



Flexible Tubing Solutions

Metallic Expansion Joints / Bellows

Types of Expansion joints

Single Expansion Joint

A simple form of the expansion joint to absorb a combination of three movements i.e. axial, lateral and angular movement along the axis of pipe line.

Universal Expansion Joint

Universal expansion joint is one containing two bellows joined with a spool piece to absorb a combination of three movements i.e. axial, lateral and angular movement along the axis of the pipe line.

However it mainly absorbs a large amount of lateral movement.

Universal Tied Expansion Joint

This type of joint is one containing two bellows joined with a spool piece with control rod arrangements. The primary purpose of this arrangement is to accept/absorb large amounts of lateral deflection in one direction by restraining the pressure thrust.

Hinged Expansion Joint

These are of either single or universal type and permit angular rotation in one plane only by use of a pair of pins through hinge plates.

Gimbal Expansion Joint

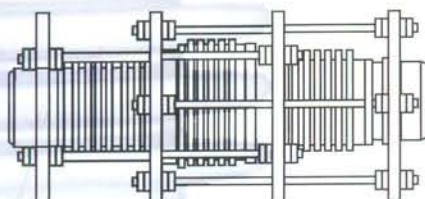
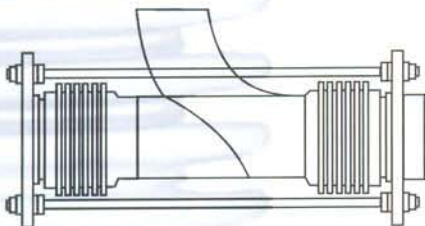
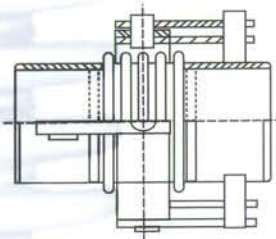
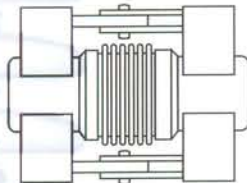
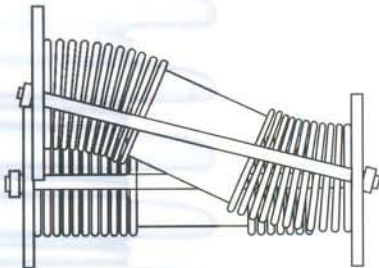
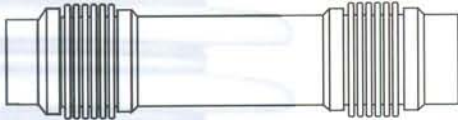
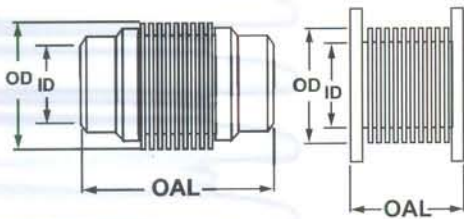
This type permits angular rotation in any plane. It consists of two pairs of hinges attached to a common floating gimbal ring.

Pressure Balanced Elbow Expansion Joint

This type is used where a change of direction occurs in a pipe line and pressure thrust is required to be absorbed. These joints can absorb axial and lateral movement.

In-line Pressure Balanced Expansion Joint

This is used where there is no change of direction in a pipe line. These joints can absorb axial and lateral movement there by restraining pressure thrust force.



In addition, we also manufacture rectangular bellows to any size in rectangular shapes with different corners including the fabricated types.

Metallic Expansion Joints / Bellows



Flexible Tubing Solutions

Types of accessories and its purpose

The following accessories are primarily used in conjunction with different types of expansion joints considering pressure rating, temperature and movement.

Shroud

It is a device used to provide required external protection to the bellows of an expansion joint assembly from foreign particles or mechanical damage.

Control rods

Rods or bars that limit the travel of individual bellows in a universal expansion joint where each bellow absorbs required/ specified motion. Control rods are not designed to withstand pressure thrust loads.

Limit rods

These rods or bars are used to restrict the movement range of the bellows. These are designed to prevent over extension or over compression of the bellows while restraining the full pressure thrust.

Tie rods

These rods or bars are attached to the expansion joint assembly and continuously restrain full pressure thrust while permitting only lateral movement.

Internal sleeve

A device which minimizes contraction between the inner surface of the bellows of an expansion joint and the fluid flowing through it to ensure smooth flow without pressure drop.

Tangent

The straight unconvoluted portion at the extremities of the bellows.

Weld ends

An expansion joint with pipe-ends to facilitate welding to adjacent equipment or pipes.

Flanged ends

An expansion joint with flanged ends that can be attached to adjacent equipment or piping with flanged ends using bolts / fasteners.



Bengal Industries Pvt. Ltd.

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Flexible Tubing Solutions

Stainless Steel Hoses and Hose Assemblies

Flexible Hoses

Flexible Hoses are manufactured by forming annular corrugations, of equal pitch over thin walled longitudinally butt welded stainless steel tubes.

Flexible hose assemblies are manufactured in three different types as per ISO 10380:2012

- **Type 1-50** : Corrugated Metal Hoses of flexibility with high fatigue life;
- **Type 1-10** : Corrugated Metal Hoses of flexibility with medium fatigue life;
- **Type 2-10** : Corrugated Metal Hoses of average flexibility;
- **Type 3** : Corrugated Metal Hoses where only pliability is required.

Bengal Industries is capable of developing flexible hose assemblies with specified working pressure, fatigue life and bend radius within allowable limits.

Advantages of Flexible Metal Hose

- High physical strength combined with light weight.
- Suitable for wide temperature range (-270°C to $+700^{\circ}\text{C}$)
- Good corrosion resistance.
- Resistance to fire, moisture, abrasion and penetration.
- Absorbs vibration and noise from pumps, compressors, engines etc.
- Compensates for intermittent or constant movement.
- Compensates for thermal expansion or contraction of piping.
- Corrects problems of misalignment.
- A flexible and quick alternative for rigid piping in difficult locations.

Lance Hoses

An import substitute product, developed and manufactured by us. These hoses distinguish themselves due to their good performance in adverse and hostile conditions.

These ultrasonically cleaned and degreased hoses are pressure tight, are leak proof under vacuum conditions and can be used with or without inside interlocked liner.

