

# UNAFLEX<sup>®</sup>

INCORPORATED



EXPANSION JOINTS  
AND FLEXIBLE CONNECTORS

ISO 9001:2000 CERTIFIED

# METAL

2 0 0 4  
REVISION

# TABLE OF CONTENTS

▪ <b>Definition of Movement</b>			
▪ <b>Anchoring and Guiding</b>			
▪ <b>Cycle Life</b>	<b>4</b>		
▪ <b>"Matchless" Bellows</b>			
<b>Expansion Joint Description</b>			
▪ <b>Recommended Installation</b>			
<b>Instructions</b>			
▪ <b>General Ordering Information</b>	<b>5</b>		
▪ <b>"Matchless" Bellows</b>			
<b>Expansion Joints</b>			
<b>Short Style</b>	<b>6</b>		
<b>Long Style</b>	<b>7</b>		
▪ <b>"Matchless" Bellows Data</b>			
▪ <b>Universal Tied Expansion Joints</b>	<b>8</b>		
▪ <b>Externally Pressurized</b>			
<b>Bellows Expansion Joints</b>			
▪ <b>Series 5000 BPC Pump</b>			
<b>Connectors</b>	<b>9</b>		
▪ <b>"Matchless" Dual Unit</b>			
▪ <b>Pressure Balanced Unit</b>			
▪ <b>Liners and Covers</b>		<b>10</b>	
▪ <b>"Tube-Flex" Engine Exhaust</b>			
<b>Expansion Joints</b>			
▪ <b>U-100 Expansion Joints</b>			
▪ <b>High Pressure Expansion</b>			
<b>Connectors</b>		<b>11</b>	
▪ <b>"Master" Flexible Metal</b>			
<b>Pump Connectors</b>		<b>12</b>	
▪ <b>"Inter-flex" Interlocked Flexible</b>			
<b>Metal Tubing</b>		<b>13</b>	
▪ <b>Flexible Corrugated Metal Hose</b>		<b>14</b>	
▪ <b>Series B - Bronze</b>			
<b>Corrugated Hose</b>			
▪ <b>"Serpent" Rubber Covered</b>			
<b>Metal Hose</b>		<b>15</b>	
▪ <b>Standard Warranty</b>			<b>Back Cover</b>

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# UNAFLEX

"Excellence In Manufacturing"

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*"Excellence In Manufacturing"*

Unaflex is one of this country's leading Expansion Joint Manufacturers. Our expertise and manufacturing capabilities include a full range of Rubber Expansion Joints, Flue Ducts, Expansion Joint Sound Absorbers, Custom Rubber Hose, Metal Hose, Pump Connectors and Metal Bellows Type Expansion Joints. No other manufacturer in the United States has the capabilities of Unaflex.

This catalog outlines selection and installation of our Metal Bellows Type Expansion Joints, Metal Hose and Pump Connectors for use in pipe lines and process vessels to absorb motion in the system. Our designs incorporate the latest recommendations of the Expansion Joint Manufacturers Association.

Unaflex is a Full Service Engineering Organization offering a full range of products in the highest grades of stainless steel as well as more exotic alloys including Monel, Inconel and Hastalloy. Quality control is rigorous and complies with requirements of MIL-I-45208 and MIL-Q-9858. Our Expansion Joints also comply with U.S. Coast Guard requirements. Certification is available.

## CONSTRUCTION DETAILS

### BELLOWS PROFILE

Unaflex "MATCHLESS" Expansion Joint Bellows are produced from fully annealed type 321 stainless steel sheet stock rolled into a tube and seam welded. The latest technology in forming the corrugations of our bellows is employed. Other alloys such as Inconel, Monel, Titanium and 316 stainless steel may be provided from our extensive inventory of raw materials.

### END CONNECTIONS

- A. Fixed Flanges  
Type 44 Ends are plate steel flanges conforming to ANSI dimensions welded directly to the integral ends of the bellows. Stainless steel and other alloys are available when specified.
- B. Floating Flanges  
Type 66 Ends are flat face plate flanges conforming to ANSI dimensions secured to the integral end of the bellows flared (Vanstoned) to retain the flanges. This allows the use of carbon steel flanges when the only wetted parts will be the stainless steel of the bellows. Also permits easy bolt hole alignment.
- C. Welding Nipples  
Type 22 End are carbon steel welding nipples with ANSI standard bevel. Schedule 40 pipe size is used through 12" diameters. 1/4" wall thickness for sizes over 12" unless otherwise specified.



TYPE 44



TYPE 66



TYPE 22

### APPLICATIONS:

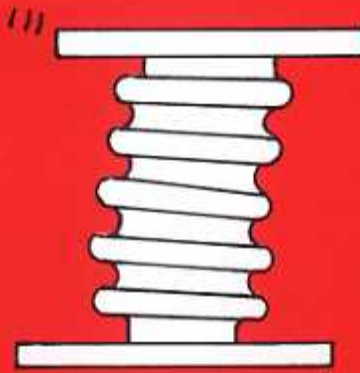
- Diesel Engine Exhaust
- Diesel Generator Exit and Boiler Flue
- High and Low-Pressure Turbine Piping
- Main Feed Pump Suction
- Propeller Shaft Air System
- Condensate Pump Suction
- Saturated and Superheated Steam

# DEFINITION OF MOVEMENT



## AXIAL MOVEMENT

Axial Compression is the dimensional shortening of an Expansion Joint along its longitudinal axis while axial extension is the dimensional lengthening of the expansion joint.



## LATERAL MOVEMENT

Lateral Deflection is the relative displacement of the two ends of an Expansion Joint perpendicular to its longitudinal axis.



## ANGULAR MOVEMENT

Angular Rotation is the displacement of the longitudinal axis of the Expansion Joint from its initial straight line position into a circular arc.

## ANCHORING AND GUIDING

To assure satisfactory performance of an expansion joint in a piping system, it is imperative that the system be properly anchored and guided.

Anchors must be designed to withstand the thrust forces, spring forces and guiding frictional forces of an

expansion joint. Pressure thrust must be calculated by using the highest internal line pressure which the system will experience. This is frequently the test pressure. Spring force can be calculated from the expansion joint design data on page 6-9.

## CYCLE LIFE

The cycle life of an expansion joint is the number of stress cycles endured, at operating conditions. A stress cycle is defined as one complete movement of the expansion joint from initial to extreme position and return.

"Matchless" Expansion Joints are rated for 7000 cycles of life at maximum operating pressure and

temperature if properly installed. For higher cycle life requirements, consult Unaflex Engineering Dept.

Elevated temperatures reduce both rated movement for a given cycle life and pressure capabilities. To compensate multiply both rated movement and maximum pressure by the temperature compensating factor in the chart to the right.

