4 x 18	12 3/4	67	1 3/4	18	480
MN	1 1/4 x 24	18 3/4	67	2 3/4	13	480
MN	1 1/2 x 9*	3 3/4	63	1/8	310	450
MN	1 1/2 x 12	6 3/4	63	1/2	170	450
MN	1 1/2 x 18	12 3/4	63	1 1/2	110	450
MN	1 1/2 x 24	18 3/4	63	2 1/2	30	450
MN	2 x 10 1/2*	4 1/2	58	1/8	460	360
MN	2 x 12	6	58	1/4	225	360
MN	2 x 18	12	58	1 3/8	125	360
MN	2 x 24	18	58	2 3/8	60	360
MN	2 1/2 x 12*	5	48	1/8	475	290
MN	2 1/2 x 18	11	48	1 1/4	325	290
MN	2 1/2 x 24	17	48	2	160	290
MN	3 x 12*	5	46	1/8	750	280
MN	3 x 18	11	46	1	600	280
MN	3 x 24	17	46	1 3/4	390	280
MN	4 x 12*	5	32	1/8	900	225
MN	4 x 18	11	32	1/2	800	225
MN	4 x 24	17	32	3/4	450	225

MN DIMENSIONS AND PRESSURE RATINGS (Metric Units)

Type	Pipe Size & End to End† (mm)	Live Length (mm)	Corrugations per meter	Maximum Lateral Offset** (mm)	Force Req'd for Max. Offset at 17kg/cm² or lower Rated Pressure (kg)	Rated Pressure @21°C (kg/cm²)
MN	15 x 163*	57	302	3	9	76
MN	15 x 300	349	302	32	4	76
MN	15 x 450	356	302	63	3	76
MN	15 x 600	501	302	88	3	76
MN	20 x 175*	69	262	3	11	48
MN	20 x 300	197	262	25	5	48
MN	20 x 450	349	262	57	4	48
MN	20 x 600	501	262	83	3	48
MN	25 x 200*	94	236	3	23	40
MN	25 x 300	194	236	19	11	40
MN	25 x 450	344	236	50	4	40
MN	25 x 600	494	236	75	3	40
MN	32 x 213*	81	220	3	82	33
MN	32 x 300	169	220	16	16	33
MN	32 x 450	319	220	44	8	33
MN	32 x 600	469	220	70	6	33
MN	40 x 225*	94	207	3	141	31
MN	40 x 300	169	207	13	77	31
MN	40 x 450	319	207	38	50	31
MN	40 x 600	469	207	63	14	31
MN	50 x 263*	113	190	3	209	25
MN	50 x 300	150	190	6	102	25
MN	50 x 450	300	190	35	57	25
MN	50 x 600	450	190	60	27	25
MN	65 x 300*	125	157	3	215	20
MN	65 x 450	275	157	32	147	20
MN	65 x 600	425	157	50	73	20
MN	80 x 300*	125	151	3	340	19
MN	80 x 450	275	151	25	272	19
MN	80 x 600	425	151	44	177	19
MN	100 x 300*	125	105	3	408	16
MN	100 x 450	275	105	13	363	16
MN	100 x 600	425	105	19	204	16

*Industry Pump Connector Lengths are not recommended, but supplied on demand.

**Lateral Offset one side of centerline and normal machinery vibration. If intermittent in both directions, reduce by 50%.

†End to End Tolerance: Sizes 1/2" - 4" 50 - 100mm, ±1/4" 6mm

FFL- Braided Hose with Carbon Steel Fixed & Floating Flanges

FFL Braided Stainless Steel Hose has fixed and floating raised face flanges. Years ago, almost all stainless steel hose was manufactured with a floating flange on one end. It is still important because it makes lining up the holes easier during installation, and eliminates the possibility of twisting the hose, when the holes do not line up. Twisting contributes to early failure.

Raised face flanges seal better. Most competitive plate flanges have flat faces to reduce machining costs, but the raised face is the better product as sealing pressure increases by factors of 2 & 3 because of the reduced gasket area.

All of our stocked flanged hose has one floating flange.

Sizes in **RED** are Minimum Recommended Lengths at Equipment Connections to Reduce Vibration Transmission. See discussion on p 3 -6.

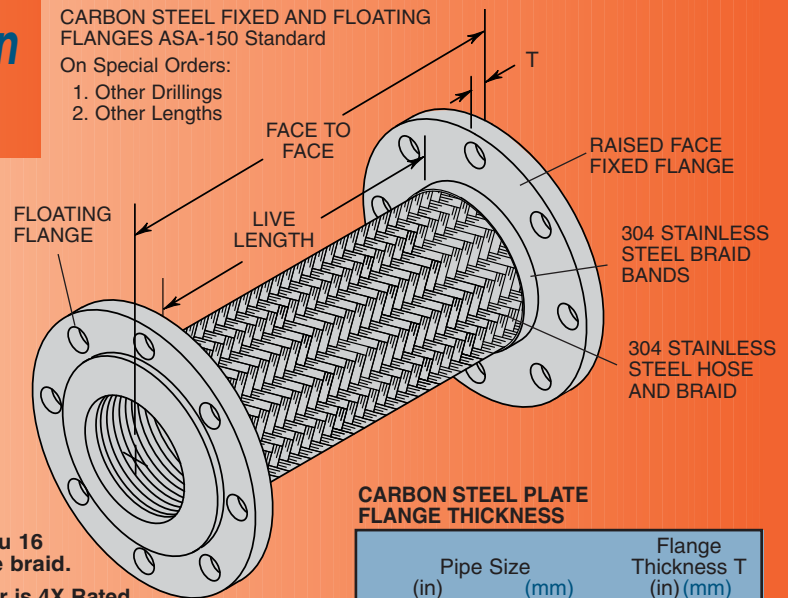
FOR RATED PRESSURES @ ELEVATED TEMPERATURES and SATURATED STEAM RECOMMENDED PRESSURE LIMITS see page 9

Sizes 12 thru 16 have double braid. Safety Factor is 4X Rated Pressure. Max. Vacuum—30" Hg 762mm Hg

CARBON STEEL FIXED AND FLOATING FLANGES ASA-150 Standard

On Special Orders:

1. Other Drillings
2. Other Lengths



CARBON STEEL PLATE FLANGE THICKNESS

Pipe Size (in)	Pipe Size (mm)	Flange Thickness T (in)	Flange Thickness T (mm)
1 1/2 thru 4	40 thru 100	5/8	16
5 thru 6	125 thru 150	3/4	19
8 thru 16	200 thru 400	1	25

FFL DIMENSIONS AND PRESSURE RATINGS (British Units)

Type	Pipe Size & Face to Face [†] (in)	Live Length (in)	Corrugations per foot	Maximum Lateral Offset** (in)	Force Req'd for Max. Offset at 250psi or lower Rated Pressure (lbs)	Rated Pressure @70°F (psi)
FFL	1 1/2 X 9*	67/8	63	1/8	83	450
FFL	1 1/2 X 12	97/8	63	7/8	85	450
FFL	1 1/2 X 18	157/8	63	2	40	450
FFL	1 1/2 X 24	217/8	63	2 3/4	30	450
FFL	2 X 9*	61/8	58	1/8	185	360
FFL	2 X 12	91/8	58	3/4	180	360
FFL	2 X 18	151/8	58	1 3/4	80	360
FFL	2 X 24	211/8	58	2 1/2	45	360
FFL	2 1/2 X 9*	61/8	48	1/8	380	290
FFL	2 1/2 X 12	91/8	48	5/8	345	290
FFL	2 1/2 X 18	151/8	48	1 1/2	215	290
FFL	2 1/2 X 24	211/8	48	2 1/4	110	290
FFL	3 X 9*	61/8	46	1/8	575	280
FFL	3 X 12	91/8	46	1/2	770	280
FFL	3 X 18	151/8	46	1 1/4	335	280
FFL	3 X 24	211/8	46	2	205	280
FFL	3 X 36	331/8	46	4	100 ***	280
FFL	4 X 9*	61/8	32	1/8	700	225
FFL	4 X 12	91/8	32	3/8	1155	225
FFL	4 X 18	151/8	32	3/4	525	225
FFL	4 X 24	211/8	32	1 3/4	485	225
FFL	4 X 36	331/8	32	3 1/2	220 ***	225
FFL	5 X 12*	87/8	29	1/8	750	200
FFL	5 X 18	147/8	29	5/8	710	200
FFL	5 X 24	207/8	29	1 1/2	575	200
FFL	5 X 36	327/8	29	3	430	200
FFL	6 X 12*	87/8	25	1/8	1050	200
FFL	6 X 18	147/8	25	1/2	2175	200
FFL	6 X 24	207/8	25	1 1/4	1485	200
FFL	6 X 36	327/8	25	2 3/4	620	200
FFL	8 X 12*	85/8	23	1/8	1680	180
FFL	8 X 18	145/8	23	3/8	3280	180
FFL	8 X 24	205/8	23	1	3180	180
FFL	8 X 36	325/8	23	2	1405	180
FFL	10 X 13*	95/8	21	1/8	2590	170
FFL	10 X 18	145/8	21	1/4	3750	170
FFL	10 X 24	205/8	21	3/4	4020	170
FFL	10 X 36	325/8	21	1 1/2	2230	170
FFL	12 X 14*	105/8	20	1/8	3690	170
FFL	12 X 24	205/8	20	1/2	4950	170
FFL	12 X 36	325/8	20	1	2960	170
FFL	14 X 14*	105/8	18	1/8	5500	170
FFL	14 X 36	325/8	18	1	12000	170
FFL	16 X 16*	125/8	16	1/8	7200	170
FFL	16 X 36	325/8	16	3/4	15000	170

