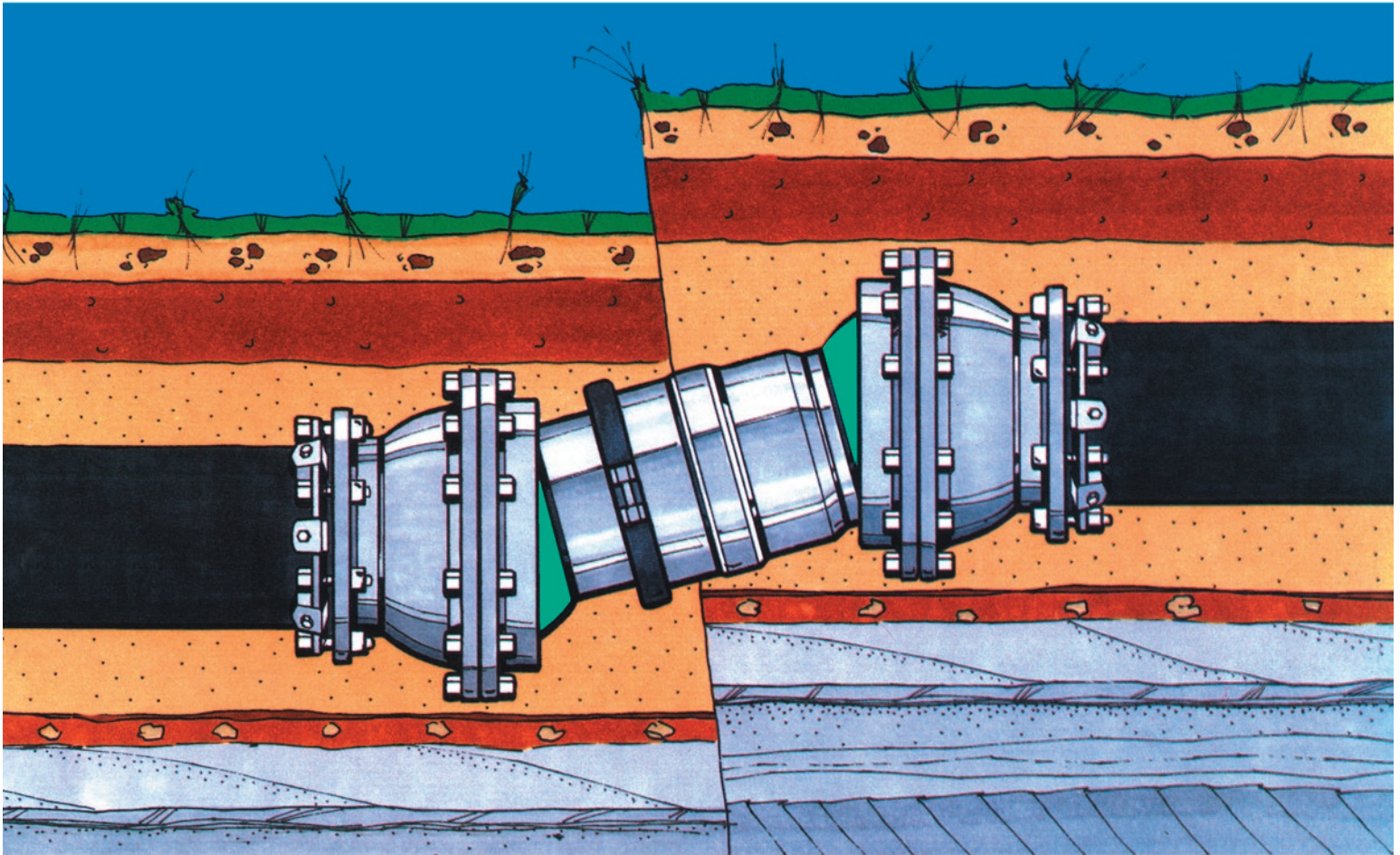


FLEX-TEND

U.S. Patent No. 4,776,617



**FLEXIBLE EXPANSION JOINT FOR THE PROTECTION
OF WATER, WASTEWATER, AND INDUSTRIAL PIPELINES**

**ADDITIONAL EXPANSION SLEEVES CAN BE ADDED
FOR INCREASED EXPANSION CAPACITY**

20° DEFLECTION PER BALL THROUGH THE 12" SIZE

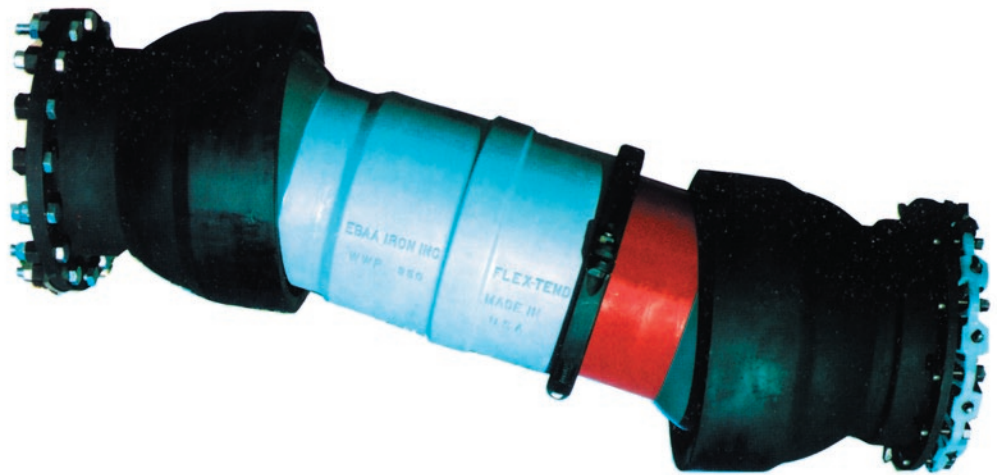
EBAA  IRON™
EBAA IRON SALES, INC.

**Factory
Mutual
System**
Approved

FLEX-TEND® FLEXIBLE EXPANSION JOINTS

Pipelines crossing unstable terrain such as faults, swamps or landfills all suffer some degree of vulnerability to damage from ground motion. This motion can be either gradual or sudden, and places damaging shear and bending forces on pipelines. In areas close to or within structures where differential movement can occur, pipelines should be restrained and supported to isolate and accommodate movement in a controllable manner at a designated location.

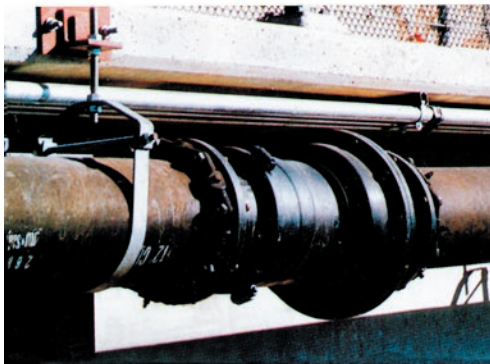
FLEX-TEND flexible expansion joints provide pipeline protection from the stresses produced by these forces with their ability to deflect up to 30



degrees in any direction while simultaneously expanding or contracting. It is available in sizes from 3 inches to 48 inches and can be used on either ductile iron, steel, or PVC pipelines for :

- Connection to buildings, tanks and other structures
- Underground to aerial transitions such as bridges
- Areas of anticipated ground movement and unstable soils
- Areas near roadways and dams
- Active fault crossings and liquefaction zones

The FLEX-TEND expansion joint is available with both flange and mechanical joint end connections for adaptable protection for pipelines, pumps, bridge crossings, tank connections and many other critical installations either above or below ground. Sizes of 3-inches through 24-inches are rated for 350 psi working water pressure. Sizes of 30 inches and larger are rated for 250 psi working water pressure.