TEMPERATURE °F.	TEMPERATURE COMPENSATING FACTOR
Room Temp.	1.00
200	.94
300	.88
400	.83
500	.78
600	.74
700	.70
800	.66
900	.62
1000	.60
1100	.58
1200	.55
1300	.50
1400	.44
1500	.40

# "MATCHLESS" BELLOWS-TYPE EXPANSION JOINTS

Metal Bellows Expansion Joints have been designed to absorb a specified amount of movement by flexing of the thin-gauge convolutions. If proper care is not taken during installation, it may reduce the cycle life and the pressure capacity of the expansion joints which could result in an early failure of the bellows element or damage the piping system.

The following recommendations are included to avoid the most common errors that occur during installation. When in doubt about an installation procedure, contact the manufacturer for clarification before attempting to install the Expansion Joint.

## RECOMMENDED INSTALLATION INSTRUCTIONS

### DO'S

- Inspect for damage during shipment, i.e., dents, broken hardware, water marks on carton, etc.
- Store in clean dry area where it will not be exposed to heavy traffic or damaging environment.
- Use only designated lifting lugs.
- Make the piping system fit the expansion joint. By stretching, compressing, or offsetting the joint to fit the piping, it may be overstressed when the system is in service.
- It is good practice to leave one flange loose until the expansion joint has been fitted into position. Make necessary adjustment of loose flange before welding.
- Install joint with arrow pointing in the direction of flow.
- Install single Van Stone liners pointing in the direction of flow. Be sure to install a gasket between the liner and Van Stone flange as well as between the mating flange and liner.
- With telescoping Van Stone liners, install the smallest I.D. liner pointing in the direction of flow.
- Remove all shipping devices after the installation is complete and before any pressure test of the fully installed system.
- Remove any foreign material that may have become lodged between the convolutions.
- Refer to EJMA Standards for proper guide spacing and anchor recommendations.

### DON'TS

- Do not drop or strike carton.
- Do not remove shipping bars until installation is complete.
- Do not use hanger lugs as lifting lugs without approval of manufacturer.
- Do not use chains or any lifting device directly on the bellows or bellows cover.
- Do not allow weld splatter to hit unprotected bellows. Protect with wet chloride-free asbestos.
- Do not use cleaning agents that contain chlorides.
- Do not use steel wool or wire brushes on bellows.
- Do not force-rotate one end of an expansion joint alignment of bolt holes. Ordinary bellows are not capable of absorbing torque.
- Do not hydrostatic pressure test or evacuate the system before proper installation of all guides and anchors.
- Pipe hangers are not adequate guides.
- Do not exceed a pressure test of 1½ times the rated working pressure of the expansion joint.
- Do not use shipping bars to retain the pressure thrust if tested prior to installation.

The manufacturer's warranty may be void if improper installation procedures have been used.

## GENERAL ORDERING INFORMATION

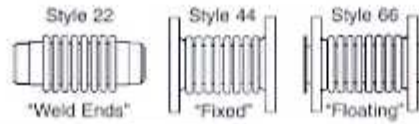
To help us provide you with the best Expansion Joint for the service intended and at the lowest possible cost, please use the following checklist.

1. Specify style (SLP, SMP, S-1, LMP etc.) if determined.
2. Quantity required
3. Pipe Size—size of existing piping
4. Installed Face to Face dimensions
5. End Connections—advise type of end, alloy and method of attachment for each end. Also, specify drilling pattern, number of bolt holes, bolt circle and flange O.D. for flange connections.
6. Medium Conveyed—type of liquid, gas, vapor etc.
7. Pressure and/or vacuum ranges
8. Temperature range
9. Movements—minimum and maximum axial compression, extension and lateral deflection. Also, angular rotation if applicable.
10. Liners and/or covers—see page 10 for details.
11. Control Units—control units are recommended for use with all Expansion Joints. For the small additional charge, safety and longevity are enhanced. They must be used when piping support is insufficient.
12. Other conditions which will help us provide the best possible Expansion Joint for the service. A complete range of standard products as well as special constructions are available to serve every possible need.



# Unaflex Matchless Bellows Expansion Joints

## Short Style Specification Chart

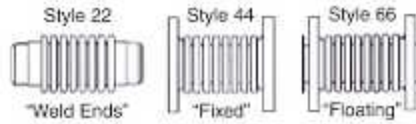


- SLP - Short Low Pressure
- SMP - Short Medium Pressure
- SHP - Short High Pressure
- DS - Duct Short

Size (inches)	Series	PSI	Style 44 & 66		Style 22		Force (lbs./in.)	Axial Movement (inches)	Lateral	
			O.A.L.	Weight	O.A.L.	Weight			Force (lbs./in.)	Movement (inches)
2	SLP	50		8		1	180	0.8	305	0.1
	SMP	150	6	8	6	1.1	180		345	
	SHP	300		8.2		1.3	600		1050	
2-1/2	SLP	50		10.5		1.8	140	0.8	500	0.1
	SMP	150	6	10.5	7	1.9	460		1506	
	SHP	300		10.7		2	840		2525	
3	SLP	50		13.5		2.6	280	0.8	866	0.1
	SMP	150	6	13.7	9	2.7	500		944	
	SHP	300		14		2.9	1275		2610	
3-1/2	SLP	50		14.2		2.8	325	0.8	1075	0.1
	SMP	150	6	14.5	9	3	726		1400	
	SHP	300		15		3.3	1396		3152	
4	SLP	50		15.7		3.5	550	0.8	1500	0.1
	SMP	150	7	16	9	3.8	699		1550	
	SHP	300		16.2		4	1135		3480	
5	SLP	50		21		6	597	1.3	2400	0.1
	SMP	150	8	21.7	10	6.8	775		2400	
	SHP	300		22.2		7.3	1500		7800	
6	SLP	50		22.2		8.5	600	1.3	2200	0.2
	SMP	150	8	25.2	10	9.5	978		2700	
	SHP	300		27		10	2000		7900	
8	SLP	50		48.5		14.5	625	1.6	2608	0.2
	SMP	150	8	53.7	10	16	1060		6026	
	SHP	300		56.7		21	2900		8200	
10	SLP	50		53.7		20.5	645	1.6	3040	0.2
	SMP	150	8	58.5	10	22	1712		6275	
	SHP	300		63		26.8	5065		11375	
12	SLP	50		87		23	615	1.6	3494	0.1
	SMP	150	9	89	10	26.3	1428		6376	
	SHP	300		92		28.5	6310		18830	
14	SLP	50		103		26	590	1.6	5899	0.1
	SMP	150	9	107	12	27.8	1500		9970	
	SHP	300		110		30	7302		21650	
16	SLP	50		138		29	604	1.6	9334	0.1
	SMP	150	9	143	12	33	2100		14890	
	SHP	300		147		36	6100		38115	
18	SLP	50		156		33	615	1.8	11350	0.1
	SMP	150	10	161	12	39	2800		21455	
	SHP	300		166		43	6080		61400	
20	SLP	50		162		38	620	1.8	13600	0.1
	SMP	150	10	167	14	41	3062		24010	
	SHP	300		172		49	6143		68350	
22	SLP	50		205		40	680	1.8	17115	0.1
	SMP	150	10	210	14	43	3100		30950	
	SHP	300		214		47	5000		71600	
24	SLP	50		222		46	815	1.8	21300	0.1
	SMP	150	11	225	14	49	3400		42750	
	SHP	300		230		50	9500		102700	
30	DS	50	11	377		56	960	1.8	175000	0.2
36				497	14	67	1100		248000	
40				602		72	1490		380000	
42	DS	50	11	641		84	1680	2.0	410000	0.2
46				750	14	98	1742		470000	
48				810		170	3600		500000	
50	DS	25	11	900		179	2500	2.0	174900	0.2
52				1008	14	210	3215		318000	
54				1061		218	3605		604000	
60	DS	25	11	1347		242	4200	2.0	780000	0.1
66				1591	14	283	4400		1300500	
72				1799		309	4750		2800300	
84	DS	15	11	2137		395	5478	2.0	4610000	0.1
96				3916	14	460	6300		12100000	
108				4200		491	7210		18400000	
126	DS	15	11	4400		565	8005	2.0	19500000	0.08
132				4700	14	600	8715		21000500	
144				5200		660	9430		25000100	