FFL DIMENSIONS AND PRESSURE RATINGS (Metric Units)

Type	Pipe Size & Face to Face [†] (mm)	Live Length (mm)	Corrugations per meter	Maximum Lateral Offset** (mm)	Force Req'd for Max. Offset at 17kg/cm ² or lower Rated Pressure (kg)	Rated Pressure @21°C (kg/cm ²)
FFL	40 X 225*	172	207	3	38	31
FFL	40 X 300	228	207	22	39	31
FFL	40 X 450	378	207	50	18	31
FFL	40 X 600	528	207	70	14	31
FFL	50 X 225*	153	190	3	84	25
FFL	50 X 300	228	190	19	82	25
FFL	50 X 450	378	190	44	36	25
FFL	50 X 600	528	190	64	20	25
FFL	65 X 225*	153	157	3	171	20
FFL	65 X 300	228	157	16	156	20
FFL	65 X 450	378	157	38	98	20
FFL	65 X 600	528	157	57	50	20
FFL	80 X 225*	153	151	3	259	19
FFL	80 X 300	228	151	13	349	19
FFL	80 X 450	378	151	32	152	19
FFL	80 X 600	528	151	50	93	19
FFL	80 X 900	828	151	100	45 ***	19
FFL	100 X 225*	153	105	3	319	16
FFL	100 X 300	228	105	10	524	16
FFL	100 X 450	378	105	19	238	16
FFL	100 X 600	528	105	44	220	16
FFL	100 X 900	828	105	89	100 ***	16
FFL	125 X 300*	222	95	3	340	14
FFL	125 X 450	372	95	16	322	14
FFL	125 X 600	522	95	38	261	14
FFL	125 X 900	822	95	75	195	14
FFL	150 X 300*	222	82	3	476	14
FFL	150 X 450	372	82	13	987	14
FFL	150 X 600	522	82	32	674	14
FFL	150 X 900	822	82	70	281	14
FFL	200 X 300*	216	75	3	762	12
FFL	200 X 450	366	75	10	1488	12
FFL	200 X 600	516	75	25	1442	12
FFL	200 X 900	816	75	50	637	12
FFL	250 X 325*	241	69	3	1175	12
FFL	250 X 450	366	69	6	1701	12
FFL	250 X 600	516	69	19	1823	12
FFL	250 X 900	816	69	38	1012	12
FFL	300 X 350*	266	66	3	1674	12
FFL	300 X 600	516	66	13	2245	12
FFL	300 X 900	829	66	25	1343	12
FFL	350 X 350*	266	59	3	2495	12
FFL	350 X 900	829	59	25	5443	12
FFL	400 X 400*	320	52	3	3266	12
FFL	400 X 900	829	52	19	6804	12

*Industry Pump Connector Lengths are not recommended, but supplied on demand.

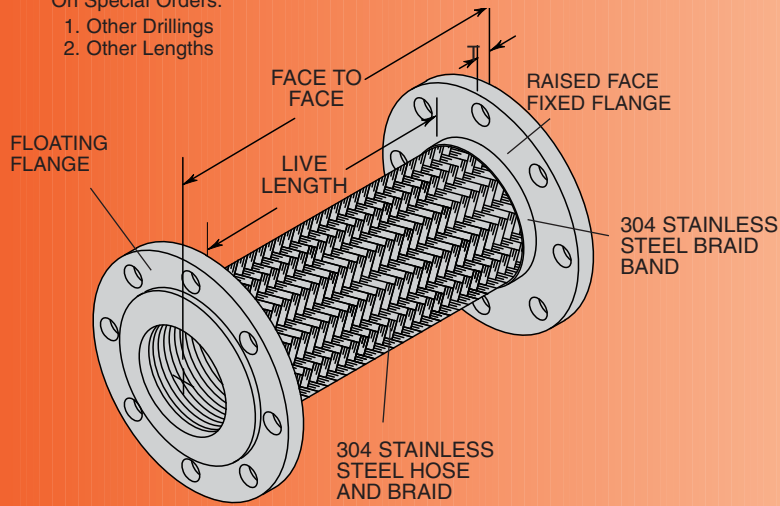
Lateral Offset one side of centerline and normal machinery vibration. If intermittent in both directions, reduce by 50%. *Estimated.

†Face to Face Tolerances: Sizes 1/4" - 4" 50 - 100mm, ±1/4" 6mm; 5" - 8" 125 - 200mm, ±3/8" 9mm; 10" 250mm and larger, ±1/2" 13mm.

STAINLESS STEEL FIXED AND FLOATING FLANGES ASA-150 Drilling Standard

On Special Orders:

1. Other Drillings
2. Other Lengths



FFLSS- Braided Hose with Stainless Steel Fixed & Floating Flanges

STAINLESS STEEL PLATE FLANGE THICKNESS

Pipe Size (in)	Pipe Size (mm)	Flange Thickness T (in)	Flange Thickness T (mm)
1 1/2 thru 4	40 thru 100	5/8	16
5 thru 6	125 thru 150	3/4	19
8 thru 12	200 thru 300	1	25

Safety Factor is 4X Rated Pressure.
Max. Vacuum— 30" Hg 762mm Hg

STOCK SIZES and LENGTHS

FFLSS DIMENSIONS AND PRESSURE RATINGS (British Units)

Type	Pipe Size & Face to Face [†] (in)	Live Length (in)	Corrugations per foot	Maximum Permanent Lateral Offset** (in)	Rated Pressure @ 70°F (psi)
FFLSS	2 X 12	91/8	58	3/4	360
FFLSS	2 1/2 X 12	91/8	48	5/8	290
FFLSS	3 X 12	91/8	46	1/2	280
FFLSS	4 X 18	147/8	32	3/4	225
FFLSS	5 X 18	147/8	29	5/8	200
FFLSS	6 X 18	147/8	25	1/2	200
FFLSS	8 X 24	197/8	23	1	200
FFLSS	10 X 24	197/8	21	3/4	170
FFLSS	12 X 24	197/8	20	1/2	170

FFLSS DIMENSIONS AND PRESSURE RATINGS (Metric Units)

Type	Pipe Size & Face to Face [†] (mm)	Live Length (mm)	Corrugations per meter	Maximum Permanent Lateral Offset** (mm)	Rated Pressure @ 21°C (kg/cm ²)
FFLSS	50 X 300	228	190	19	25
FFLSS	65 X 300	228	157	16	20
FFLSS	80 X 300	228	151	13	19
FFLSS	100 X 450	372	105	19	16
FFLSS	125 X 450	372	95	16	14
FFLSS	150 X 450	372	82	13	14
FFLSS	200 X 600	497	75	25	14
FFLSS	250 X 600	497	69	19	12
FFLSS	300 X 600	497	66	13	11

*Lateral Offset one side of centerline and normal machinery vibration. If intermittent in both directions, reduce by 50%.

†Minimum Burst is four times the Rated Pressure. Size 12 has double braid.

NOTE: In applications calling for stainless flanges and meeting special overall vibration reduction lengths, order to specified lengths.