▲ Single-ball bridge crossing in a non-seismic application

FEATURES

For ductile iron, steel, or PVC pipelines

Minimum of 15 degree deflection per ball

Variable expansion capability

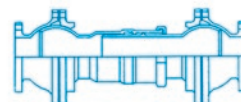
Choice of double-ball or single-ball

Sizes 3" through 24", 350 psi; 30" and 48", 250 psi

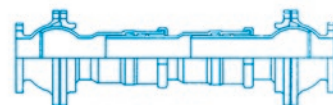
Manufactured entirely of 60-42-10 ductile iron

Each unit tested to rated working pressure prior to shipment

For flanged or mechanical joint connections and combinations



Standard Unit Expansion



Plus One Additional Sleeve



Plus Two Additional Sleeves

FLEX-900® FLEXIBLE BALL JOINT

For protection against damage from bending movements where protection against linear expansion is not required, the FLEX-900 flexible ball joint provides a minimum of 15 degrees of deflection for pipeline connections.

The FLEX-900 flexible ball joint is available in standard sizes from 4 inches through 12 inches (call for larger sizes) with mechanical joint, flange, restrained PE or any combination of connections available. Each unit is manufactured entirely of 60-42-10 ductile iron and conforms to the material and other applicable requirements of ANSI/AWWA C153/A21.53. In addition, each FLEX-900 ball

joint receives a 15-mil, fusion-bonded epoxy lining for corrosion protection. This lining is tested in accordance with ANSI/AWWA C213 and meets or exceeds the requirements of ANSI/AWWA C550. And performance is assured as each unit is tested to its designed working pressure of 350 psi prior to leaving the factory.

In order for the FLEX-900 ball joint to protect pipeline connections, any load on the pipeline (and in some cases, loads on adjacent pipelines) must be transferred to the unit by restrained joints. Joint restraint is provided with each mechanical joint outlet. Please specify the proper EBAA mechanical joint restraint or ask for assistance when ordering.



FEATURES

Sizes 4 through 12 inches
(call for larger sizes)

Mechanical joint, flange,
restrained PE, or combination

15 degree minimum deflection

For use with MJ, push-on, and
restrained push-on pipe and fittings

EX-TEND® 200 EXPANSION JOINT

The EX-TEND 200 expansion joint is designed especially for protection against damage from linear expansion and is self restrained at full expansion. Joint restraint is provided with each mechanical joint outlet. Configurations are available with flange by mechanical joint outlets, flange by flange, and mechanical joint by mechanical joint outlets. Custom assemblies with grooved or restrained plain ends can easily be accommodated.

Each unit is provided with expansion and contraction capability cast as an integral part of the end connection. The expansion capacity can be adjusted to meet particular applications by the insertion of additional sleeves. Every EX-TEND 200 expansion joint comes

factory-set for 50% expansion/50% contraction. This may be adjusted in the field for different requirements. (Due to hydrostatic forces that cause the unit to expand, some applications may require anchors or blocking to isolate the areas of anticipated movement and to prevent this expansion from affecting adjacent piping).

The EX-TEND 200 expansion joint is manufactured entirely of 60-42-10 ductile iron and conforms to the material and other applicable requirements of ANSI/AWWA C153/A21.53. For protection against corrosion, each pressure-containing component is lined with a minimum of 15 mils of fusion-bonded epoxy which conforms to the material requirements of, and is tested in accordance with, ANSI/AWWA

C213. This lining also meets or exceeds the requirements of ANSI/AWWA C550.