We have successfully supplied and are getting repeat orders for Water and Oxygen Lance Hoses from Steel Plants like Tisco, Rourkela, Vishakhapatnam, JSW, Bokaro to name a few.

Highly Critical application Hoses have been supplied to India Space Research Organisation and department of Atomic Energy.





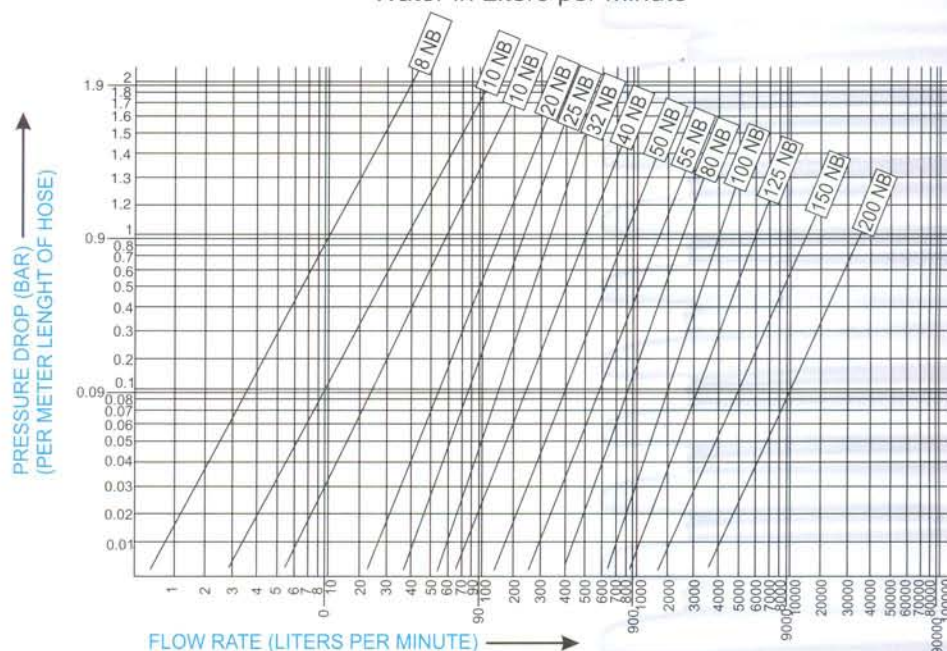
Pressure Loss

The pressure loss in corrugated hoses is 100% higher than in new steel pipes, because the bore of a corrugated hose is not smooth. This means that in the case of corrugated hoses, an increase in diameter of 15% is required to reduce the pressure loss to the value of the pressure loss in steel pipes.

The chart shows the approximate pressure drop for each size of corrugated hose related to a flow rate where water is the fluid. To utilize the chart, read off on the base line the flow rate required.

Where a vertical line from the selected point on the base line intersects the nominal bore line, the pressure drop is shown on the vertical axis, corresponding to the point of intersection.

Chart Indicating the Approximate Pressure Drop Per Meter Length in Corrugated Hoses Corresponding to flow rate of Water in Liters per minute



NOTE: 1 PSI PER FOOT = 0.226 bar PER METER
1 GALLON PER MINUTE = 4.546 LITERS PER MINUTE

Temperature Correction Factor

Where hoses are required to work at higher temperatures, the working pressure given in Table, should be multiplied by the correction factor. This will determine the pressure rating of the hoses at the higher temperature.

Temperature Range		Correction Factor 'F' _t		
°C	°F	Material		
		1.4541 (SS 321)	1.4404 & 1.4306 (SS316L & SS304L)	Carbon Steel
> -200 ≤ -20	> -328 ≤ -4	1	1	-
> -20 ≤ 50	> -4 ≤ 122	1	1	1
> 50 ≤ 100	> 122 ≤ 212	0.96	0.94	0.91
> 100 ≤ 150	> 212 ≤ 302	0.92	0.90	0.83
> 150 ≤ 200	> 302 ≤ 392	0.88	0.86	0.74
> 200 ≤ 250	> 392 ≤ 482	0.84	0.82	0.66
> 250 ≤ 300	> 482 ≤ 572	0.80	0.78	0.59
> 300 ≤ 350	> 572 ≤ 662	0.76	0.74	0.54
> 350 ≤ 400	> 662 ≤ 752	0.72	0.70	0.52
> 400 ≤ 450	> 752 ≤ 842	0.66	0.66	-
> 450 ≤ 500	> 842 ≤ 932	0.60	0.60	-
> 500 ≤ 550	> 932 ≤ 1022	0.54	-	-
> 550 ≤ 600	> 1022 ≤ 1112	0.44	-	-
> 600 ≤ 650	> 1112 ≤ 1202	0.36	-	-

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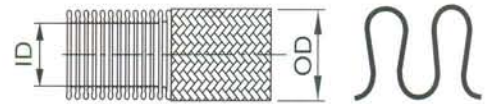


Flexible Tubing Solutions

Technical Data for Special Series Hose

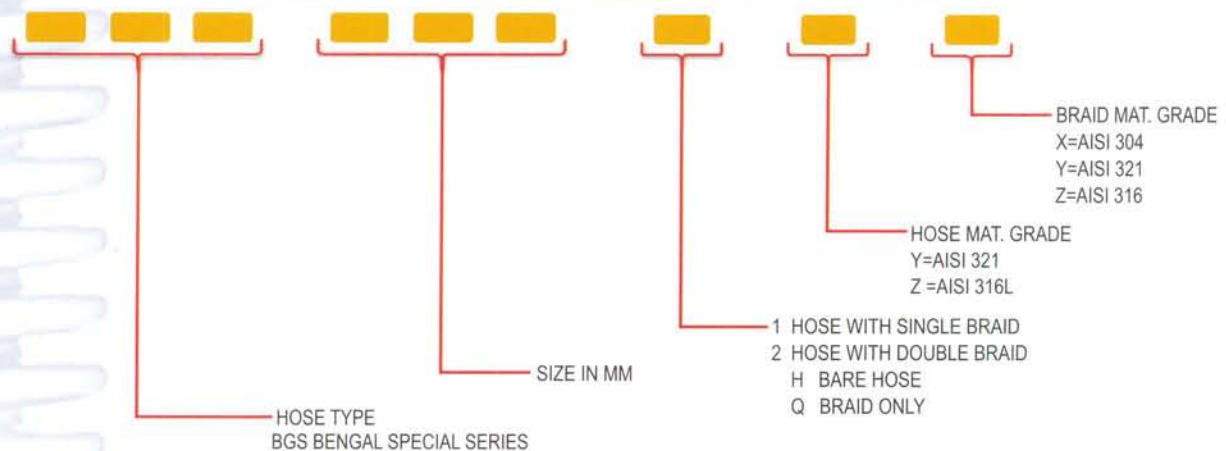
Stainless Steel Hoses and Hose Assemblies