Rated Pressure @ Elevated Temperatures for FFL and FFLSS

RATED PRESSURES @ ELEVATED TEMPERATURES (psi) (kg/cm²)

Hose Size (in) (mm)	250°F 121°C Factor 0.92	350°F 176°C Factor 0.86	450°F 232°C Factor 0.81
1 1/2 40	410 29	387 27	365 25
2 50	330 23	310 21	290 20
2 1/2 65	270 19	250 17	235 16
3 80	260 18	240 16	230 16
4 100	207 15	194 14	182 13
5 125	190 13	180 12	170 11
6 150	190 13	180 12	170 11
8 200	180 12	170 11	160 11
10 250	160 11	150 10	140 9
12 300	160 11	150 10	140 9
14 350	140 9	130 8	120 7
16 400	130 8	120 7	110 6

SATURATED STEAM RECOMMENDED PRESSURE LIMITS

Size (in) (mm)	Max Gauge (psi) (kg/cm ²)	Temp Reference (°F) (°C)
1 1/2 40	150 11	362 183
2 50	150 11	362 183
2 1/2 65	125 9	355 179
3 80	125 9	355 179
4 100	125 9	355 179
5 125	100 7	337 169
6 150	100 7	337 169
8 200	100 7	337 169
10 250	60 4	307 153
12 300	60 4	307 153
14 350	60 4	307 153
16 400	60 4	307 153

Our steam service ratings are very low in the interest of safety although our 70°F 21°C pressure ratings are as high or higher than our competitors. All locations where failure could lead to personal injury or suffocation must be avoided. In dangerous locations we suggest housed expansion joints, solid loops, ball joints, packed devices etc. rather than thin walled flexible products regardless of manufacturer.

Consult factory with full location description as well as service conditions for higher pressure or temperature applications.

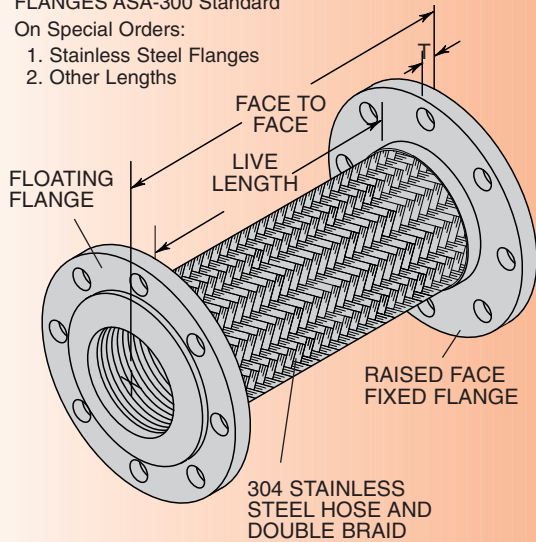
304 SS can be used up to 850°F 454°C in applications such as engine exhaust with minor pressure.

FFL2B300- Double Braided Hose with 300 ASA Flanges

CARBON STEEL FIXED AND FLOATING
FLANGES ASA-300 Standard

On Special Orders:

1. Stainless Steel Flanges
2. Other Lengths



**RATED PRESSURES @
ELEVATED TEMPERATURES** (psi) (kg/cm²)

Hose Size (in) (mm)	250°F 121°C Factor 0.92	350°F 176°C Factor 0.86	450°F 232°C Factor 0.81
2 50	460 31	430 29	405 28
2 1/2 65	460 31	430 29	405 28
3 80	345 24	323 22	304 21
4 100	345 24	323 22	304 21
5 125	345 24	323 22	304 21
6 150	345 24	323 22	304 21
8 200	216 15	202 14	190 13
10 250	193 13	181 12	170 11
12 300	156 11	146 10	138 9

**SATURATED STEAM
RECOMMENDED PRESSURE LIMITS**

Size (in) (mm)	Max Gauge (psi)(kg/cm ²)	Temp Reference (F) (°C)
2 50	200 14	388 198
2 1/2 65	150 10	362 183
3 80	150 10	362 183
4 100	150 10	362 183
5 125	125 9	355 179
6 150	125 9	355 179
8 200	90 6	330 166
10 250	75 5	307 153
12 300	60 4	307 153

Our steam service ratings are very low in the interest of safety although our 70°F 21°C pressure ratings are as high or higher than our competitors. All locations where failure could lead to personal injury or suffocation must be avoided. In dangerous locations we suggest housed expansion joints, solid loops, ball joints, packed devices etc. rather than thin walled flexible products regardless of manufacturer.

Consult factory with full location description as well as service conditions for higher pressure or temperature applications.

304 SS can be used up to 850°F 454°C in applications such as engine exhaust with minor pressure.

**Safety Factor is 4X Rated Pressure.
Max. Vacuum— 30" Hg 762mm Hg**

CARBON STEEL PLATE FLANGE THICKNESS

Pipe Size (in)	Flange Thickness T (in) (mm)
2 thru 4 50 thru 100	3/4 19
5 thru 6 125 thru 150	1 25
8 thru 12 200 thru 300	1 1/4 32

*Lateral Offset one side of centerline and normal machinery vibration. If intermittent in both directions, reduce by 50%.

*Face to Face Tolerances:

- Sizes 2" - 4" 50 - 100mm, ±1/4" 6mm;
- Sizes 5" - 6" 125 - 150mm, ±3/8" 9mm;
- Sizes 10"+ 250mm, ±1/2" 13mm

STOCK SIZES and LENGTHS

**FFL2B300 DIMENSIONS AND
PRESSURE RATINGS (British Units)**

Pipe Size & Face to Face ¹ (in)	Live Length (in)	Corrugations per foot	Maximum Permanent Lateral Offset ² (in)	Rated Pressure @70°F (psi)
2 X 12	9 1/8	58	3/4	500
2 1/2 X 12	9 1/8	48	5/8	500
3 X 12	9 1/8	46	1/2	375
4 X 18	14 7/8	32	3/4	375
5 X 18	14 7/8	29	5/8	375
6 X 18	14 7/8	25	1/2	375
8 X 24	19 7/8	23	1	235
10 X 24	19 7/8	21	3/4	210
12 X 24	19 7/8	20	1/2	170

**FFL2B300 DIMENSIONS AND
PRESSURE RATINGS (Metric Units)**

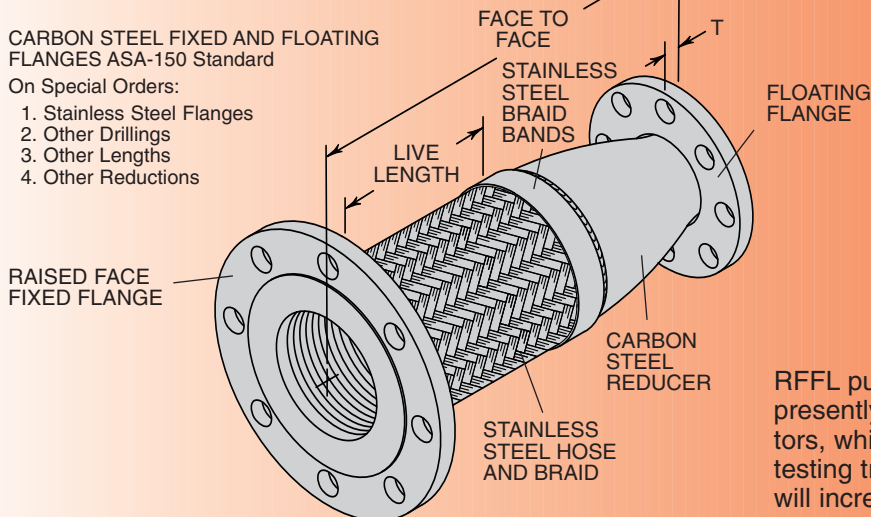
Pipe Size & Face to Face ¹ (mm)	Live Length (mm)	Corrugations per meter	Maximum Permanent Lateral Offset ² (mm)	Rated Pressure @21°C (kg/cm ²)
50 X 300	228	190	19	34
65 X 300	228	157	16	34
80 X 300	228	151	13	26
100 X 450	228	105	19	26
125 X 450	372	95	16	26
150 X 450	372	82	13	26
200 X 600	497	75	25	16
250 X 600	497	69	19	14
300 X 600	497	66	13	12

RFFL- Reducer with Fixed & Floating Flanges

CARBON STEEL FIXED AND FLOATING
FLANGES ASA-150 Standard

On Special Orders:

1. Stainless Steel Flanges
2. Other Drillings
3. Other Lengths
4. Other Reductions



**FOR RATED PRESSURES @
ELEVATED TEMPERATURES
and SATURATED STEAM
RECOMMENDED PRESSURE
LIMITS see page 11**

RFFL published lengths are based on live lengths presently the industry standard for pump connectors, which we feel are too short. We are physically testing transverse stiffness and in the near future will increase live lengths based on our research.