# Unaflex Matchless Bellows Expansion Joints

## Long Style Specification Chart



- LLP** - Long Low Pressure
- LMP** - Long Medium Pressure
- LHP** - Long High Pressure
- DL** - Duct Long

LONG STYLE										
Size (inches)	Series	PSI	Style 44 & 66		Style 22		Force (lbs./in.)	Axial Movement (Inches)	Lateral	
			O.A.L.	Weight	O.A.L.	Weight			Force (lbs./in.)	Movement (Inches)
2	LLP	50		8.1		1.2	98		55	0.5
	LMP	150	8	8.2	10	1.4	320		195	0.3
	LHP	300		8.5		1.6	525	2.0	330	0.3
2-1/2	LLP	50		10.7		2.1	110		78	0.5
	LMP	150	8	11	10	2.4	215	2.0	200	0.3
	LHP	300		11.2		2.5	550		612	0.2
3	LLP	50		12.5		2.7	243		148	0.6
	LMP	150	8	13	10	3	369	2.0	304	0.4
	LHP	300		13.2		3.2	615		730	0.3
3-1/2	LLP	50		14.2		3.5	300		285	0.6
	LMP	150	8	14.5	10	3.7	380	2.0	498	0.4
	LHP	300		14.7		4	723		1062	0.3
4	LLP	50		16.7		4.2	316		433	0.7
	LMP	150	8	17	10	4.5	416	2.0	633	0.4
	LHP	300		17.5		4.7	851		1132	0.3
5	LLP	50		23		8	394		793	0.5
	LMP	150	11	25	14	10	494	3.0	840	0.5
	LHP	300		26		10.2	936		1487	0.4
6	LLP	50		28		11	360		838	1.0
	LMP	150	12	30	14	12.7	569	3.0	915	0.6
	LHP	300		32		14.5	1113		1873	0.5
8	LLP	50		53		23.5	472		1140	1.2
	LMP	150	12	56	17	26.5	747	4.0	1314	0.7
	LHP	300		63		30.5	1412		2715	0.5
10	LLP	50		54		27.5	338		1260	1.2
	LMP	150	12	58	17	31.5	761	4.0	1430	0.7
	LHP	300		68		41.5	1807		3549	0.5
12	LLP	50		96		30	282		1470	1.2
	LMP	150	12	101	17	36	835	4.0	1635	0.7
	LHP	300		112		48	2947		7786	0.5
14	LLP	50		110		33	310		1920	1.0
	LMP	150	12	117	17	37	1111	3.6	3434	0.6
	LHP	300		119		39	3125		10185	0.4
16	LLP	50		145		36	302		2412	1.0
	LMP	150	12	152	17	43	1218	3.6	4500	0.6
	LHP	300		158		49	3260		12800	0.4
18	LLP	50		145		40	341		3400	0.7
	LMP	150	12	154	17	44	1280	3.6	6144	0.5
	LHP	300		160		50	3566		17974	0.4
20	LLP	50		173		42	380		4610	0.7
	LMP	150	12	177	17	46	1361	3.6	8343	0.5
	LHP	300		183		52	3912		22105	0.4
22	LLP	50		222		48	359		5230	0.6
	LMP	150	13	232	18	58	1484	3.6	9480	0.4
	LHP	300		240		66	4076		26800	0.3
24	LLP	50		226		50	767		9120	
	LMP	150	13	236	18	60	1504	3.6	12218	0.2
	LHP	300		243		67	4506		36761	
30				350		130	960		64500	
36	DL	50	13	530	18	157	1160	4.0	132000	0.2
40				626		173	1300		158000	
42				730		182	1186		230000	
46	DL	50	13	806	18	200	1244	4.0	260000	0.2
48				930		210	2400		368000	
50				980		220	1440		45500	
52	DL	25	13	1100	18	250	2200	4.0	80100	0.3
54				1150		265	2290		90900	
60				1433		288	2580		115000	
66	DL	25	13	1650	18	350	2840	4.0	150500	0.2
72				1850		380	3100		225000	
84				2240		490	3610		1500000	
96	DL	15	13	4100	18	640	4150	4.0	1900000	0.15
108				4600		660	4670		2300000	
126				5050		730	5100		2800000	
132	DL	15	13	5400	18	810	5650	4.0	3200000	0.1
144				6600		900	6100		3600000	

## Unaflex Matchless Metal Bellows Expansion Joints

- **Metal expansion joints** are primarily used to absorb movements in piping caused by thermal changes. Our designs incorporate the latest technology to produce a premium product.
- **Unaflex "MATCHLESS"** expansion joint bellows are produced from fully annealed stainless steel sheet rolled into a tube and seam welded.
- **Service:** Units are capable of handling Vacuum to 300 PSI.
- **Standard bellows:** 321 stainless steel. Other alloys are available to withstand your toughest applications.
- **Standard fittings:** welding nipples, fixed and floating flanges.
- **Standard sizes:** 2" through 144".

### Pressure Thrust

When a bellows is pressurized, it reacts causing a load equal to its effective area X working pressure along its longitudinal axis. These loads must be considered when designing the system arrangement and appropriate anchors.