Special Series Hose (BGS)



TYPE	NOMINAL HOSE ID	NOMINAL SIZE	HOSE+ BRAID	BEND RADIUS		WT. OF HOSE+BRAID KG/MTR.	WORKING PR (BAR)	WORKING PR (BAR)	PACKING (MTR)	STANDARD PACK LENGTH (MTR)
	ID INCH	MM		STATIC MM	DYNAMIC MM		SINGLE BRAID	DOUBLE BRAID		STRAIGHT
BGS	3/4"	0020	28.5	115	285	0.600	64	102.4		As per Customer Requirement.
BGS	1"	0025	35.5	135	325	0.800	50	80		
BGS	1"	025A	38	135	325	1.660	130	208		
BGS	1-1/4"	0032	44	190	380	1.105	42	67.2		
BGS	1-1/4"	032A	45.5	190	380	1.530	51	81.6		
BGS	1-1/2"	0040	56.5	240	430	2.270	50	80		
BGS	2"	0050	67.5	280	490	2.640	43	68.8		
BGS	2-1/2"	0065	84	300	580	3.620	38	60.8		
BGS	3"	0080	99.5	410	800	4.955	45	72		
BGS	3-1/2"	0090	106	430	900	3.720	16	25		
BGS	4"	0100	120	450	1000	3.970	19	30.4		
BGS	4"	100A	121	460	1000	5.230	27	43.2		
BGS	4"	100B	120	480	1000	6.040	27	43.2		
BGS	5"	0125	148	520	1250	6.950	21	33.6		
BGS	6"	0150	178	600	1550	11.280	21	33.6		
BGS	7"	0175	206	650	1800	12.100	12	20		
BGS	8"	0200	231.5	700	2000	13.620	15	24		

Hose Nomenclature



Example:

BGS00202YX refers to Bengal Special Series 20 NB Hose With Double Braid, Hose Mat. SS 321 & Braid Mat. SS 304.
BGS00201YZ refers to Bengal Special Series 20 NB Hose With Single Braid, Hose Mat. SS 321 & Braid Mat. SS 316.
BGS0020HY refers to Bengal Special Series 20 NB Bare Hose, Hose Mat. SS 321.

Note:

The above data are subject to change without notice.

The above values apply only to Bengal Braided hose and assemblies at ambient temperature.

For the above values tolerances are applicable.

Test Pressure is 1.5 times working Pressure.

Burst Pressure is 4 times Working Pressure.

Other types of special hoses can be designed and manufactured based on customers requirement.

Technical Data for Interlock Hoses

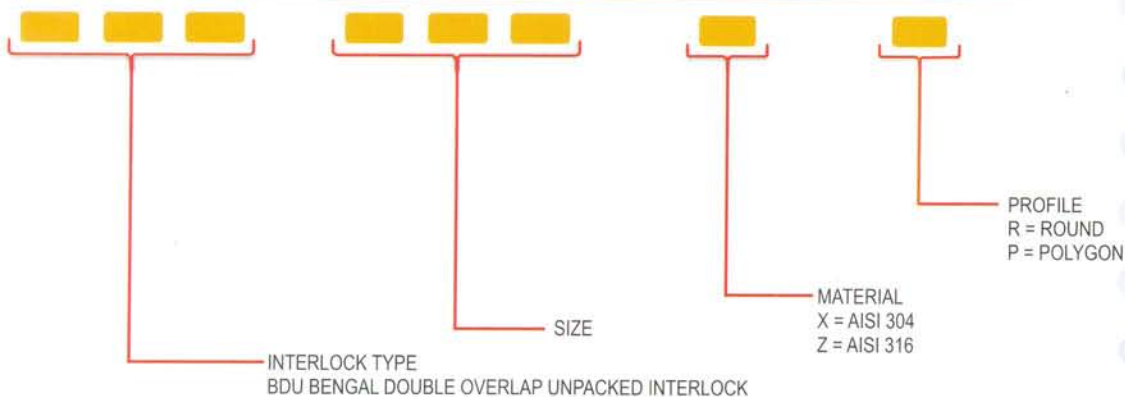
Double Overlap Unpacked Interlock (BDU)



TYPE	SIZE	INSIDE DIAMETER	OUTSIDE DIAMETER	MINIMUM BEND RADIUS	COIL THK.
	(mm)	ID(mm)	OD(mm)	(mm)	(mm)
BDU	014	14	17.2	130	0.3
BDU	028	28	31.2	203	0.3
BDU	032	32	35.2	205	0.3
BDU	037	37	41	245	0.3
BDU	040	40	44	250	0.3
BDU	042	42	46	255	0.3
BDU	045	45	49	260	0.3
BDU	048	48	52	265	0.3
BDU	050	50	54	305	0.3
BDU	055	55	59	335	0.3
BDU	057	57	61	355	0.3
BDU	060	60	64	360	0.3
BDU	065	65	69	365	0.3
BDU	067	67	71	385	0.3
BDU	070	70	74	390	0.3
BDU	075	75	79	395	0.3
BDU	080	80	84	400	0.3
BDU	081	81	85	465	0.3
BDU	085	85	89	470	0.3
BDU	090	90	94	475	0.3
BDU	095	95	99	480	0.4
BDU	100	100	104	485	0.4
BDU	105	105	110	550	0.4
BDU	110	110	115	570	0.4
BDU	115	115	120	590	0.4
BDU	120	120	125	610	0.4
BDU	125	125	130	625	0.4
BDU	128	128	134	675	0.4
BDU	130	130	136	700	0.4
BDU	135	135	141	720	0.4
BDU	146	136	142	740	0.4
BDU	140	140	146	760	0.4
BDU	145	145	151	780	0.4