STOCK SIZES and LENGTHS

RFFL DIMENSIONS AND PRESSURE RATINGS (British Units)

Type	Pipe Sizes— Large End X Small End (in)	Face to Face [†] (in)	Live Length (in)	Corru- gations per foot	Maximum Permanent Lateral Offset** (in)	Rated Pressure @70°F (psi)
RFFL	2 1/2 X 2	14	65/8	48	1/8	290
RFFL	3 X 2	14	65/8	46	1/8	280
RFFL	3 X 2 1/2	14	65/8	46	1/8	280
RFFL	4 X 2	14	71/8	32	1/8	225
RFFL	4 X 2 1/2	14	71/8	32	1/8	225
RFFL	4 X 3	14	71/8	32	1/8	225
RFFL	5 X 3	17	87/8	29	1/8	200
RFFL	5 X 4	17	87/8	29	1/8	200
RFFL	6 X 3	18	93/8	25	1/8	200
RFFL	6 X 4	18	93/8	25	1/8	200
RFFL	6 X 5	18	93/8	25	1/8	200
RFFL	8 X 4	18	85/8	23	1/8	180
RFFL	8 X 5	18	85/8	23	1/8	180
RFFL	8 X 6	18	85/8	23	1/8	180
RFFL	10 X 6	20	95/8	21	1/8	170
RFFL	10 X 8	20	95/8	21	1/8	170
RFFL	12 X 10	22	105/8	20	1/8	170

**Lateral Offset one side of centerline and normal machinery vibration. If intermittent in both directions, reduce by 50%.

[†]Large End to Small End Tolerances: Sizes 2" - 4" 50 - 100mm, ±1/4" 6mm; Sizes 5" - 8" 125 - 200mm, ±3/8" 9mm; Sizes 10" 250mm and larger, ±1/2" 13mm. Size 12 has double braid.

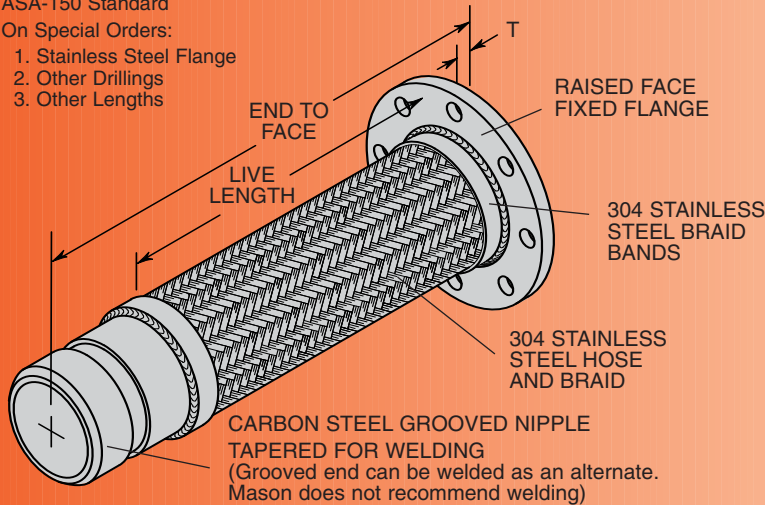
RFFL DIMENSIONS AND PRESSURE RATINGS (Metric Units)

Type	Pipe Sizes— Large End X Small End [†] (mm)	Face to Face (mm)	Live Length (mm)	Corru- gations per meter	Maximum Permanent Lateral Offset** (mm)	Rated Pressure @21°C (kg/cm ²)
RFFL	65 X 50	350	166	157	3	20
RFFL	80 X 50	350	166	151	3	19
RFFL	80 X 65	350	166	151	3	19
RFFL	100 X 50	350	178	105	3	16
RFFL	100 X 65	350	178	105	3	16
RFFL	100 X 80	350	178	105	3	16
RFFL	125 X 80	425	222	95	3	14
RFFL	125 X 100	425	222	95	3	14
RFFL	150 X 80	450	234	82	3	14
RFFL	150 X 100	450	234	82	3	14
RFFL	150 X 125	450	234	82	3	14
RFFL	200 X 100	450	216	75	3	12
RFFL	200 X 125	450	216	75	3	12
RFFL	200 X 150	450	216	75	3	12
RFFL	250 X 150	500	241	69	3	12
RFFL	250 X 200	500	241	69	3	12
RFFL	300 X 250	550	266	66	3	12

CARBON STEEL FIXED FLANGE
ASA-150 Standard

On Special Orders:

1. Stainless Steel Flange
2. Other Drillings
3. Other Lengths



**Safety Factor is 4X Rated Pressure.
Max. Vacuum— 30" Hg 762mm Hg**

**Lateral Offset one side of centerline and normal machinery vibration. If intermittent in both directions, reduce by 50%.

[†]End to Face Tolerances: Sizes 2" - 4" 50 - 100mm, ±1/4" 6mm; Sizes 5" - 8" 125 - 200mm, ±3/8" 9mm; Sizes 10" 250mm and larger, ±1/2" 13mm.

Size 12 has double braid.

Rated Pressure @ Elevated Temperatures for RFFL, GNF and GN

RATED PRESSURES @
ELEVATED TEMPERATURES (psi) (kg/cm²)

Hose Size (in) (mm)	250°F 121°C Factor 0.92	350°F 176°C Factor 0.86	450°F 232°C Factor 0.81
2 50	330 23	310 21	290 20
2 1/2 65	270 19	250 17	235 16
3 80	260 18	240 16	230 16
4 100	210 15	200 14	190 13
5 125	190 13	180 12	170 11
6 150	190 13	180 12	170 11
8 200	170 11	160 11	150 10
10 250	160 11	150 10	140 9
12 300	160 11	150 10	140 9

SATURATED STEAM
RECOMMENDED PRESSURE LIMITS

Size (in) (mm)	Max Gauge (psi) (kg/cm ²)	Temp Reference (F) (°C)
2 50	150 11	362 183
2 1/2 65	125 9	355 179
3 80	125 9	355 179
4 100	125 9	355 179
5 125	100 7	337 169
6 150	100 7	337 169
8 200	75 5	320 160
10 250	60 4	307 153
12 300	60 4	307 153

GNF— Braided Hose with Grooved Nipple and Flange

STOCK SIZES and LENGTHS

GNF DIMENSIONS AND PRESSURE RATINGS (British Units)

Type	Pipe Size & End to Face [†] (in)	Live Length (in)	Corru- gations per foot	Maximum Permanent Lateral Offset** (in)	Rated Pressure @70°F (psi)
GNF	2 x 13	83/8	58	1/4	360
GNF	2 1/2 x 13	83/8	48	1/4	290
GNF	3 x 13	83/8	46	1/4	280
GNF	4 x 16	103/8	32	1/4	225
GNF	5 x 18	121/4	29	1/4	200
GNF	6 x 20	141/4	25	1/4	200
GNF	8 x 22	16	23	1/4	180
GNF	10 x 25	18	21	1/4	170
GNF	12 x 27	20	20	1/4	170

GNF DIMENSIONS AND PRESSURE RATINGS (Metric Units)