FEATURES

Sizes 4 through 24 inches

Mechanical joint, flange,
or combination

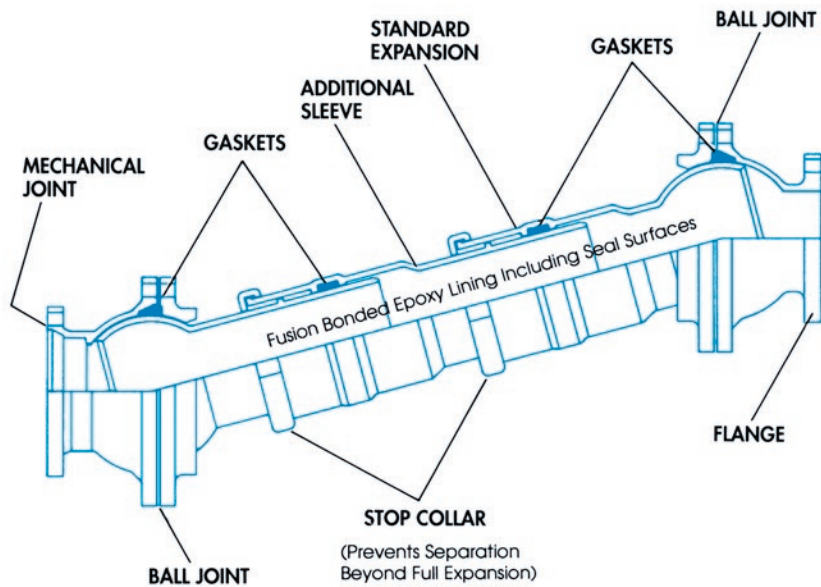
Rated for 350 psi
working water pressure

Self-restrained at full expansion

Combination Flange by Mechanical Joint

FLEX-TEND expansion joints are manufactured entirely of ductile iron, conforming to all applicable requirements of ANSI/AWWA C153/A21.53 and is totally protected from internal corrosion with a lining of fusion-bonded epoxy.

FLEX-TEND flexible expansion joints are available in double ball or single ball configurations. Double-ball units offer the unique ability to accommodate a considerable degree of close-coupled vertical subsidence and will deflect at least 30 degrees in any direction. Single-ball configurations are ideally suited for the protection of pumps and valve



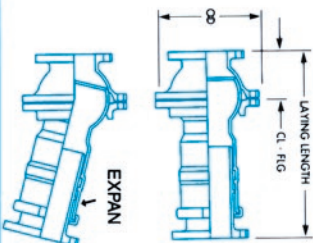
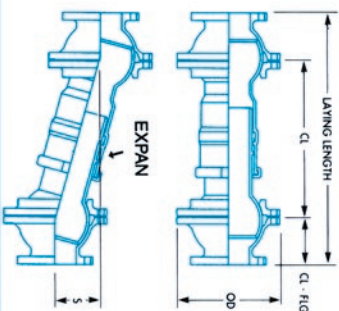
▲ Double-ball bridge crossing - 24" flange x flange with 16" expansion
▼ Double-ball tank connection - 6" flange x flange with 4" expansion

installations inside buildings, "in-line" pipeline protection, and will deflect at least 15 degrees in any direction.

Expansion/contraction capability is cast as an integral part of the ball and socket, and can be adjusted with additional sleeves installed at the factory prior to shipping or in the field at a later date. The use of additional sleeves increases both the axial movement and the available offset.

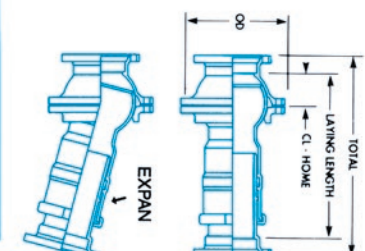
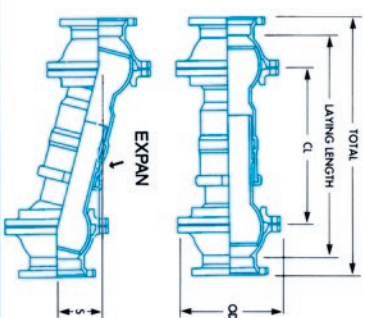


EBAA IRON™
EBAA IRON SALES, INC.