TYPE	SIZE	INSIDE DIAMETER	OUTSIDE DIAMETER	MINIMUM BEND RADIUS	COIL THK.
	(mm)	ID(mm)	OD(mm)	(mm)	(mm)
BDU	150	150	156	805	0.4
BDU	153.5	153.5	159.5	835	0.4
BDU	155	155	161	840	0.4
BDU	160	160	166	860	0.4
BDU	165	165	171	880	0.4
BDU	170	170	176	900	0.5
BDU	175	175	181	910	0.5
BDU	180	180	186	930	0.5
BDU	185	185	191	950	0.5
BDU	190	190	196	970	0.5
BDU	195	195	201	990	0.5
BDU	200	200	206	1000	0.5
BDU	205	205	212	1040	0.5
BDU	210	210	217	1050	0.5
BDU	215	215	222	1060	0.5
BDU	220	220	227	1080	0.5
BDU	225	225	232	1100	0.5
BDU	230	230	237	1120	0.5
BDU	235	235	242	1140	0.5
BDU	240	240	247	1160	0.5
BDU	245	245	252	1180	0.5
BDU	250	250	257	1200	0.5
BDU	255	255	262	1270	0.6
BDU	260	260	267	1310	0.6
BDU	265	265	272	1330	0.6
BDU	270	270	277	1350	0.6
BDU	275	275	282	1370	0.6
BDU	280	280	287	1390	0.6
BDU	285	285	292	1410	0.6
BDU	290	290	297	1430	0.6
BDU	300	300	307	1450	0.6
BDU	310	310	317	1500	0.6

Interlock Nomenclature



Example:

BDU090XP refers to Bengal Double Overlap Unpacked Interlock 90 mm ID, material SS304 Polygonal Profile.
BDU090ZP refers to Bengal Double Overlap Unpacked Interlock 90 mm ID, material SS316 Polygonal Profile.
BDU090ZR refers to Bengal Double Overlap Unpacked Interlock 90 mm ID, material SS316 Round Profile.

Note:

- Other sizes can be manufactured on request. •Double Interlock hoses with packing can also be supplied (Copper coated MS Wire, Rubber).
- The above data are subject to change without notice. •For the above values tolerances are applicable.
- Test Pressure is 1.5 times working Pressure. •Burst Pressure is 4 times Working Pressure.

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Stainless Steel Hoses and Hose Assemblies

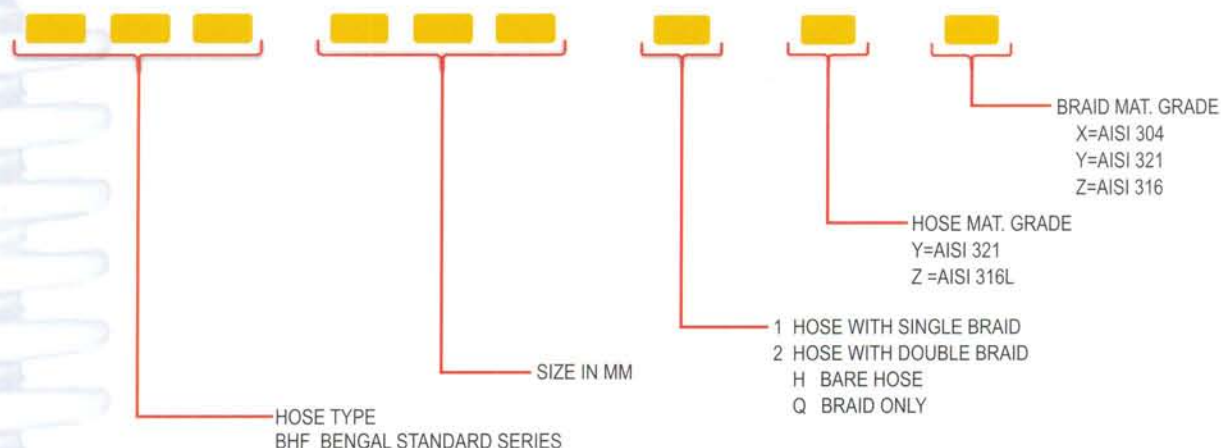
Technical Data for Heavy Highflex Series Hose

Heavy Highflex Series Hose (BHF)



TYPE	NOMINAL HOSE ID	NOMINAL SIZE	HOSE+ BRAID	BEND RADIUS		WT. OF HOSE+BRAID	WORKING PR (BAR)	WORKING PR (BAR)	PACKING (MTR)	STANDARD PACK LENGTH (MTR)
	ID INCH	MM	OD MM	STATIC MM	DYNAMIC MM	KG/MTR.	SINGLE BRAID	DOUBLE BRAID	DRUM	STRAIGHT
BHF	1"	025	36	77	170	0.864	50	80	100	20
BHF	1-1/4"	032	44	94	213	1.097	42	67	100	20
BHF	1-1/2"	040	54	111	213	1.366	32	51	60	20
BHF	2"	050	67.5	149	298	1.930	31	49	60	20
BHF	2-1/2"	065	83.5	170	349	2.523	26	41	--	20
BHF	3"	080	97.5	174	383	2.730	18	28	--	20
BHF	4"	100	119.5	196	476	3.840	16	26	--	20
BHF	5"	125	148.5	238	561	6.070	16	25	--	15
BHF	6"	150	178.5	272	693	7.610	12	20	--	15
BHF	8"	200	231.5	370	863	12.528	10	16	--	15

Hose Nomenclature



Example:

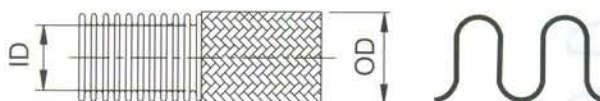
BHF0252YX refers to Bengal High Flex 25 NB Hose With Double Braid, Hose Mat. SS 321 & Braid Mat. SS 304.
 BHF0251YZ refers to Bengal High Flex 25 NB Hose With Single Braid, Hose Mat. SS 321 & Braid Mat. SS 316.
 BHF025HY refers to Bengal High Flex 25 NB Bare Hose, Hose Mat. SS 321.
 BHF0251YZ refers to Bengal High Flex 25 NB Hose With Single Braid, Hose Mat. SS 321 & Braid Mat. SS 316.