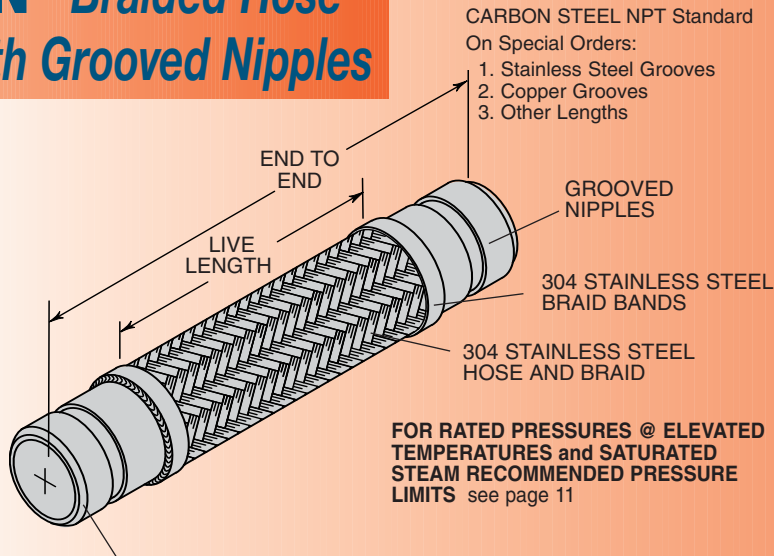
Type	Pipe Size & End to Face [†] (mm)	Live Length (mm)	Corru- gations per meter	Maximum Permanent Lateral Offset** (mm)	Rated Pressure @21°C (kg/cm ²)
GNF	50 x 325	209	190	6	25
GNF	65 x 325	209	157	6	20
GNF	75 x 325	209	151	6	19
GNF	100 x 400	259	105	6	16
GNF	125 x 450	306	95	6	14
GNF	150 x 500	356	82	6	14
GNF	200 x 550	400	75	6	12
GNF	250 x 625	450	69	6	12
GNF	300 x 675	500	66	6	12

Our steam service ratings are very low in the interest of safety although our 70°F 21°C pressure ratings are as high or higher than our competitors. All locations where failure could lead to personal injury or suffocation must be avoided. In dangerous locations we suggest housed expansion joints, solid loops, ball joints, packed devices etc. rather than thin walled flexible products regardless of manufacturer.

Consult factory with full location description as well as service conditions for higher pressure or temperature applications.

304 SS can be used up to 850°F 454°C in applications such as engine exhaust with minor pressure.

GN- Braided Hose with Grooved Nipples



TAPERED ENDS FOR WELDING (Grooved ends can be welded as an alternate. Mason does not recommend welding)

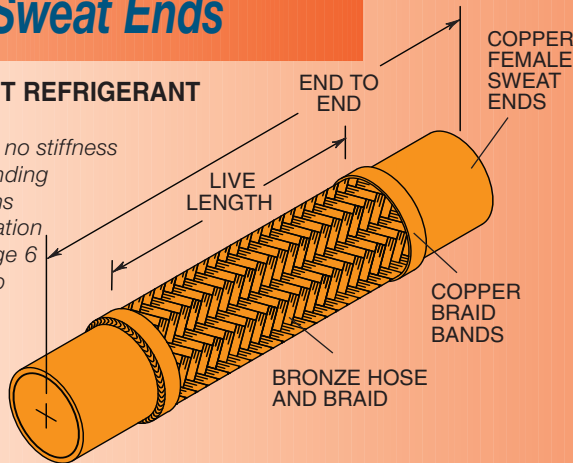
Sizes in **RED** are Minimum Recommended Lengths at Equipment Connections to Reduce Vibration Transmission. See discussion on pages 3 - 6.

Safety Factor is 4X Rated Pressure.
Max. Vacuum— 30" Hg 762mm Hg

CPSB- Braided Bronze Hose with Copper Sweat Ends

ALL SERVICES EXCEPT REFRIGERANT

Copper Lines have virtually no stiffness or mass. We are recommending our longest standard lengths primarily for offset, not vibration reduction. See spec on page 6 for special longer lengths to reduce vibration.



STOCK SIZES and LENGTHS

CPSB DIMENSIONS AND PRESSURE RATINGS (British Units)

Type	Tubing [†] Size & End to End [†] (in)	Live Length (in)	Corrugations per foot	Maximum Permanent Lateral Offset ^{**} (in)	Rated Pressure @70°F (psi)
CPSB	1/2 X 61/2*	23/4	92	1/8	700
CPSB	1/2 X 12	81/4	92	11/4	700
CPSB	1/2 X 18	141/4	92	21/2	700
CPSB	3/4 X 7*	23/4	80	1/8	575
CPSB	3/4 X 12	73/4	80	1	575
CPSB	3/4 X 18	133/4	80	21/4	575
CPSB	1 X 8*	33/8	72	1/8	470
CPSB	1 X 12	73/8	72	3/4	470
CPSB	1 X 18	133/8	72	2	470
CPSB	1 1/4 X 81/2*	33/4	67	1/8	360
CPSB	1 1/4 X 12	71/4	67	3/4	360
CPSB	1 1/4 X 18	131/4	67	13/4	360
CPSB	1 1/2 X 9*	4	63	1/8	325
CPSB	1 1/2 X 12	7	63	5/8	325
CPSB	1 1/2 X 18	13	63	11/2	325
CPSB	2 X 12	61/2	58	1/4	315
CPSB	2 X 18	121/2	58	13/8	315
CPSB	2 1/2 X 12*	43/4	48	1/8	270
CPSB	2 1/2 X 18	103/4	48	11/4	270
CPSB	3 X 12*	41/2	46	1/8	200
CPSB	3 X 18	101/2	46	1	200
CPSB	4 X 18*	91/2	32	1/2	200 [°]
CPSB	4 X 24	151/2	32	3/4	200[°]

CPSB DIMENSIONS AND PRESSURE RATINGS (Metric Units)

Type	Tubing [†] Size & End to End [†] (mm)	Live Length (mm)	Corrugations per meter	Maximum Permanent Lateral Offset ^{**} (mm)	Rated Pressure @21°C (kg/cm ²)
CPSB	15 X 163*	70	302	3	48
CPSB	15 X 300	210	302	32	48
CPSB	15 X 450	362	302	63	48
CPSB	20 X 175*	70	262	3	40
CPSB	20 X 300	197	262	25	40
CPSB	20 X 450	349	262	57	40
CPSB	25 X 200*	86	236	3	32
CPSB	25 X 300	187	236	19	32
CPSB	25 X 450	340	236	50	32
CPSB	32 X 213*	95	220	3	25
CPSB	32 X 300	184	220	19	25
CPSB	32 X 450	337	220	44	25
CPSB	40 X 225*	102	207	3	23
CPSB	40 X 300	178	207	16	23
CPSB	40 X 450	330	207	38	23
CPSB	50 X 300	165	190	6	22
CPSB	50 X 450	318	190	35	22
CPSB	65 X 300*	121	157	3	19
CPSB	65 X 450	300	157	32	19
CPSB	80 X 300*	114	151	3	14
CPSB	80 X 450	267	151	25	14
CPSB	100 X 450*	241	105	13	14 [°]
CPSB	100 X 600	394	105	18	14[°]

FOR RATED PRESSURES @ ELEVATED TEMPERATURES see page 13

NOT SUITABLE FOR STEAM.

[†]Female hose fits over copper tubing, e.g. 1/2 x 61/2 15 x 163mm fits over 1/2" 15mm tubing.

^{*}Industry Pump Connector Lengths are not recommended, but supplied on demand.

^{**}Lateral Offset one side of centerline and normal machinery vibration. If intermittent in both directions, reduce by 50%.

[†]End to End Tolerances: Sizes 1/2" - 4" 15 - 100mm, ±1/4" 6mm

[°]Size 4 has double braid.

STOCK SIZES and LENGTHS

GN DIMENSIONS AND PRESSURE RATINGS (British Units)

Type	Pipe Size & End to End (in)	Live Length (in)	Corrugations per foot	Maximum Permanent Lateral Offset ^{**} (in)	Rated Pressure @70°F (psi)
GN	2 X 14	8	58	1/4	360
GN	2 X 24	18	58	21/4	360
GN	2 1/2 X 14	8	48	1/4	290
GN	2 1/2 X 24	18	48	2	290
GN	3 X 14	8	46	1/4	280
GN	3 X 36	30	46	33/4	280
GN	4 X 18	10	32	1/4	225
GN	4 X 36	28	32	31/4	225
GN	5 X 20	12	29	1/4	200
GN	5 X 36	28	29	23/4	200
GN	6 X 22	14	25	1/4	200
GN	6 X 36	28	25	21/2	200
GN	8 X 24	16	23	1/4	200
GN	8 X 36	28	23	21/4	200
GN	10 X 28	18	21	1/4	170
GN	10 X 36	26	21	11/4	170
GN	12 X 30	20	20	1/4	170
GN	12 X 36	26	20	7/8	170

GN DIMENSIONS AND PRESSURE RATINGS (Metric Units)

Type	Pipe Size & End to End (mm)	Live Length (mm)	Corrugations per meter	Maximum Permanent Lateral Offset ^{**} (mm)	Rated Pressure @21°C (kg/cm ²)
GN	50 X 350	200	190	6	25
GN	50 X 600	450	190	60	25
GN	65 X 350	200	157	6	20
GN	65 X 600	450	157	51	20
GN	75 X 350	200	151	6	19
GN	75 X 900	750	151	95	19
GN	100 X 450	250	105	6	16
GN	100 X 900	700	105	83	16
GN	125 X 500	300	95	6	14
GN	125 X 900	700	95	70	14
GN	150 X 550	350	82	6	14
GN	150 X 900	700	82	54	14
GN	200 X 600	400	75	6	14
GN	200 X 900	700	75	57	14
GN	250 X 700	450	69	6	12
GN	250 X 900	650	69	32	12
GN	300 X 750	500	66	6	12
GN	300 X 900	650	66	22	12

^{**}Lateral Offset one side of centerline and normal machinery vibration. If intermittent in both directions, reduce by 50%.