The expansion (+) / contraction (-) capacities are as follows:
 4" EXPAN = +3" / -1"
 8" EXPAN = +6" / -2"
 10" EXPAN = +7.5" / -2.5"
 12" EXPAN = +9" / -3"
 16" EXPAN = +12" / -4"
 20" EXPAN = +15" / -5"
 24" EXPAN = +18" / -6"
 30" EXPAN = +22.5" / -7.5"

S(OFFSET) = CL x Tan (20°)
 (15° above 12" nominal size)



FLANGE BY FLANGE

GENERAL DIMENSIONS				DOUBLE BALL					SINGLE BALL				
SIZE	EXPAN*	OD	CL TO FLANGE	LAYING	CL	S (OFFSET)	WEIGHT (LBS)	ASSY. NO.	LAYING	WEIGHT LBS	ASSY. NO.		
3	4	9.2	5.7	26.5 34.5 42.5	15.1 23.1 31.1	5.5 8.3 11.3	121 145 170	403F20 403F21 403F22	19.2 27.2 35.2	63 87 111	403F10 403F11 403F12		
4	4	13.0	6.6	35.0 49.5 63.5	21.9 36.1 50.4	8.0 13.1 18.3	193 236 279	404F20 404F21 404F22	25.5 39.5 54.0	139 182 226	404F10 404F11 404F12		
6	4	15.0	6.7	36.5 49.5 63.0	22.8 36.1 49.4	8.3 13.1 18.0	273 337 401	406F20 406F21 406F22	27.0 40.5 53.5	185 249 314	406F10 406F11 406F12		
8	4	17.3	7.2	39.0 55.0 71.0	24.5 40.6 56.7	8.9 14.8 20.6	374 456 557	408F20 408F21 408F22	29.5 45.5 61.5	269 361 452	408F10 408F11 408F12		
10	4	20.4	8.4	45.0 60.0 75.0	28.4 43.2 58.0	10.3 15.7 21.1	571 708 845	410F20 410F21 410F22	32.0 46.5 61.5	487 624 761	410F10 410F11 410F12		
12	4	22.7	9.3	47.5 62.5 77.5	29.1 44.1 59.1	10.6 16.1 21.5	764 914 1064	412F20 412F21 412F22	33.5 48.5 63.5	638 788 938	412F10 412F11 412F12		
14	8	25.0	13.6	71.5 97.5 123.5	44.3 70.2 96.1	11.9 18.8 25.7	1267 1605 1942	414F20 414F21 414F22	41.4F10 41.4F11 41.4F12	51.5 77.5 103.5	998 1466 1673	414F10 414F11 414F12	
16	8	25.0	13.6	71.5 97.5 123.5	43.9 70.2 96.1	11.8 18.8 25.7	1768 1605 1942	418F20 418F21 418F22	41.8F10 41.8F11 41.8F12	55.0 77.5 103.5	1060 1466 1673	418F10 418F11 418F12	
18	8	30.5	13.9	71.5 97.0 122.0	43.9 69.2 94.4	11.8 18.5 25.3	1768 2161 2534	418F20 418F21 418F22	41.8F10 41.8F11 41.8F12	55.0 77.5 103.5	1060 1466 1673	418F10 418F11 418F12	
20	8	30.5	11.4	67.0 92.0 117.5	43.9 69.2 94.4	11.8 18.5 25.3	1805 2226 2647	420F20 420F21 420F22	48.0 73.0 98.5	1347 2189 2783	420F10 420F11 420F12		
24	8	37.3	15.5	81.0 106.5 131.5	50.2 75.5 100.8	13.4 20.2 27.0	3057 3747 4437	424F20 424F21 424F22	55.0 80.5 106.0	2093 2783 3473	424F10 424F11 424F12		
30	10	44.1	16.7	96.7 129.0 161.0	63.3 95.0 126.0	17.0 25.0 33.0	4864 5848 6832	430F20 430F21 430F22	67.3 95.0 126.0	1673 2189 2783	430F10 430F11 430F12		
36	20	50.6	17.0	95.0 127.0 159.0	61.0 93.0 125.0	16.0 25.0 33.0	7016 8416 9816	436F20 436F21 436F22	67.3 95.0 126.0	1673 2189 2783	436F10 436F11 436F12		
48	24	67.0	22.0	151.0	106.0	18.0	14730	448F20	106.0	2783	448F10		