Size	Eff. area Sq. In.	Size	Eff. area Sq. In.	Size	Eff. area Sq. In.
2	6.3	18	290	52	2290
2-1/2	9.6	20	354	54	2460
3	12.0	22	426	60	3025
4	20.0	24	500	66	3635
5	30.0	30	775	72	4300
6	43.0	36	1090	84	5800
8	72.0	40	1350	96	7550
10	110	42	1470	108	9510
12	150	46	1775	126	13200
14	180	48	1940	132	14110
16	234	50	2125	144	16750

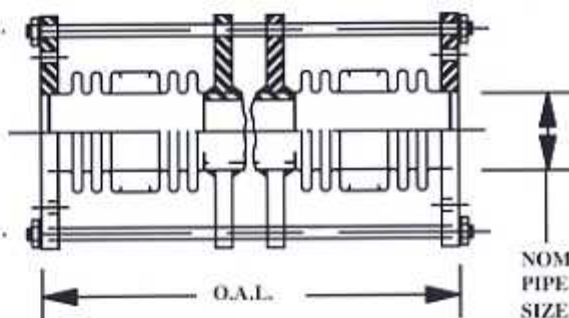
### Temperature:

Elevated temperatures reduce both rated movement and pressure capabilities.

To compensate multiply both rated movement and rated pressure by the temperature compensating factor shown in the chart below.

Temperature°F	Temperature Compensating Factor	Temperature°F	Temperature Compensating Factor
Room Temp.	1.00	600	.74
200	.94	700	.70
300	.88	800	.66
400	.83	901	.62
500	.78	1000	.60

## Unaflex Universal Tied Expansion Joints

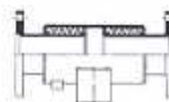
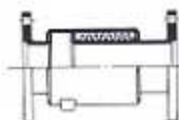


- Unaflex Universal Tied Expansion Joints are capable of absorbing greater lateral movements than standard bellows type expansion joints.
- Bellows manufactured of 321 Stainless steel.
- Assembly designed in accordance with EJMA standards.
- Available with optional liners or covers.
- Working temperature 500 degrees F
- Working pressure up to 150 PSI.

Nominal Pipe Size (in.)	Lateral Mvt. +/- (in.)	O.A.L. (in.)	Lateral spring rate lbs./inches	Added Mvt. Per 1" of additional Length	Number of tie rods	For nipple ends add to flange unit O.A.L.
2	1.5	14	22	.188	2	4
	3.8	18	18			
	5.4	21	10			
2-1/2	1.4	14	28	.157	2	4
	3.3	18	20			
	4.6	22	10			
3	1.3	14	32	.152	2	4
	3.1	18	12			
	4.5	23	10			
4	1.0	14	44	.151	2	4
	2.6	18	17			
	3.7	24	11			
5	2.0	19	50	.182	2	4
	3.0	24	22			
	4.0	36	12			
6	1.5	21	100	.152	2	6
	3.5	25	60			
	4.0	36	15			
8	1.5	20	120	.138	2	6
	3.5	25	80			
	4.0	36	30			
10	1.3	20	20	.128	2	6
	3.2	25	25			
	4.0	36	36			
12	1.6	25	25	.110	2	8
	4.2	34	34			
	6.0	48	48			
14	3.0	30	30	.102	4	8
	4.0	36	36			
	5.0	48	48			
16	3.0	30	30	.100	4	8
	3.5	36	36			
	5.0	48	48			
18	2.5	30	30	.098	4	8
	3.5	36	36			
	5.0	48	48			
20	2.0	30	30	.092	4	10
	3.0	36	36			
	4.0	48	48			
24	2.0	36	36	.079	4	10
	2.5	42	42			
	3.0	48	48			
30	2.0	42	42	.073	4	10
	2.5	50	50			
	3.0	60	60			

All data is for reference. Specific requirements should be sent to the factory for engineering review.

# Unaflex Externally Pressurized Bellows Expansion Joints



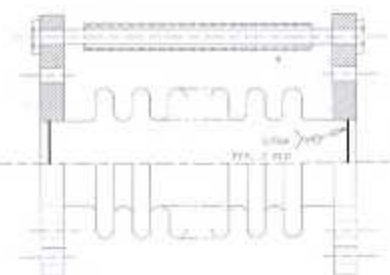
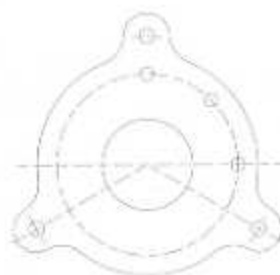
TYPE EXS SINGLE							TYPE EXD DOUBLE						
Size (in.)	PSI 600°F	O.A.L.	Axial Movements		Spring Rate		Size (in.)	PSI 600°F	O.A.L.	Axial Movements		Spring Rate	
			Comp.	Ext.	150#	300#				Comp.	Ext.	150#	300#
2	150 300	25	4	1	190	388	2	150 300	40	8	2	190	388
		34	6	2	130	260			60	12	4	130	260
		42	8	2	97	194			72	16	4	97	194
2-1/2	150 300	25	4	1	120	240	2-1/2	150 300	40	8	2	120	240
		34	6	2	80	160			60	12	4	80	160
		40	8	2	72	125			72	16	4	72	125
3	150 300	25	4	1	150	380	3	150 300	40	8	2	150	380
		34	6	2	90	230			60	12	4	90	230
		40	8	2	85	190			72	16	4	85	190
4	150 300	25	4	1	185	540	4	150 300	40	8	2	185	540
		34	6	2	116	340			60	12	4	116	340
		40	8	2	94	270			72	16	4	94	270
5	150 300	25	4	1	390	990	5	150 300	40	8	2	390	990
		34	6	2	270	670			60	12	4	270	670
		40	8	2	210	490			72	16	4	210	490
6	150 300	27	4	1	470	1180	6	150 300	42	8	2	470	1180
		35	6	2	315	800			60	12	4	315	800
		47	8	2	250	590			72	16	4	250	590
8	150 300	27	4	1	650	1450	8	150 300	40	8	2	650	1450
		35	6	2	410	850			60	12	4	410	850
		42	8	2	325	710			72	16	4	325	710
10	150 300	27	4	1	780	1740	10	150 300	40	8	2	780	1740
		35	6	2	490	1015			60	12	4	490	1015
		42	8	2	390	870			72	16	4	390	870
12	150 300	29	4	1	980	2020	12	150 300	46	8	2	980	2020
		37	6	2	610	1213			64	12	4	610	1213
		45	8	2	520	1050			76	16	4	520	1050
14	150 300	29	4	1	1940	3896	14	150 300	46	8	2	1940	3896
		37	6	2	1220	2370			64	12	4	1220	2370
		45	8	2	980	1930			76	16	4	980	1930
16	150 300	29	4	1	2180	4320	16	150 300	46	8	2	2180	4320
		37	6	2	1370	2630			64	12	4	1370	2630
		45	8	2	1080	2152			76	16	4	1080	2152

For sizes 18" and larger consult factory with application details. All units can be provided with pipe nipples, along with anchor bases, drains and other accessories. All data is for reference only. Specific requirements should be sent to the factory for engineering review. Spring rates shown are for each bellows.