Size 12 has double braid.

Rated Pressure @ Elevated Temperatures for CPSB

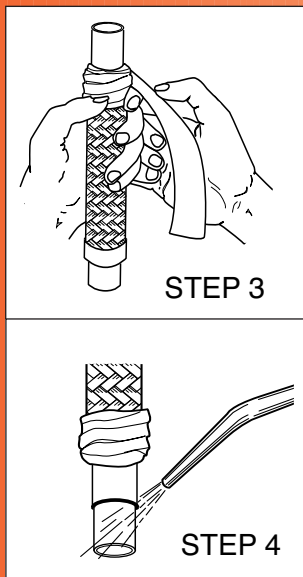
Consult factory with full location description as well as service conditions for higher pressure or temperature applications.

Pressure ratings are limited by the copper fittings (ASME B16.22-2001), not the bronze hose body.

RATED PRESSURES** @ ELEVATED TEMPERATURES (psi) (kg/cm²)

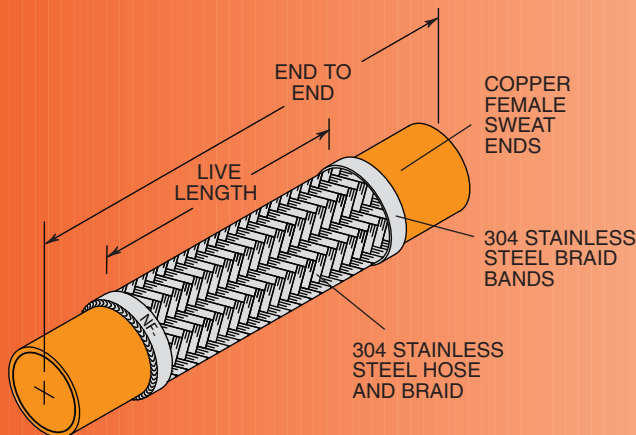
Hose Size (in) (mm)	150°F 66°C Factor 0.85	300°F 149°C Factor 0.78	400°F 204°C Factor 0.50
1/2 15	595 41	545 38	350 24
3/4 20	490 34	450 31	290 20
1 25	400 28	365 25	235 16
1 1/4 32	305 21	280 19	180 12
1 1/2 40	275 19	255 18	165 11
2 50	265 18	245 17	160 11
2 1/2 65	230 16	210 14	135 9
3 80	170 12	155 11	100 7
4 100	170 12	155 11	100 7

**ASME B16.22 - 2001 Copper Fitting Control Ratings



INSTALLATION INSTRUCTIONS for CPSB and ULCPS

1. Thoroughly clean male and female ends using steel wool and steel brushes.
2. Apply flux.
3. Wrap base of copper fitting on connector and 2" (50mm) of the braid with a wet cloth to prevent overheating during soldering.
4. Direct the torch away from the base of the copper fitting and braided section. Avoid contact of the flame with the base of the copper fitting and braid. Heat end of copper fitting for proper flow of silver solder. Silver solder flows at approximately 430°F (221°C).
5. Do not use brazing rod or other higher temperature techniques. Overheating will cause leaks.
6. Remove wet rag and remove all soldering flux immediately after installation. Chlorides will cause premature failure of joint.



ULCPS— Braided SS Hose with Copper Sweat Ends U. L. Approved for Refrigerant Services

Safety Factor is 5X Rated Pressure.
Max. Vacuum— 30" Hg 762mm Hg

Lengths are industry standard
always ordered for this service.

STOCK SIZES and LENGTHS

ULCPS DIMENSIONS AND PRESSURE RATINGS (British Units)

Stamped Code	Size & End to End [†] (in)	Fits Over Tubing Size	Tubing OD (in)	Live Length (in)	Maximum Permanent Lateral Offset* (in)	Rated Pressure @70°F (psi)
NF1	1/4 X 8 1/2	1/4	3/8	6	1/8	500
NF2	3/8 X 9	3/8	1/2	6 1/4	1/8	500
NF3	1/2 X 9 3/4	1/2	5/8	6 5/8	1/8	500
NF4	5/8 X 10 1/2	5/8	3/4	6 3/4	1/8	500
NF5	3/4 X 12	3/4	7/8	7 1/2	1/8	500
NF6	1 X 13	1	1 1/8	7 7/8	1/8	500
NF7	1 1/4 X 15 1/2	1 1/4	1 3/8	9 3/4	1/8	500
NF8	1 1/2 X 17	1 1/2	1 5/8	10 1/2	1/8	500
NF9	2 X 20 1/2	2	2 1/8	13 1/4	1/8	390
NF10	2 1/2 X 24 1/4	2 1/2	2 5/8	15 1/2	1/8	340
NF11	3 X 27	3	3 1/8	17	1/8	300
NF12	4 X 33	4	4 1/8	21	1/8	250

ULCPS DIMENSIONS AND PRESSURE RATINGS (Metric Units)

Stamped Code	Size & End to End [†] (mm)	Fits Over Tubing Size	Tubing OD (mm)	Live Length (mm)	Maximum Permanent Lateral Offset* (mm)	Rated Pressure @21°C (kg/cm ²)
NF1	6 X 215	6	10	150	3	34
NF2	10 X 225	10	15	156	3	34
NF3	15 X 245	15	17	166	3	34
NF4	17 X 265	17	19	169	3	34
NF5	20 X 300	20	22	188	3	34
NF6	25 X 325	25	28	197	3	34
NF7	32 X 388	32	35	244	3	34
NF8	40 X 425	40	41	263	3	34
NF9	50 X 515	50	54	331	3	27
NF10	65 X 606	65	68	388	3	23
NF11	80 X 675	80	78	425	3	20
NF12	100 X 840	100	105	535	3	16

*Lateral Offset one side of centerline and normal machinery vibration. If intermittent in both directions, reduce by 50%.

[†]End to End Tolerances: All Sizes, ±1/4" 6mm

CSA Series of Braided Hose

Everyone is concerned when installing flexible hose in flammable gas or liquid lines because of the risk of both asphyxiation and fire. Approved by the CSA, the successor to the American Gas Association, and complying with UL 536 provides that assurance. Tests include vibration 300 hours at 15 Hz, 90° bends at rated pressure @ 10 cpm for 20,000 cycles, elongation and tension, 450°F (232°C) for 100 hours as well as flame resistance. All of our standard hoses 1/2" through 4"

diameter passed and can be used in straight, looped or Vee configurations. However, in addition to the general UL approval, all specific hoses must be rechecked with an approved thread gauge, if threaded, and retested to 50% above rated pressure using water or rated pressure using air. It must be clearly identified as a Mason product and tagged with maximum pressure rating and minimum bend radius.

CSAMN— Braided Hose with Threaded Nipples CSAWN— Braided Hose with Weld Nipples



These assemblies have been "CSA" approved for use on gas pipelines. "CSA" is the current certification agency for gas industry products, assuming the authority formerly associated with the American Gas Association (AGA).

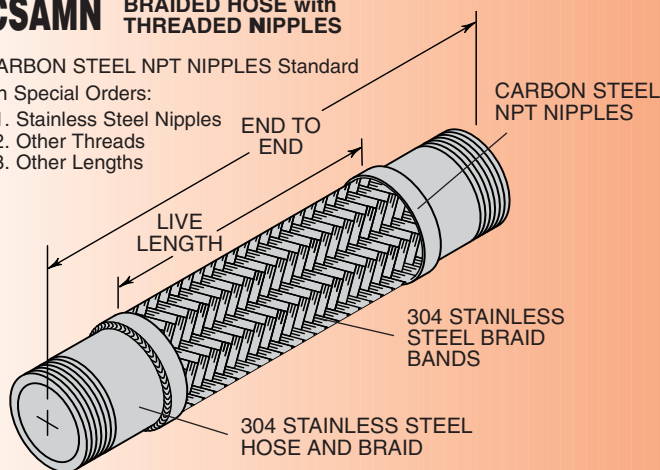
Our Certification Report is #230720-1764990. This Certification meets all requirements of ANSI/UL #536-1997 Standards for Flexible Metal Hose.