Note:

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 The above values apply only to Bengal Braided hose and assemblies at ambient temperature.
 For the above values tolerances are applicable.
 Test Pressure is 1.5 times working Pressure.
 Burst Pressure is 4 times Working Pressure.

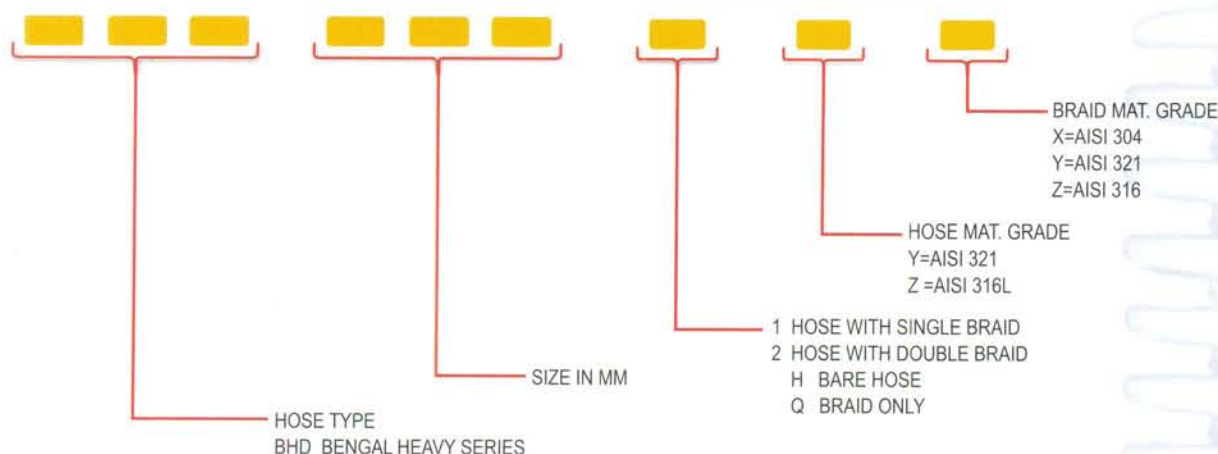
Technical Data for Heavy Series Hose

Heavy Series Hose (BHD)



TYPE	NOMINAL HOSE ID	NOMINAL SIZE	HOSE+ BRAID	BEND RADIUS		WT. OF HOSE+BRAID	WORKING PR (BAR)		PACKING (MTR)	STANDARD PACK LENGTH (MTR)	
	ID INCH	MM		STATIC MM	DYNAMIC MM		SINGLE BRAID	DOUBLE BRAID		DRUM	STRAIGHT
BHD	1"	025	36	90	200	0.780	50	80	100	20	
BHD	1-1/4"	032	44	110	250	0.958	42	67	100	20	
BHD	1-1/2"	040	54	130	250	1.230	32	51	60	20	
BHD	2"	050	67.5	175	350	1.750	31	49	60	20	
BHD	2-1/2"	065	83.5	200	410	2.290	26	41	--	20	
BHD	3"	080	97.5	205	450	2.470	18	28	--	20	
BHD	4"	100	119.5	230	560	3.460	16	26	--	20	
BHD	5"	125	148.5	280	660	5.483	16	25	--	15	
BHD	6"	150	178.5	320	815	6.850	12	20	--	15	
BHD	8"	200	231.5	435	1015	11.160	10	16	--	15	
BHD	10"	250	284.5	560	1220	15.700	6.5	10.5	--	10	

Hose Nomenclature



Example:

BHD0252YX refers to Bengal Heavy Series 25 NB Hose With Double Braid, Hose Mat. SS 321 & Braid Mat. SS 304.

BHD0251YZ refers to Bengal Heavy Series 25 NB Hose With Single Braid, Hose Mat. SS 321 & Braid Mat. SS 316.

BHD025HY refers to Bengal Heavy Series 25 NB Bare Hose, Hose Mat. SS 321.

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Flexible Tubing Solutions

Technical Data for Standard Series Hose

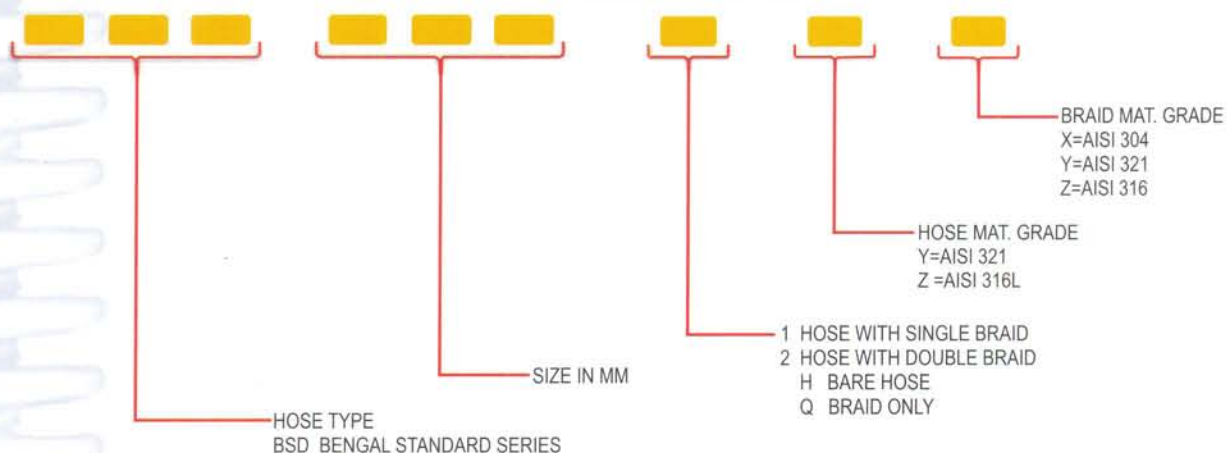
Stainless Steel Hoses and Hose Assemblies

Standard Series Hose (BSD)