## Series 5000 BPC Bellows Pump Connector Assemblies

### Metal Bellows Pump Connector Dimensions

Dash Number	Nominal I.D. (in.)	Overall Length (in.)	Flange Thickness (in.)
-032	2	3-1/2	5/8
-040	2-1/2	3-1/2	5/8
-048	3	4	5/8
-056	3-1/2	4	5/8
-064	4	4-1/2	5/8
-080	5	4-1/2	5/8
-096	6	5	5/8
-128	8	5	5/8
-160	10	6	3/4
-192	12	6	3/4
-224	14	8	1
-256	16	8	1



### Standard Operating Specifications

Max. Operating Pressure: 150 PSI  
Max. Operating Temperature: 800 °F

#### Movements:

Axial Comp. (2" to 8" Nom.) 1/2"  
Axial Comp. (10" to 16" nom.) 3/4"  
Axial Ext. (All sizes) 1/4"  
Lateral Offset, (All Sizes) 1/8"

Flanges to mate with ANSI B16.5 150# Flange Drilling.  
If flow velocity exceeds 25 F.P.S. a liner must be added.

### Ordering Code:

Nom. Size, Dash Number,  
Liner Example:  
3" BPC -048-L  
Standard end configuration -44 (welded)

The technical statements and engineering data in this catalog is the best information available at the time of printing and are subject to change without notice. As Unaflex does not supervise or control the use of our products, we cannot be responsible for improper use or misapplication of catalog data.

# "MATCHLESS" NON-STANDARD DUAL UNIT



Dual Expansion Joints are often used where axial movement is greater than can be absorbed by a single Expansion

Joint. The dual assembly consists of two single Expansion Joints connected by an interconnecting pipe nipple. In many

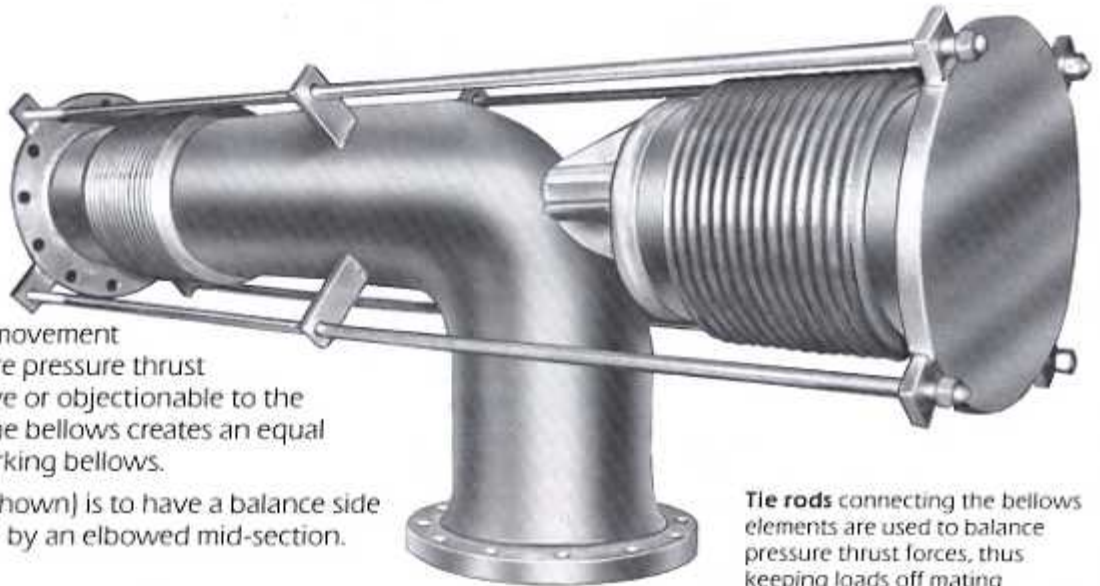
cases, this interconnecting nipple has an integral anchor base. The base is designed to withstand the forces required to move either expansion joint. When no anchor base is provided, the interconnecting nipple must be anchored with standard pipe anchors.

Dual Expansion Joints are employed where large amounts of movement in any combination are required, i.e. axial, lateral deflection and angular rotation which can not be absorbed by a single expansion joint. In these types of application, the interconnecting nipple is not anchored by the remaining system must be properly anchored and guided.

## PRESSURE-BALANCED UNIT

"Matchless" pressure balanced expansion joints are designed to absorb axial movement and/or lateral deflection where pressure thrust loading is considered excessive or objectionable to the system. The balance side of the bellows creates an equal and opposite force to the working bellows.

The typical arrangement (as shown) is to have a balance side and a working side separated by an elbowed mid-section.



Tie rods connecting the bellows elements are used to balance pressure thrust forces, thus keeping loads off mating equipment.

## SPECIAL CONSTRUCTION TYPES:

- TIED
- UNIVERSAL
- PEDESTAL
- HINGED
- GIMBAL
- EXTERNALLY GUIDED

## LINERS AND COVERS

Liners and Covers are used to provide additional protection to the thin wall bellows element of the expansion joint. Dents or other damage to the bellows will materially affect the performance of an expansion joint and a cover should be used where conditions warrant this additional protection.

Liners or internal sleeves are used to minimize contact with the medium, smooth flow, control erosion and eliminate resonance where flow velocities are high.



### FLEXIBILITY

Unaflex offers various liner designs. Drop in liners are available which allow easy maintenance and replacement. Flared liners welded directly to the expansion joint are designed to allow proper clearance for expansion joint motion.

# "TUBE-FLEX" ENGINE EXHAUST EXPANSION JOINTS



UNAFLEX "TUBE-FLEX" Series 7000 Stainless Steel Engine exhaust Expansion Joints are manufactured from a thin-gauge stainless steel tube. This tubular body is formed into corrugations forming a bellows providing a highly flexible and durable connector for the extremes of exhausting engine gases.



END CONNECTIONS	
Type W	Welding Nipples
Type T	IPT Threaded Nipples
Type FP	1/2" Thick plate flange (specify O.D. Bolt Circle, number of Bolt Holes and Bolt Hole diameter).
Type SFP	Square plate flange (specify outside dimension, Bolt pattern and Bolt hole diameter).

TYPE W Pipe Size	TYPE T Max. Operating Pressure at 70° F.	TYPE FP Standard Length (in.)	TYPE SFP Part Number
1"	40	18	7001
1-1/4"	24	18	7101
1-1/2"	20	18	7201
2"	15	18	7002
3"	8	18	7003
4"	5	18	7004
5"	3	18	7005
6"	3	18	7006
8"	3	18	7008
10"	2	18	7010
12"	2	18	7012

## U-100 STYLE EXPANSION JOINTS

UNAFLEX "TUBE-FLEX" STYLE U-100 Expansion Joints can absorb longitudinal and lateral movement in one cycle. Opposite ends of the joint can move laterally in opposite directions to complete an expansion cycle. UNAFLEX U-100 Joints can be lagged with fire-proofing insulation for fire protection without affecting flexibility.