Dimensions Are In Inches ±1%

Weights Are Estimates

Flanges: AWWA C110 Flange Bolt Pattern (class 125/150)

Mechanical Joint Restraint Provided, Please Specify or ask for Assistance

MECHANICAL JOINT BY MECHANICAL JOINT

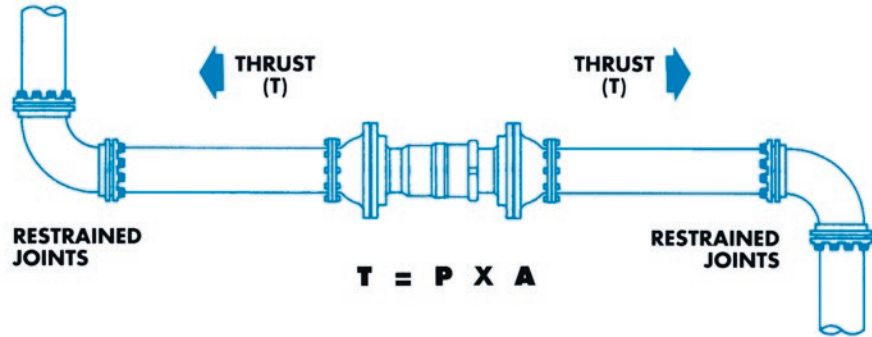
DIMEN.			DOUBLE BALL								SINGLE BALL								
SIZE	EXPAN.	OD	LAYING		CL		S (OFFSET)		WEIGHT (LBS)		ASSY. NO.	LAYING	TOTAL		CL TO HOME		WEIGHT (LBS)		ASSY. NO.
3	8	9.2	22.0	27.0	15.1	5.5	113	117	403M20	403M20	403M20	22.5	27.5	13.1	183	187	403M10	403M10	403M10
8	12	9.2	30.0	35.0	23.1	8.4	137	167	403M22	403M22	403M22	30.5	35.5	21.1	230	284	403M12	403M12	403M12
4	4	13.0	29.5	34.5	21.9	8.0	187	230	404M20	404M20	404M20	22.5	27.5	13.1	183	187	404M10	404M10	404M10
8	12	13.0	44.0	49.0	36.1	13.1	230	273	404M22	404M22	404M22	36.5	41.5	25.1	56.0	60.0	404M12	404M12	404M12
4	4	15.0	32.0	37.0	22.8	8.3	271	335	406M20	406M20	406M20	23.5	28.5	13.1	183	187	406M10	406M10	406M10
8	12	15.0	45.0	50.0	36.1	13.1	335	399	406M22	406M22	406M22	37.0	42.0	25.1	50.5	55.5	406M12	406M12	406M12
4	4	17.3	34.5	39.5	24.5	8.9	362	454	408M20	408M20	408M20	26.0	31.0	13.1	183	187	408M10	408M10	408M10
8	12	17.3	51.0	56.0	40.6	14.8	454	545	408M22	408M22	408M22	48.5	53.5	25.1	60.5	65.5	408M12	408M12	408M12
0	8	20.4	40.5	45.5	28.4	10.3	569	734	410M20	410M20	410M20	28.1	33.1	13.1	183	187	410M10	410M10	410M10
12	8	20.4	55.0	60.0	43.2	15.7	706	894	410M22	410M22	410M22	42.6	47.6	25.1	57.1	62.1	410M12	410M12	410M12
4	4	22.7	43.5	48.5	29.1	10.6	734	938	412M20	412M20	412M20	30.5	35.5	13.1	183	187	412M10	412M10	412M10
12	8	22.7	58.5	63.5	44.1	16.1	894	1117	412M22	412M22	412M22	45.5	50.5	25.1	60.5	65.5	412M12	412M12	412M12
12	12	22.7	73.5	78.5	59.1	21.5	1034	1267	414M20	414M20	414M20	60.5	65.5	35.1	80.5	85.5	414M10	414M10	414M10
14	16	25.0	65.0	72.0	44.3	11.9	1267	1625	414M22	414M22	414M22	70.5	75.5	35.1	90.5	95.5	414M12	414M12	414M12
14	24	25.0	90.5	97.5	70.2	18.8	1625	1962	414M22	414M22	414M22	106.5	111.5	45.1	138.5	143.5	414M12	414M12	414M12
16	16	25.0	65.0	72.0	44.3	11.9	1267	1625	416M20	416M20	416M20	47.0	52.0	35.1	80.5	85.5	416M10	416M10	416M10
16	24	25.0	90.5	97.5	70.2	18.8	1625	1962	416M22	416M22	416M22	73.0	78.0	45.1	106.5	111.5	416M12	416M12	416M12
8	8	30.5	64.5	71.5	43.9	11.8	1752	2189	418M20	418M20	418M20	45.5	50.5	35.1	80.5	85.5	418M10	418M10	418M10
8	16	30.5	90.5	97.0	69.2	18.5	2181	2653	418M22	418M22	418M22	70.5	75.5	45.1	106.5	111.5	418M12	418M12	418M12
18	16	30.5	115.0	122.0	94.4	25.3	2538	3003	418M22	418M22	418M22	106.5	111.5	45.1	138.5	143.5	418M12	418M12	418M12
24	24	30.5	64.5	71.5	43.9	11.8	1752	2189	420M20	420M20	420M20	45.5	50.5	35.1	80.5	85.5	420M10	420M10	420M10
20	16	30.5	90.5	97.0	69.2	18.5	2232	2653	420M22	420M22	420M22	70.5	75.5	45.1	106.5	111.5	420M12	420M12	420M12
24	24	30.5	115.0	122.0	94.4	25.3	2653	3003	420M22	420M22	420M22	106.5	111.5	45.1	138.5	143.5	420M12	420M12	420M12
8	8	36.6	78.0	85.0	50.2	13.4	3003	3663	424M20	424M20	424M20	53.0	60.0	35.1	80.5	85.5	424M10	424M10	424M10
24	24	36.6	103.0	110.0	75.5	20.2	3693	424M21	424M21	424M21	78.5	85.5	45.1	106.5	111.5	424M12	424M12	424M12	
24	24	36.6	128.0	135.5	100.8	27.0	4033	424M22	424M22	424M22	106.5	111.5	45.1	138.5	143.5	424M12	424M12	424M12	