CSAMN BRAIDED HOSE with THREADED NIPPLES

CARBON STEEL NPT NIPPLES Standard

On Special Orders:

1. Stainless Steel Nipples
2. Other Threads
3. Other Lengths



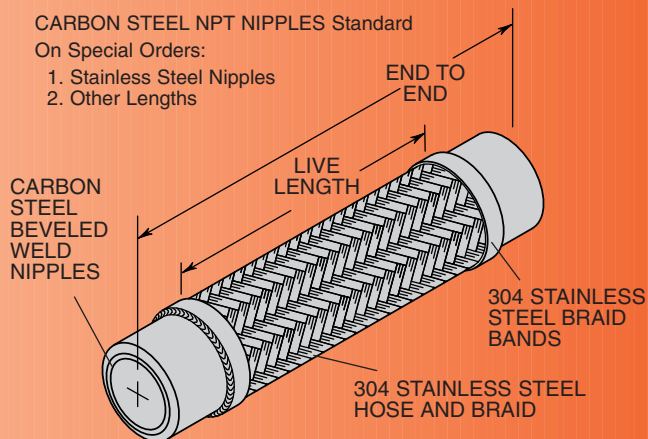
Select Lengths Based on Maximum Anticipated Offset.

CSAWN BRAIDED HOSE with WELD NIPPLES

CARBON STEEL NPT NIPPLES Standard

On Special Orders:

1. Stainless Steel Nipples
2. Other Lengths



Max. Vacuum— 30" Hg 762mm Hg

STOCK SIZES and LENGTHS

CSAMN & CSAWN DIMENSIONS AND PRESSURE RATINGS (British Units)

Pipe Size (in)	MN End to End ¹ (in)	WN End to End ¹ (in)	Live Length (in)	Corrugations per foot	Maximum Permanent Lateral Offset* (in)	Rated Pressure @70°F (psi)	Min Burst Pressure (psi)	Safety Factor
1/2	12	11	81/4	112	11/4	175	4300	25
1/2	18	17	141/4	112	21/2	175	4300	25
1/2	24	23	201/4	112	31/2	175	4300	25
3/4	12	10 1/2	81/4	90	1	175	3168	18
3/4	18	16 1/2	141/4	90	2 1/4	175	3168	18
3/4	24	22 1/2	201/4	90	3 1/4	175	3168	18
1	12	10	73/4	56	3/4	175	3132	18
1	18	16	133/4	56	2	175	3132	18
1	24	22	193/4	56	3	175	3132	18
1 1/4	12	10	63/4	52	5/8	175	2656	15
1 1/4	18	16	123/4	52	13/4	175	2656	15
1 1/4	24	22	183/4	52	23/4	175	2656	15
1 1/2	12	10	63/4	46	1/2	175	2284	13
1 1/2	18	16	123/4	46	1 1/2	175	2284	13
1 1/2	24	22	183/4	46	2 1/2	175	2284	13
2	12	10	6	67	1/4	175	2120	12
2	18	16	12	67	13/8	175	2120	12
2	24	22	18	67	23/8	175	2120	12
2 1/2	18	15 1/2	11	55	1 1/4	175	1724	10
2 1/2	24	21 1/2	17	55	2	175	1724	10
3	18	15 1/2	11	29	1	175	1564	9
3	24	21 1/2	17	29	13/4	175	1564	9
4	18	15 1/2	11	28	1/2	175	1160	7
4	24	21 1/2	17	28	3/4	175	1160	7

STOCK SIZES and LENGTHS

CSAMN & CSAWN DIMENSIONS AND PRESSURE RATINGS (Metric Units)

Pipe Size (mm)	MN End to End ¹ (mm)	WN End to End ¹ (mm)	Live Length (mm)	Corrugations per meter	Maximum Permanent Lateral Offset* (mm)	Rated Pressure @21°C (kg/cm ²)	Min Burst Pressure (kg/cm ²)	Safety Factor
15	300	275	206	367	32	12	296	25
15	450	425	356	367	63	12	296	25
15	600	575	506	367	88	12	296	25
20	300	263	206	295	25	12	218	18
20	450	413	356	295	57	12	218	18
20	600	563	506	295	83	12	218	18
25	300	250	194	184	19	12	216	18
25	450	400	344	184	50	12	216	18
25	600	550	494	184	75	12	216	18
32	300	250	169	171	16	12	183	15
32	450	400	319	171	44	12	183	15
32	600	550	469	171	70	12	183	15
40	300	250	169	151	13	12	157	13
40	450	400	319	151	38	12	157	13
40	600	550	469	151	63	12	157	13
50	300	250	150	220	6	12	146	12
50	450	400	300	220	35	12	146	12
50	600	550	450	220	60	12	146	12
65	450	388	275	180	32	12	119	10
65	600	538	425	180	50	12	119	10
80	450	388	275	95	25	12	108	9
80	600	538	425	95	44	12	108	9
100	450	388	275	92	13	12	80	7
100	600	538	425	92	19	12	80	7

*Lateral Offset one side of centerline and normal machinery vibration. If intermittent in both directions, reduce by 50%.

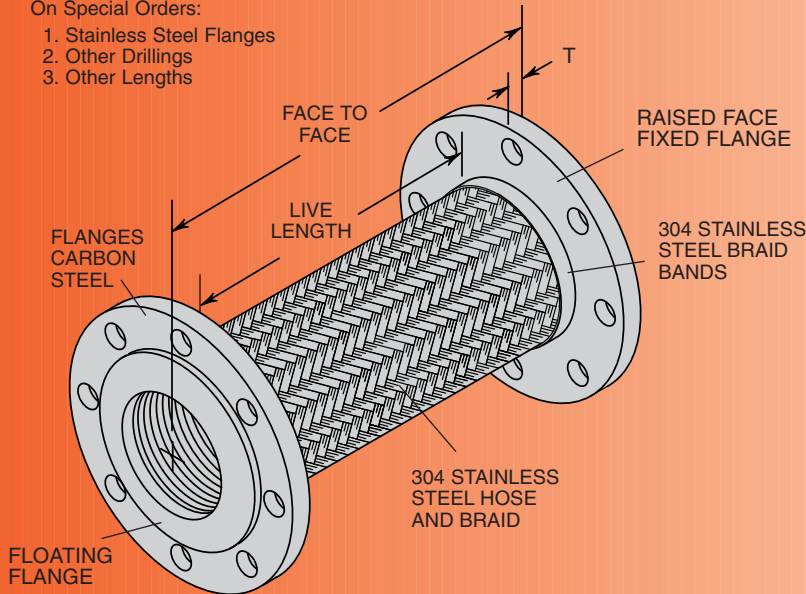
¹End to End Tolerance: Sizes 1/2" - 4" 50 - 100mm, ±1/4" 6mm

CSAFFL- Braided SS Hose with Fixed and Floating Flanges

CARBON STEEL FIXED AND FLOATING FLANGES ASA-150 Standard

On Special Orders:

1. Stainless Steel Flanges
2. Other Drillings
3. Other Lengths



These assemblies have been "CSA" approved for use on gas pipelines. "CSA" is the current certification agency for gas industry products, assuming the authority formerly associated with the American Gas Association (AGA).

Our Certification Report is #230720-1764990. This Certification meets all requirements of ANSI/UL #536-1997 Standards for Flexible Metal Hose.

CARBON STEEL PLATE FLANGE THICKNESS

Pipe Size (in)	Flange Thickness T (in) (mm)
1 1/2 thru 4	5/8 16

Select Lengths Based on Maximum Anticipated Offset.