### FEATURES:

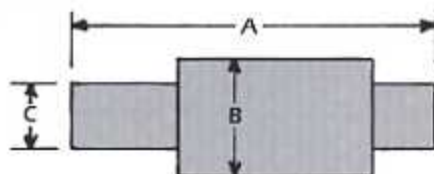
- Can be ordered packed (A) or special packed (S).
- Equipped with rigid or floating flanges (optional)
- Sizes 4" to 26" I.D.

### APPLICATIONS:

- Diesel Exhaust \*Steam Lines
- Water and Oil Lines; \*Air Intakes
- Air Service For Boilers
- Conveying Hot Liquids

## HIGH-PRESSURE EXPANSION COMPENSATORS

Designed to eliminate pipe "networks" and to save space. Their all metal construction allows use in high-pressure steam and water riser applications with pressures tested to 225 psi for recommended maximum operating pressure of 150 psi. Maximum temperatures to 850 degrees F. are allowed. Stainless steel bellows, high-quality carbon steel housings and fittings, with welded construction throughout, assures long life and maintenance free operation. Compensator ends are male threaded, weld or flanged ends are also available. Style HPNF is available with SS housing and copper sweat ends for installation in copper lines.



### STYLE HPN DIMENSIONS

Pipe Size (in)	*Dim. A	Dim. B	Dim. C	Pipe Size (in)	*Dim. A	Dim. B	Dim. C
3/4	12-3/4	2-3/8	1.050	2	14-5/8	4	2.375
1	13-1/4	2-1/2	1.315	2-1/2	16	5	2.875
1-1/4	13-1/4	3	1.660	3	16	5-9/16	3.500
1-1/2	14-5/8	3-1/2	1.900	4	16-3/8	6-5/8	4.50

\* ± 1/8 inch.

# "MASTER" FLEXIBLE METAL PUMP CONNECTORS

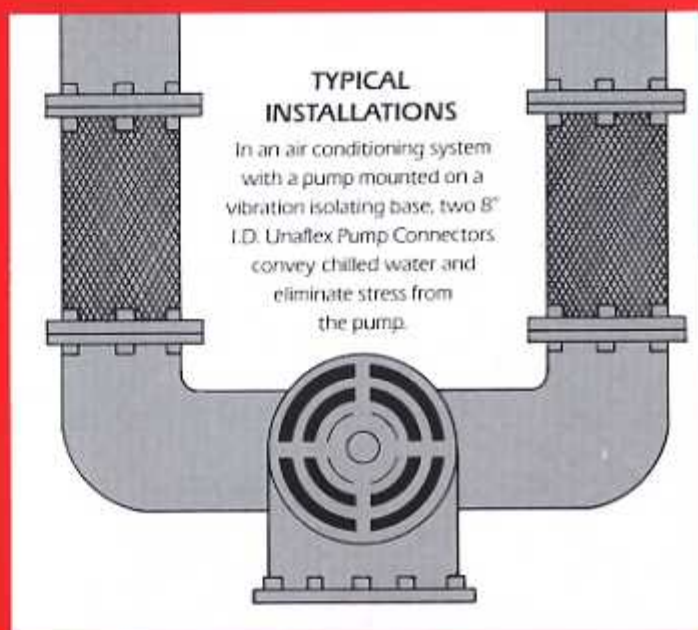


## DESCRIPTION

UNAFLEX "MASTER" Flexible Metal Pump Connectors are designed with a flexible core of corrugated tin bronze (98¾% copper, 1¼% tin), or corrugated-type 321 stainless steel tubing under the braid. Flat-face flanges are standard; however other types (150# R.F., 300#, stainless, millimetric, male nipples) are available. A wire braid is used over the flexible core on most designs to provide strength for the rated operating pressure. Braid for bronze core—98¾% copper, 1¼% tin. Braid for stainless steel core—type 321 stainless steel.

## THREADED METAL PUMP CONNECTOR SPECIFICATIONS

Part Number 8000	Nominal Hose I.D.	Overall Length (in.)	Max. Working Pressure At Room Temp. (psi)	Approx. Wt (lbs) Per Unit
8200	1/2	6-1/2	950	3/8
8750	3/4	7	700	1/2
8001	1	8	550	3/4
8250	1-1/4	8-1/2	420	1
8220	1-1/2	9	380	1-1/4
8002	2	10-1/2	300	2-1/8
8222	2-1/2	12	300	2-1/2



## FLANGED METAL PUMP CONNECTORS SPECIFICATIONS

Part Number 8000	Flange IPS And Nominal Hose I.D. (in.)	Overall Length (in.)	Max. Working Pressure At Room Temp. (psi)	Approx. Wt (lbs) Per Unit
8202	2-1/2	9"	250	16
8003	3	9"	250	19
8203	3-1/2	9"	200	23
8004	4	9"	200	19
8005	5	11"	200	32

Part Number 8000	Flange IPS And Nominal Hose I.D. (in.)	Overall Length (in.)	Max. Working Pressure At Room Temp. (psi)	Approx. Wt (lbs) Per Unit
8006	6	11"	200	40
8008	8	12"	200	62
8010	10	13"	150	101
8012	12	14"	125	153
8014	14	14"	100	200

# "INTER-FLEX" INTERLOCKED FLEXIBLE METAL TUBING



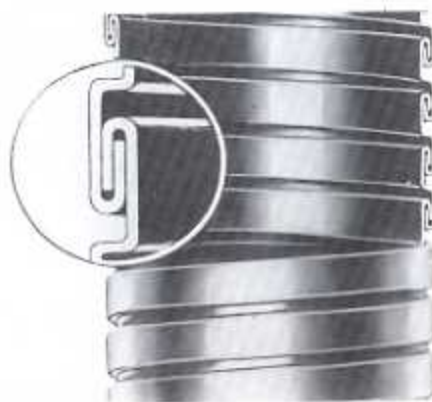
## Description:

UNAFLEX "INTER-FLEX" Styles U-12 and U-20 Interlocked Flexible Metal Tubing is constructed of a variety of metals (galvanized or bright steel, aluminum, brass, bronze or stainless steel) in strip thicknesses of .010" to .012" (Style U-12), and .018" to .020" (Style U-20). Coupling options available are: soldered, brazed or welded-on pipe

nipples, couplings or flanges. Special fittings are also available on request. They are widely used in the industrial, marine and automotive fields for armoring, shielding and as conveyor hose. Extreme flexibility, ruggedness and their ability in achieving irregular curves and angles makes them ideal for a wide variety of applications.