TYPE	NOMINAL HOSE ID	NOMINAL SIZE	HOSE+BRAID	BEND RADIUS		WT. OF HOSE+BRAID	WORKING PR (BAR)	WORKING PR (BAR)	PACKING (MTR)	STANDARD PACK LENGTH (MTR)
	ID INCH	MM	OD MM	STATIC MM	DYNAMIC MM	KG/MTR.	SINGLE BRAID	DOUBLE BRAID	DRUM	STRAIGHT
BSD	1/4"	006	12.5	25	100	0.180	154	246	500	25
BSD	5/16"	008	13.5	35	130	0.222	120	192	500	25
BSD	3/8"	010	16	40	150	0.265	108	168	500	25
BSD	1/2"	012	19.5	50	200	0.375	88	140	300	25
BSD	5/8"	015	24	50	200	0.450	73	116	200	25
BSD	3/4"	020	28.5	70	200	0.520	64	102	200	25
BSD	1"	025	36	90	200	0.740	50	80	100	20
BSD	1-1/4"	032	42.5	110	250	0.925	42	67	100	20
BSD	1-1/2"	040	52.5	130	250	1.155	32	51	60	20
BSD	2"	050	66	175	350	1.610	31	49	60	20
BSD	2-1/2"	065	81	200	410	2.150	26	41	--	20
BSD	3"	080	97.5	205	450	2.470	18	28	--	20
BSD	4"	100	118.5	230	560	3.120	16	26	--	20
BSD	5"	125	146	280	660	4.940	16	25	--	15
BSD	6"	150	175	320	815	6.390	12	20	--	15
BSD	8"	200	228	435	1015	10.455	10	16	--	15
BSD	10"	250	284	560	1220	15.700	6.5	10.5	--	10

Hose Nomenclature



Example:

BSD0202YX refers to Bengal Std. Series 20 NB Hose With Double Braid, Hose Mat. SS 321 & Braid Mat. SS 304.

BSD0201YZ refers to Bengal Std. Series 20 NB Hose With Single Braid, Hose Mat. SS 321 & Braid Mat. SS 316.

BSD020HY refers to Bengal Std. Series 20 NB Bare Hose, Hose Mat. SS 321.

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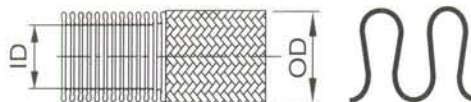
For the above values tolerances are applicable.

Test Pressure is 1.5 times working Pressure.

Burst Pressure is 4 times Working Pressure.

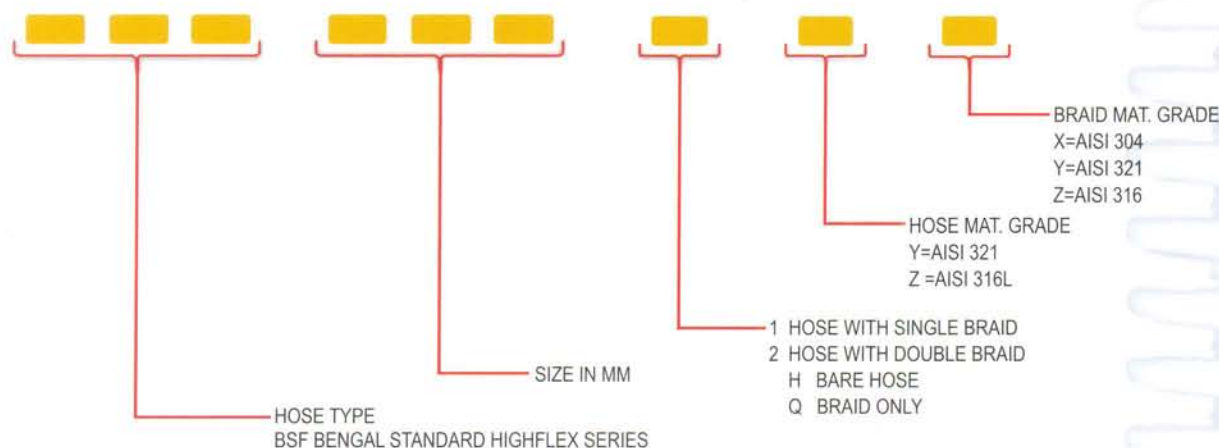
Technical Data for Standard High Flex Series Hose

Standard High Flex Series Hose (BSF)



TYPE	NOMINAL HOSE ID	NOMINAL SIZE	HOSE+ BRAID	BEND RADIUS		WT. OF HOSE+BRAID	WORKING PR (BAR)	WORKING PR (BAR)	PACKING (MTR)	STANDARD PACK LENGTH (MTR)
	ID INCH	MM		STATIC MM	DYNAMIC MM		SINGLE BRAID	DOUBLE BRAID		STRAIGHT
BSF	1/2"	012	20	43	170	0.385	88	140	300	25
BSF	5/8"	015	24	43	170	0.498	73	116	200	25
BSF	3/4"	020	28.5	60	170	0.578	64	102	200	25
BSF	1"	0.25	36	77	170	0.823	50	80	100	20
BSF	1-1/4"	032	43	94	213	1.025	42	67	100	20
BSF	1-1/2"	040	52.5	111	213	1.279	32	51	60	20
BSF	2"	050	66	149	298	1.776	31	49	60	20
BSF	2-1/2"	065	81	170	349	2.370	26	41	--	20
BSF	3"	080	97.5	174	383	2.730	18	28	--	20
BSF	4"	100	118.5	196	476	3.436	16	26	--	20
BSF	5"	125	146.5	238	561	5.412	16	25	--	15
BSF	6"	150	175.5	272	693	7.068	12	20	--	15
BSF	8"	200	228.5	370	863	11.695	10	16	--	15

Hose Nomenclature



Example:

BSF0202YX refers to Bengal std. Flex 20 NB Hose With Double Braid, Hose Mat. SS 321 & Braid Mat. SS 304.

BSF0201YZ refers to Bengal std. Flex 20 NB Hose With Single Braid, Hose Mat. SS 321 & Braid Mat. SS 316.

BSF020HY refers to Bengal std. Flex 20 NB Bare hose, hose material SS 321.

BSF0201YZ refers to Bengal std. Flex 20 NB Hose With Single Braid, Hose Mat. SS 321 & Braid Mat. SS 316.

Note:

- The above data are subject to change without notice.
- The above values apply only to Bengal Braided hose and assemblies at ambient temperature.
- For the above values tolerances are applicable.
- Test Pressure is 1.5 times working Pressure. • Burst Pressure is 4 times Working Pressure.

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Flexible Tubing Solutions

Quality



Quality Assurance at Bengal Industries is of vital importance. Every stage of production is constantly monitored by a qualified team of QC Engineers.