NOTES

A Because the FLEX-TEND flexible expansion joint incorporates an expansion joint with the ball and socket flexible ends, it behaves similar to other expansion joint products under pressure. Due to their design, expansion joints generate end thrust when subject to internal pressure. This end thrust must be accounted for in pipeline design. The end thrust generated by the FLEX-TEND flexible expansion joint is calculated by multiplying the internal pressure (psi) by the area listed below.

SIZE (in.)	AREA (in ²)	THRUST AT 150 PSI (lb)
3	12.3	1,845
4	18.1	2,715
6	37.4	5,610
8	64.3	9,645
10	96.8	14,520
12	136.9	20,535
14	237.8	35,670
16	237.8	35,670
18	366.4	54,960
20	366.4	54,960
24	522.8	78,420
30	804.3	120,645
36	1,152.1	172,815
48	2027.0	304,050

When used in a long and relatively straight pipeline, the pipe-to-soil friction is generally sufficient to balance the force. The use of thrust blocks or other means of anchoring may be required when fittings are placed in close proximity to the expansion joint underground. This protects the pipeline from the tendency of the unit to expand when pressurized. In an above-ground installation such as a bridge application, some means must be provided to prevent the expansion of the joint due to internal



pressure. This can be accomplished by anchoring the piping to the structure while allowing room for movement when motion occurs.