## APPLICATIONS:

- Ventilator, blower hose
- Hot air, fume, fresh air ducts
- Shielding electrical wiring, conduit and refrigeration lines
- Engine exhaust
- Breather tube connections
- Heater connections
- Bendable tail pipes
- Exhaust fume collectors



## STYLE U-12 (LIGHT-WEIGHT GALVANIZED) SPECIFICATIONS

### UNPACKED

I.D. (in.)	O.D. (in.)	Inside Diameter of Bend (in.)	Approx. Wgt. Per Ft. Lbs.	I.D. (in.)	O.D. (in.)	Inside Diameter of Bend (in.)	Approx. Wgt. Per Ft. Lbs.
1/2	5/8	5	.14	2-1/2	2-5/8	18-1/2	.85
5/8	3/4	6	.17	2-5/8	2-3/4	19-1/2	.89
3/4	7/8	6-1/2	.20	2-3/4	2-7/8	20-1/2	.93
7/8	1	7	.25	2-7/8	3	21-1/2	.97
1	1-1/8	8	.28	3	3-1/8	22-1/2	1.00
1-1/8	1-1/4	9	.31	3-1/8	3-1/4	23	1.06
1-1/4	1-3/8	10	.35	3-1/4	3-3/8	24	1.10
1-3/8	1-1/2	10-3/4	.38	3-3/8	3-1/2	25	1.14
1-1/2	1-5/8	11	.49	3-1/2	3-5/8	26	1.18
1-5/8	1-3/4	12	.53	3-3/4	3-7/8	28	1.27
1-3/4	1-7/8	13	.57	4	4-1/8	30	1.35
1-7/8	2	14	.61	4-1/4	4-3/8	32	1.40
2	2-1/8	15	.66	4-1/2	4-5/8	34	1.50
2-1/8	2-1/4	16	.72	5	5-1/8	38	1.65
2-1/4	2-3/8	17	.76	6	5-1/8	44	1.90
2-3/8	2-1/2	17-1/2	.81	8	8-1/8	60	2.92

To obtain weight of metals other than steel multiply by the given factor: Aluminum—.344 Brass—1.08 Bronze—1.12 Stainless Steel—1.02. All weights and lengths are measured with hose extended. Also available with Asbestos or Copper packing.

## STYLE U-20 (HEAVY-DUTY GALVANIZED) SPECIFICATIONS

### UNPACKED

I.D. (in.)	O.D. (in.)	Inside Diameter of Bend (in.)	Approx. Wgt. Per Ft. Lbs.	I.D. (in.)	O.D. (in.)	Inside Diameter of Bend (in.)	Approx. Wgt. Per Ft. Lbs.
2	2-1/4	18	1.25	4	4-1/4	36	2.50
2-1/4	2-1/2	21	1.40	4-1/2	4-3/4	40	2.80
2-1/2	2-3/4	23	1.55	5	5-1/4	45	3.30
2-3/4	3	26	1.70	6	6-1/4	52	4.20
3	3-1/4	29	1.85	8	8-1/4	72	6.20
3-1/4	3-1/2	31	1.98	10	10-1/4	94	8.20
3-1/2	3-3/4	33	2.10	12	12-1/4	116	10.20
3-3/4	4	35	2.30				

To obtain weight of metals other than steel multiply by the given factor: Aluminum—.344 Brass—1.08 Bronze—1.12 Stainless Steel—1.02. Also available with Asbestos or Copper packing. All weights and lengths are measured with hose extended.

# FLEXIBLE CORRUGATED METAL HOSE AND ASSEMBLIES



**UNAFLEX "FLEXIBLE" Metal Hoses** are designed as general all-purpose hose for conveying liquids and gases. They are pressure-tight and are used for applications involving vibration or flexure. They are available as Series SS—stainless steel types 304, 321 and 316L or Series B—Bronze.

**Series SS** (standard gauge) hoses are constructed of close pitch, annular corrugation in 1) hose only; 2) hose with single braid; or 3) hose with double braid configurations.

**Series B** hoses are constructed with annular corrugations from seamless tin bronze tubing usually covered with a bronze wire braid.

## UNAFLEX FITTINGS

Offers industry's widest range of standard fittings for use in metal hose assemblies. Practically any fitting can be attached to corrugated metal hose. Welding or brazing must be compatible with the metals used. Available in a wide selection of materials.

**A. Male Nipple:** Available in all sizes and materials (MN).

**B. Hex Male Nipple:** Available in 1/4" to 1-1/2" in brass, steel and stainless steel (HMN).

**C. Female Adaptor Unions:** Available in brass only, 1/4" to 3". Male adaptor unions available in certain sizes (FAU).

**D. Female Pipe Unions:** Available in 1/4" to 4" in all metals and standard pressure ratings (FPU).

**E. Fixed Flange:** Available in ASA, MSS or plate. Materials include forged steel, stainless steel, monel, aluminum and brass (FPF).

**F. Floating Flange:** Normally forged steel, supplied with stub end suitable for material handled. All flanges available in standard or special drillings as required (FSF).

**G. Female Pipe Couplings:** Available in standard sizes and most materials (FPC).

## SERIES SS—CORRUGATED METAL HOSE SPECIFICATIONS

Nominal I.D. (in.)	Hose Type	Max. O.D. (in.)	Wall Thickness (in.)	Minimum Radius Constant Flexing	Bend (in.) Static Bend	Maximum Working Pressure (PSIG) 70° F	Maximum Test Pressure (PSIG) 70° F	Nominal Burst Pressure (PSIG) 70° F
1/4	SS-0	.455	.012	4	1	255	—	4500
	SS-1	.500				1125	1687	6600
	SS-2	.545				1650	2475	—
3/8	SS-0	.645	.012	6	1-1/8	255	90	—
	SS-1	.695				875	1312	3500
	SS-2	.745				1300	1950	5250
1/2	SS-0	.790	.012	8	1-1/2	60	90	—
	SS-1	.850				875	1312	3500
	SS-2	.920				1300	1950	5200
3/4	SS-0	1.080	.012	7-1/2	1-1/4	40	60	—
	SS-1	1.140				600	900	2400
	SS-2	1.210				900	1350	3600
1	SS-0	1.56	.014	8	2-1/2	40	60	—
	SS-1	1.62				600	900	2400
	SS-2	1.70				990	1485	3960
1-1/4	SS-0	1.85	.014	9	3	24	36	—
	SS-1	1.91				500	750	2000
	SS-2	1.97				825	1238	3300
1-1/2	SS-0	2.19	.014	11	3-1/2	20	30	—
	SS-1	2.27				425	637	1700
	SS-2	2.35				700	1050	2800
2	SS-0	2.83	.014	12	4-1/2	15	23	—
	SS-1	2.91				400	600	1600
	SS-2	2.99				660	990	2640
2-1/2	SS-0	3.31	.016	13	5	12	18	—
	SS-1	3.43				380	570	1520
3	SS-0	3.92	.016	16	7-1/2	8	12	—
	SS-1	4.04				285	428	1140
3-1/2	SS-0	4.43	.016	17	8	7.6	11	—
	SS-1	4.55				275	413	1100
4	SS-0	4.97	.016	20	10	5	7.5	—
	SS-1	5.09				250	375	1000
5	SS-0	6.01	.018	24	12	3.5	5.3	—
	SS-1	6.17				225	338	900
6	SS-0	6.97	.018	30	15	3	4.5	—
	SS-1	7.13				200	300	800
8	SS-0	9.08	.020	40	20	2.7	4.1	—
	SS-1	9.33				185	278	740
10	SS-0	11.19	.024	50	25	2.2	3.3	—
	SS-1	11.44				175	263	700
12	SS-0	13.25	.024	60	30	1.8	2.7	—
	SS-1	13.50				160	240	640