Bengal Industries has complete in-house testing facilities for various types of tests, as per international standards specified for metallic flexible hoses.

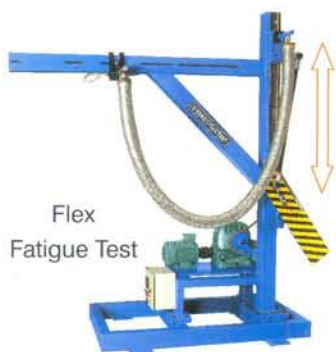
We regularly conduct :

- Pliable Test.
- Cyclic Test.
- U bend Test.
- Cantilever Bend Test.
- Burst Test.
- Elongation Test.

TUV Certified type test: All our hoses are type tested by TUV as per ISO 10380:2004 vide their certificate no. :02421998 001

Every single hose-assembly is tested hydraulically at 1.5 times working pressure before despatch. Pneumatic testing is also carried out whenever necessary. All raw material used in the manufacture of hoses, braiding and end-connections undergo rigid inspection by qualified engineers to ensure highest quality standards.

Besides stringent in-house control of quality, raw materials are being bought only from reputed manufacturers and these are regularly checked by external inspection agencies for physical and chemical properties.



Flex
Fatigue Test



Cantilever
Test



Yield Test



Applications

- Refineries
- Power Plants
- Fertilizer Industry
- Pharmaceutical Industry
- Chemical Industry
- Automotive Industry
- Steam, Hot Water, Pneumatic Service
- Vacuum Systems
- Steel Plants
- Nuclear Installations
- Cryogenic Service
- Paper Plants
- Lubrication Systems
- Defence Industry
- Boilers
- Piping
- Ports and Ship Yards
- Railways
- Aero Space
- Vibration Absorption
- Tank Terminals
- Fuel Dispensing Pumps
- Air Conditioning & Refrigeration
- Cargo Hoses for Ship loading/unloading

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Flexible Tubing Solutions

Stainless Steel Hoses and Hose Assemblies

Hose

A range of metallic flexible hoses are manufactured in different grades of stainless steel as below confirming to BS 6501-1:2004, ISO 10380:2012 and BS EN 14585-1:2006.

EN 10028-7 Specification	ASME Specification
1.4306	AISI 304L
1.4541	AISI 321
1.4404	AISI 316L

Stainless steel corrugated flexible hoses are offered from 6mm NB (1/4 ") to 250mm NB (10"). The annular corrugated hose body gives tight core to the assembly. We also manufacture highly flexible close-pitch and heavy duty hoses for special applications.

Braid

When pressure is applied, unbraided corrugated hose tends to elongate axially. To restrain this, an external layer of SS wire braid is provided. The braid also makes the assembly pressure resistant.

Sometimes two or even three layers of braiding are provided for higher pressure applications. The braiding is highly flexible and follows the movement of the hose.

Braid is normally manufactured in fully annealed stainless steel wires as per specifications given below:

EN 10028-7 Specification	ASME Specification
1.4306	AISI 304L
1.4301	AISI 304
1.4541	AISI 321
1.4404	AISI 316L
1.4401	AISI 316

Assemblies

We have in-house designing facility and regularly manufactures hoses for highly critical applications. We also manufacture specials hoses like close pitch hoses / heavy duty hoses, jacketed hose-assemblies, road tanker and ship loading and unloading hoses for liquid cargo.

The end connections are TIG Welded / Brazed by our welders approved by Lloyds register / DNV.

Welding procedures and welders are qualified as per ASME Sec IX and EN ISO 15614-1 : 2004 in compliance with PED and NACE.

Liners

Double interlock hoses are manufactured in compliance with requirement of ISO 15465:2004 in various grades of austenitic stainless steel in the range of 25 mm (1")ID to 350mm (12" ID). Both polygonal and round profiles are available as per customer's requirement and application.



Flexible Tubing Solutions

Stainless Steel Hoses and Hose Assemblies

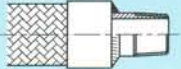
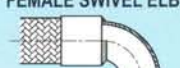
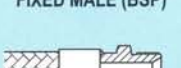
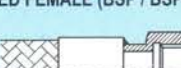
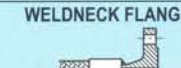
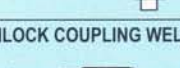
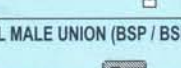
End Connections & Assemblies



End Connections

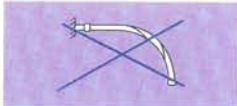
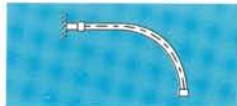
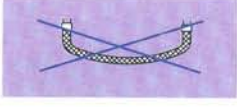
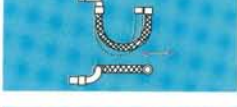
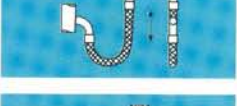
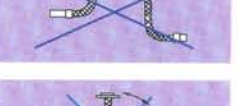
All Hose assemblies are individually made. They can have end fittings selected to suit customer requirements.

End connections can be from a wide range including male and female, BSP/ NPT threads, fixed and swivel flanges to suit various specifications, tube ends, weld ends, quick-release couplings etc.

FIXED MALE (BSP) 	THREADED PIPE END (NPT / BSPT) 	FEMALE SWIVEL NUT (37° JIC) 
PIPE END 	FIXED MALE (NPT / BSPT) 	FEMALE SWIVEL NUT 
90° FEMALE SWIVEL ELBOW 	FIXED MALE (BSP) 	FIXED FEMALE (BSP / BSPT / NPT) 
LAP JOINT FLANGE WITH STUB END 	FIXED FLANGE (SORF) 	WELDNECK FLANGE 
CAMLOCK COUPLING WELDED 	FULL FEMALE UNION (BSP / BSPT / NPT) 	FULL MALE UNION (BSP / BSPT / NPT) 

Installation

Metallic flexible hose-assemblies should be installed correctly to obtain maximum life.