B In order for the FLEX-TEND expansion joint to protect pipeline connections, any load must be transferred to the unit by restrained joints. Depending on the piping arrangement and the anticipated movement of the pipeline, adjacent piping must be restrained to adequately transfer the loads to the unit. Joint restraint is provided with each mechanical joint end connection. The table below lists some of the restraint products offered by EBAA as well as the pipe material on which each are used.

SIZE RANGE	PIPE MATERIAL	RESTRAINT PRODUCT
3" - 48"	Ductile Iron	Series 1100
3" - 24"	PVC	Series 2000PV

Weld-on flanges are generally used for applications on steel piping. For other piping material please contact EBAA. For technical information call EBAA Engineering, 800-633-9190.

C Each unit is tested to rated pressure prior to shipment.

D Mechanical joint end connections conform to the dimensional requirements of either ANSI/AWWA C111/A21.11 or ANSI/AWWA C153/A21.53 depending on size.

E The flange outlets are dimensioned according to ANSI/AWWA C110/A21.10 (class 150) with addition of an O-ring groove. An O-ring is provided to ensure a watertight seal.

F Due to the design of the seals as well as the assembly, no periodic maintenance is required.

G Assembly instructions and polyethylene wrap (for under ground applications) are provided with each unit.

H FLEX-TEND expansion joints are suitable for direct burial. If installation in a vault is necessary, the design must be such that movement is not impeded.

I EBAA Iron Inc. reserves the right to revise and improve its products as necessary. This brochure describes the status of these products at the time of publication and may not reflect their status in the future.

SPECIFICATION

1 Flexible expansion joints shall be installed in the locations indicated on the drawings and shall be manufactured of 65-45-12 ductile iron conforming to the material requirements of ASTM A536 and ANSI/AWWA C153/A21.53. Foundry certification of material shall be readily available upon request.

2 Each flexible expansion joint shall be pressure tested prior to shipment against its own restraint to a minimum of 350 psi (250 psi for flexible expansion joints 30 inches and larger.) A minimum 2:1 safety factor, determined from the published pressure rating, shall apply. Factory Mutual Approval for the 12 inch and smaller sizes is required.

3 Each flexible expansion joint shall consist of an expansion joint designed and cast as an

integral part of a ball and socket type flexible joint, having a minimum per ball deflection of: 20°, 3"-12"; 15°, 14"-36"; 12°, 48" and 4-inches minimum expansion. Additional expansion sleeves shall be available and easily added or removed at the factory or in the field. Both standardized mechanical joint and flange end connections shall be available.

4 All internal surfaces (wetted parts) shall be lined with a minimum of 15 mils of fusion-bonded epoxy conforming to the applicable requirements of ANSI/AWWA C213 and shall be holiday tested with a 1500 volt spark test conform-

ing to said specification. Sealing gaskets shall be constructed of EPDM. The coating and gaskets shall meet ANSI/NSF-61.

5 All external surfaces shall be coated with a catalyzed coal tar epoxy conforming to the material requirements of AWWA C210. Appropriately sized polyethylene sleeves, meeting ANSI/AWWA C105/A21.5, shall be included for direct buried applications.

6 Manufacture certification of compliance to the above standards and requirements shall be readily available upon request. The purchaser (or owner) shall reserve the right to inspect the manufacturers facility for compliance. All flexible expansion joints shall be FLEX-TEND as manufactured by EBAA Iron Inc., Eastland, TX., U.S.A.



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