SS-0—Hose only  
SS-1—Hose with single braid  
SS-2—Hose with double braid

The pressure rating and outside diameter in the above data are based upon the wire braid manufactured by National Standards.

\*Heavy duty hose is available for size 1"-2". Consult UNAFLEX Engineering for specific applications.



**Temperature Conversion Factors**  
Apply to pressure rating for elevated temperatures.

Temperature F°	Material		
	Stainless Steel	Steel	Bronze
70	1.00	1.00	1.00
150	.97	.99	.92
200	.94	.97	.89
250	.92	.96	.86
300	.89	.93	.83
350	.86	.91	.81
400	.83	.87	.78
450	.81	.86	.75
500	.78	.81	
600	.74	.74	
700	.70	.66	
800	.66	.52	
900	.62	.50	
1000	.60		
1100	.58		
1200	.55		
1300	.50		
1400	.44		
1500	.40		

### Temperature

As the working temperature increases, the pressure ratings of corrugated hose decreases. The following charts can be used as a reference.

**Maximum Service Temperature**

Alloy	Maximum Temp. °F.	Alloy	Maximum Temp. °F.
<b>AISI Stainless Steel Type</b>		<b>Brazing (BCu-Zn-C or BCu-P-Z)</b>	
321	1500	Bronze Hose	450
316L	1500	Steel Hose	850
304	850	Silver Brazing (AWS-B-Ag-2)	600
Mild Steel	850	Asbestos Packing Grade	400
Malleable Iron	800	Commercial Asbestos	550
Bronze	450	A Asbestos	600
Brass	450	AA Asbestos	750
Copper	400	AAA Asbestos	900
Aluminum 525-0 (5052-0)	600	AAAA Asbestos	200
Galvanizing	450	Cotton Cord Packing	
Soft Solder (Pb: 60, Sn: 40)	250		
Soft Solder (Pb: 95, Sn: 5)	350		

## SERIES B—BRONZE CORRUGATED HOSE SPECIFICATIONS

Nominal I.D. (in.)	Hose Type	Max. O.D. (in.)	Minimum C/L Bend Radius For		Minimum Exposed Length For Normal Vibration (in.)	Pressure Data				Approx. Weight Per Foot (lbs.)		
			Constant Flexure (in.)	Permanent Bend (in.)		Max. Pressure Unbraided and Unrestrained (psi)	Rated Burst Pressure (psi)		Maximum Test Pressure (psi)			
							Reusable Fittings	Welded Fittings				
1/4	B-0	.460	4-1/2	1	4	220	3500	3500	1750	.11		
	B-1	.520				—				5200	2300	.19
	B-2	.580				—				—	—	—
5/16	B-0	.565	4-1/2	1-1/8	4-1/4	135	3200	3200	1600	.17		
	B-1	.625				—				4500	2200	.28
	B-2	.685				—				—	—	—
3/8	B-0	.645	5	1-1/4	4-1/2	110	2800	2800	1400	.20		
	B-1	.725				—				4000	2000	.33
	B-2	.805				—				—	—	—
1/2	B-0	.895	6	1-1/2	5	60	2100	2100	1050	.34		
	B-1	.975				—				3500	1250	.54
	B-2	1.055				—				—	—	—
3/4	B-0	1.210	7	2	6	55	1800	1800	900	.65		
	B-1	1.320				—				3200	1000	.99
	B-2	1.430				—				—	—	—
1	B-0	1.465	8	3	7	50	1200	1500	750	.69		
	B-1	1.575				—				2500	900	1.10
	B-2	1.685				—				—	—	—
1-1/4	B-0	1.775	9	3-1/4	7-1/2	45	1000	1200	600	.98		
	B-1	1.885				—				1800	850	1.53
	B-2	1.995				—				—	—	—
1-1/2	B-0	2.090	10	3-1/2	8	35	900	1200	600	1.30		
	B-1	2.230				—				1800	650	2.00
	B-2	2.370				—				—	—	—
2	B-0	2.715	11	6-1/4	9-1/2	12	650	800	400	1.89		
	B-1	2.855				—				1400	525	2.79
	B-2	2.995				—				—	—	—
2-1/2	B-0	3.340	14	9-1/2	10-1/2	11	450	950	420	2.42		
	B-1	3.510				—				1600	420	3.76
	B-2	3.680				—				—	—	—
3	B-0	3.965	18	12-3/4	11	10	400	500	250	3.23		
	B-1	4.135				—				800	400	4.71
	B-2	4.305				—				—	—	—

B-0—Hose only  
 B-1—Hose with single braid  
 B-2—Hose with double braid  
 To calculate maximum pressure on above, divide rated burst pressure by 4 (four).

# UNAFLEX OFFERS THE BEST OF BOTH WORLDS, RUBBER COVERED METAL HOSE



### SERPENT RUBBER COVERED METAL HOSE

There are those applications where a corrugated inner liner of stainless steel, bronze or Monel are the answer to your chemical transfer problems. When this is the case, you do not have to sacrifice the handling characteristics, safety and durability of a rubber hose. UNAFLEX combines the two through a proprietary vulcanization process which adheres the scuff and abrasion resistant cover directly to the wire reinforced metal hose.

ISO 9001:2000 CERTIFIED

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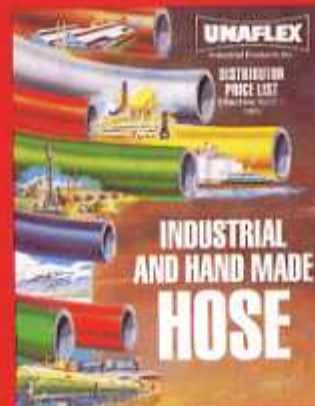
Pompano Beach, Florida 33064

Phone: (954) 943-5002

1-800-327-1286

FAX: (954) 941-7968

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