Do not twist the hose			Install it torsion-free
Dimension the hose adequately			Take care that the flexible length is not too short
Avoid excessive bending of the hose			Use pipe bends
Do not move the hose obliquely to the installation plane			Movement should be along the axis of the hose only
Do not allow the hose to sag			Use a support
Avoid torsional twist when fittings are not in line			Install in one plane only
Don't permit axial movements			Install the hose vertical to the direction of movement
Do not use excess length			Dimension the exact length
Avoid torsion due to angular movements			All movements should be only along the axis of the hose

Testing & Certification

- All unbraided Hoses are subjected to leak detection using compressed air.
- All assemblies are checked for dimensional accuracy and pressure tested.
- Test certificates for pressure tests carried out will be provided.
- Tests stipulated by BS 6501 : Part 1 : 1991 / ISO 10380 : 2012 are conducted periodically.
- Raw material test certificates showing the physical and chemical properties will be furnished on request.
- Radiography, D.P. Test, Helium Leak Test will be carried out against specific customer requirements.
- The products can be supplied under any third party inspection.

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Metallic Expansion Joints / Bellows



Flexible Tubing Solutions

Welding Capabilities:

We have an experienced team of welding experts who can offer specialized solutions to meet customer specific welding requirements. Our team of welders is qualified by DNV/BVIS/LLOYDS/CUSTOMERS as per ASME Sec IX. Production and supply of a sophisticated and quality range of products has brought Bengal Industries worldwide recognition.

Type of welding facilities:

- a.) TIG welding.
- b.) MIG welding.
- c.) Longitudinal seam welding.
- d.) Resistance seam & spot welding.

Our strength in welding:

- Similar metal welding (Stainless Steel to Stainless Steel)
- Dissimilar metal welding (Stainless Steel to Carbon Steel, S.S to Cu-Ni, S.S to Hastelloy, S.S to Monel)
- Heat resistant metals welding (Inconel 600, 625, 800, 825, Hastelloy C22)



Design capabilities:

The design of bellows is determined considering parameters such as temperature, pressure, types of movement to be absorbed in the pipe line (axial ,lateral, angular) and flow media.

Bengal has a team of qualified and trained engineers to design bellows for specific application. We have dedicated CAD workstations and use the latest CAD software for 2-D, 3-D modeling and simulation by Finite Element Analysis for critical applications.

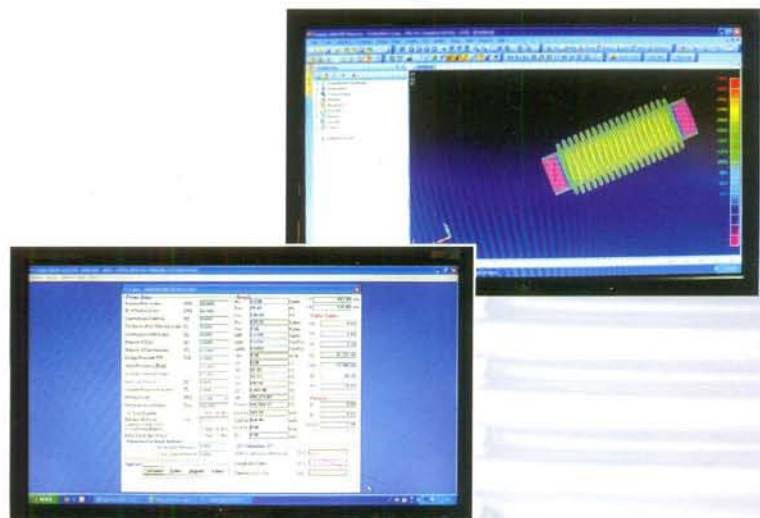
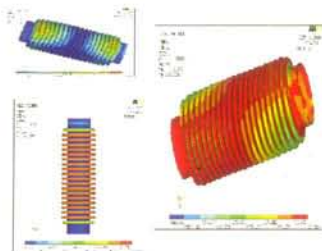
We use universally recognized standard EJMA (Expansion Joint Manufacturers Association) for design of Bellows.

Bengal also has the ability and expertise for design bellows in Stainless steel and Hastelloy materials etc .

ANALYSIS PROCESS

COMPONENT LEVEL

- Bellows Static Analysis
- Bellows stiffness analysis
(Axial / Shear / Bending / Torsion stiffness)
- Bellows strength analysis
- Bellows Durability Analysis



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Flexible Tubing Solutions

Metallic Expansion Joints / Bellows

Testing facilities

- a.) **Liquid penetrant test:** This tests involves cleaning the surface coating it with a dye, whipping the excess dye off and applying a developer on the surface and allow the same to dry. This dye is drawn from the cracks, pin holes and weld roll-over points thereby indicating these defects to the observer.
- b.) **Air jet leak testing:** This test utilizes compressed air which is directed through a nozzle on to a small area between two welded parts. Bubble soap solution/leak detector solution is applied on the opposite side of the welded connection, which will bubble in case of a leakage at the weld joint.
- c.) **Spring rate testing:** The force required to deflect a bellows is a function of the dimensions of the bellows and the material from which it is made. Initially the bellows is deflected through its elastic range. As deflection continues and extends into the plastic range the force vs deflection relationship becomes non-linear when the point of maximum deflection is reached.
- d.) **Hydrostatic pressure testing:** This type of testing involves filling the expansion joint with a liquid, usually de-mineralized water. After the expansion joint is filled it can then be pressurized to the required test pressure. Generally, hydrostatic pressure test is performed at one and half times the design pressure.
- e.) **Radiographic testing:** This test is based on the principle that X-rays will penetrate solid materials and when projected on to a photosensitive film, will reveal voids, areas of discontinuity and lack of homogeneity.

This test is widely used to determine defects in welds. In general it is limited to checking butt welds for similar thickness of material. In case of bellows, this is done to check longitudinal seam welds before forming.

- f.) **Helium leak testing:** This is a very sensitive test that is used to determine the presence of minute leakage using Helium. This test is capable of detecting leakage rates up to 10^{-9} mbar l/sec. This test may be used to examine for the total sum of leakage or with a probe to locate individual leakage point.
- g.) **Fatigue life testing:** This test is used to verify the ability of the bellows to withstand a given number of flexing cycles. Fatigue testing may be performed at constant or varying pressure.
- h.) **Squirm testing:** This is used to determine the internal pressure which will cause a bellows to become unstable. Squirm is defined on the basis of a change in pitch of the bellow convolutions under internal pressure. The bellows may be tested with its axis in either horizontal or vertical position. For safety reasons, water is used as the testing medium.



Non-Destructive Tests