Max. Vacuum— 30" Hg 762mm Hg

STOCK SIZES and LENGTHS

CSAFFL DIMENSIONS AND PRESSURE RATINGS (British Units)

Pipe Size & Face to Face [†] (in)	Live Length (in)	Corrugations per foot	Maximum Permanent Lateral Offset* (in)	Rated Pressure @70°F (psi)	Min Burst Pressure (psi)	Safety Factor
1 1/2 X 12	97/8	46	7/8	175	2284	13
1 1/2 X 18	157/8	46	2	175	2284	13
1 1/2 X 24	217/8	46	2 3/4	175	2284	13
2 X 12	91/8	67	3/4	175	2120	12
2 X 18	151/8	67	1 3/4	175	2120	12
2 X 24	211/8	67	2 1/2	175	2120	12
2 1/2 X 12	91/8	55	5/8	175	1724	10
2 1/2 X 18	151/8	55	1 1/2	175	1724	10
2 1/2 X 24	211/8	55	2 1/4	175	1724	10
3 X 12	91/8	30	1/2	175	1564	9
3 X 18	151/8	30	1 1/4	175	1564	9
3 X 24	211/8	30	2	175	1564	9
3 X 36	331/8	30	4	175	1564	9
4 X 12	91/8	29	3/8	175	1160	7
4 X 18	151/8	29	3/4	175	1160	7
4 X 24	211/8	29	1 3/4	175	1160	7
4 X 36	331/8	29	3 1/2	175	1160	7

CSAFFL DIMENSIONS AND PRESSURE RATINGS (Metric Units)

Pipe Size & Face to Face [†] (mm)	Live Length (mm)	Corrugations per meter	Maximum Permanent Lateral Offset* (mm)	Rated Pressure @21°C (kg/cm ²)	Min Burst Pressure (kg/cm ²)	Safety Factor
40 X 300	228	151	22	12	157	13
40 X 450	378	151	50	12	157	13
40 X 600	528	151	70	12	157	13
50 X 300	228	220	19	12	146	12
50 X 450	378	220	44	12	146	12
50 X 600	528	220	64	12	146	12
65 X 300	228	180	16	12	119	10
65 X 450	378	180	38	12	119	10
65 X 600	528	180	57	12	119	10
80 X 300	228	95	13	12	108	9
80 X 450	378	95	32	12	108	9
80 X 600	528	95	50	12	108	9
80 X 900	828	95	100	12	108	9
100 X 300	228	92	10	12	80	7
100 X 450	378	92	19	12	80	7
100 X 600	528	92	44	12	80	7
100 X 900	828	92	89	12	80	7

*Lateral Offset one side of centerline and normal machinery vibration. If intermittent in both directions, reduce by 50%.

[†]Face to Face Tolerances: Sizes 1 1/2" - 4" 40 - 100mm, ±1/4" 6mm.

CSACPS— Braided Hose with Copper Sweat Ends

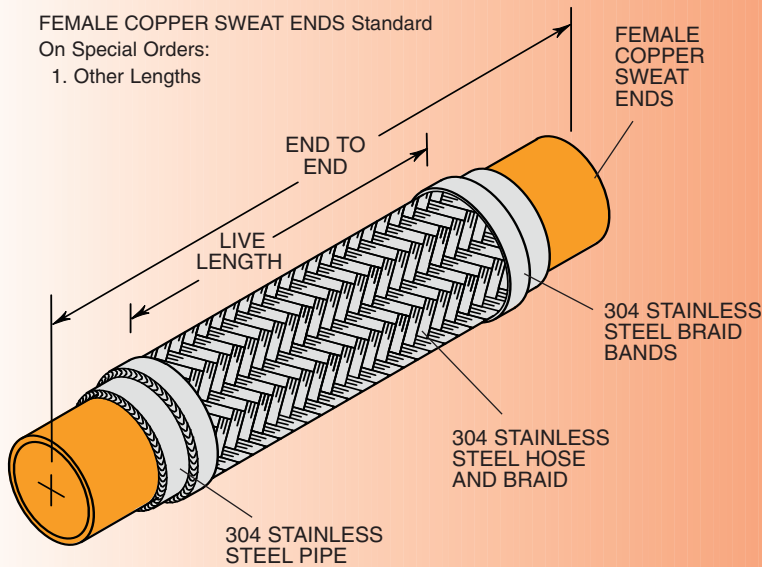
GAS SERVICE ONLY—

See ULCPS page 13 for Refrigerants



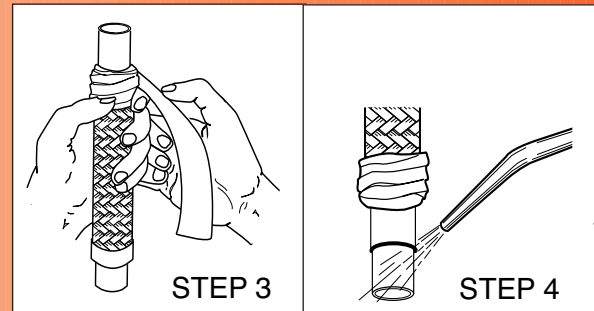
These assemblies have been “CSA” approved for use on gas pipelines. “CSA” is the current certification agency for gas industry products, assuming the authority formerly associated with the American Gas Association (AGA).

Our Certification Report is #230720-1764990. This Certification meets all requirements of ANSI/UL #536-1997 Standards for Flexible Metal Hose.



Max. Vacuum— 30" Hg 762mm Hg

Select Lengths Based on Maximum Anticipated Offset.



INSTALLATION INSTRUCTIONS for CSACPS

1. Thoroughly clean male and female ends using steel wool and steel brushes.
2. Apply flux.
3. Wrap base of copper fitting on connector and 2" (50mm) of the braid with a wet cloth to prevent overheating during soldering.
4. Direct the torch away from the base of the copper fitting and braided section. Avoid contact of the flame with the base of the copper fitting and braid. Heat end of copper fitting for proper flow of silver solder. Silver solder flows at approximately 430°F (221°C).
5. Do not use brazing rod or other higher temperature techniques. Overheating will cause leaks.
6. Remove wet rag and remove all soldering flux immediately after installation. Chlorides will cause premature failure of joint.

STOCK SIZES and LENGTHS

CSACPS DIMENSIONS AND PRESSURE RATINGS (British Units)

Tubing [†] Size & End to End [†] (in)	Live Length (in)	Corrugations per foot	Maximum Permanent Lateral Offset* (in)	Rated Pressure @70°F (psi)	Min Burst Pressure (psi)	Safety Factor
1/2 X 12	83/4	112	11/4	175	2880	16
1/2 X 18	143/4	112	21/2	175	2880	16
3/4 X 12	81/4	90	1	175	2320	13
3/4 X 18	141/4	90	21/4	175	2320	13
1 X 12	8	56	3/4	175	1960	11
1 X 18	14	56	2	175	1960	11
1 1/4 X 12	8	52	3/4	175	1740	10
1 1/4 X 18	14	52	13/4	175	1740	10
1 1/2 X 12	73/4	46	5/8	175	1620	9
1 1/2 X 18	133/4	46	11/2	175	1620	9
2 X 12	61/2	67	1/4	175	1440	8
2 X 18	121/2	67	13/8	175	1440	8
2 1/2 X 18	12	55	11/4	175	1160	6
3 X 18	111/2	29	1	175	1120	6
4 X 18	10	28	1/2	175	920	5
4 X 24	16	28	3/4	175	920	5

CSACPS DIMENSIONS AND PRESSURE RATINGS (Metric Units)

Tubing [†] Size & End to End [†] (mm)	Live Length (mm)	Corrugations per meter	Maximum Permanent Lateral Offset* (mm)	Rated Pressure @21°C (kg/cm ²)	Min Burst Pressure (kg/cm ²)	Safety Factor
15 X 300	219	367	32	12	200	16
15 X 450	369	367	63	12	200	16
20 X 300	206	295	25	12	160	13
20 X 450	356	295	57	12	160	13
25 X 300	200	184	19	12	136	11
25 X 450	350	184	50	12	136	11
32 X 300	200	171	19	12	120	10
32 X 450	350	171	44	12	120	10
40 X 300	194	151	16	12	112	9
40 X 450	344	151	38	12	112	9
50 X 300	163	220	6	12	100	8
50 X 450	313	220	35	12	100	8
65 X 450	300	180	32	12	80	6
80 X 450	288	95	25	12	76	6
100 X 450	254	92	13	12	64	5
100 X 600	400	92	18	12	64	5

*Lateral Offset one side of centerline and normal machinery vibration. If intermittent in both directions, reduce by 50%.

[†]End to End Tolerances: Sizes 1/2" - 4" 50 - 100mm, ±1/4" 6mm

^{††}Female hose fits over copper tubing, e.g. 1/2 x 61/2 15 x 163mm fits over 1/2" 15mm tubing.