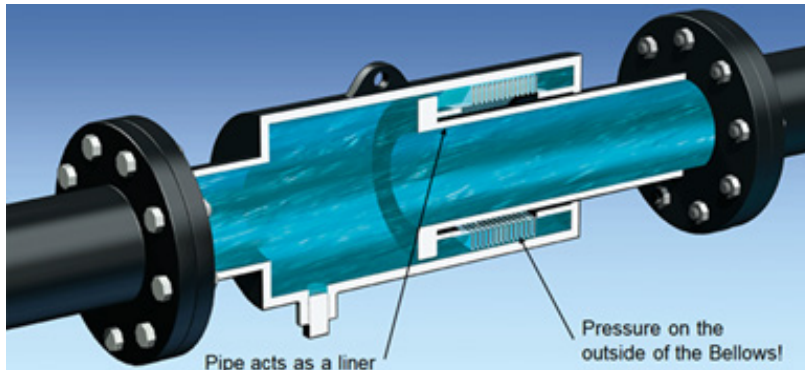




1. General

- a. The Metragator is an externally pressurized bellows joint. Since the pressure is on the outside of the bellows, these can be constructed with additional corrugations, allowing for more movement.
- b. Built in liner – The pipe acts as a liner to protect the bellows.
- c. Built in housing – The outer casing acts as a shield protecting the bellows.

2. Application

- a. Metragators are available in 4", 6" or 8" axial movement joints. Dual Metragators are available in 8" 12" or 16" axial movements. Custom movements are available.
- b. Metragator expansion joints are designed for axial compression only.
- c. Metragator expansion joints are not designed for lateral, angular movement, or torques. Install only one joint between anchors.
- d. Standard Metragators are set up to handle pipe growth / expansion for hot systems. For example, a 4" axial joint is designed for 4" compression and 1" of extension. For chilled systems this needs to be reset or cold sprung to 1" compression and 4" extension. Notify Metraflex of this at time of order.

3. Installation:

- a. Inspect joint for shipping damage, ensure that the shipping bar is intact.
- b. Install only one joint between anchors.
- c. Installation of expansion joint and anchors must be made as close to the design ambient temperature as possible. If compensator is installed into a hot pipeline or at other than design ambient temperature, consult Metraflex.
- d. Single joints ideally are installed near an anchor. Dual expansion joints are supplied with an intermediate anchor and must be installed equidistant between main anchors.
- e. Do not remove shipping bar before the installation of guides and anchors.
- f. Metragator expansion joints are not flow directional.

4. Vertical installation

- a. Consult Metraflex for guide spacing recommendations.
- b. When installing Metragator joints on a vertical application, the traveling end should be installed on the top to allow for proper drainage.
- c. There is an O-ring on the traveling end. The only function of the O-ring is to keep debris from falling into the Metragator

5. Anchors

a. Always make sure that the anchors and guides are properly installed before testing. During test hydrostatic end loads will develop that will cause the joint to overextend, crushing the bellows. If this happened the joint must be replaced even if it passes a pressure test since we do not know how many cycles the joint will function for. See anchor load calc.

6. Guides

a. All expansion joints require guiding and anchoring in accordance with EJMA (Expansion Joint Manufacturers Association) guidelines for horizontal pipe runs, see Guide spacing table and Typical guide spacing diagram below.
b. For riser applications or curved pipe, EJMA guidelines are not applicable, consult Metraflex.

7. Testing:

a. Joint may be one-time pressure tested to 225 PSIG for 150 lb. class joints, or 450 PSIG for 300 lb. class joints. Do not exceed maximum pressure or temperature during operation.
b. Metraflex recommends hydrostatic test with all air in the system removed. If an air test is performed, appropriate safety precautions must be made.
c. Do not test until joint is properly anchored and guided. The shipping bar is not designed to restrain the hydrostatic end load that will be developed by the expansion compensator under pressure.

8. Precautions:

a. Joint will develop hydrostatic end loads equal to pressure time effective area and must be included in anchor load calculations.
b. For steam systems it is recommended to make provisions for draining condensate from the housing.
c. If the system is pressurized prior to installing guides and anchors, the bellows will be overextended. If this occurs, we recommend replacing the joint. Overextension will crush the corrugations making the joints longevity and effectiveness unpredictable.

9. Maintenance:

a. Metragator expansion joints have no serviceable parts and do not require maintenance.

Anchor Load Calc.

$(\text{Spring Rate} \times \text{Movement}) + (\text{Effective area} \times \text{test pressure}) + \text{Safety Factor} = \text{Anchor Load}$

The spring rate is the force it takes to compress or extend the bellows. To calculate the spring load multiply the spring rate by the movement of the joint. These values can be found on "Bellow Data Table".

To find the hydrostatic end load multiply the effective area by the test pressure. This is the force pushing out on the anchors. The effective areas of the bellows can be found on "Bellow Data Table".



Externally Pressurized Bellows Expansion Joints
METRAGATOR
 OPERATION, INSTALLATION AND MAINTENANCE
 INSTRUCTIONS

		150 lb. Class		300 lb. Class	
Size	Compression	Spring Rate Lbs./In.	Effective Area In ²	Spring Rate Lbs./In.	Effective Area In ²
2"	4"	183	13.18	639	14.3
	6"	115		435	
	8"	92		340	
2.5"	4"	183	13.18	639	14.3
	6"	115		435	
	8"	92		340	
3"	4"	343	20.77	823	22.9
	6"	235		650	
	8"	172		441	
4"	4"	200	35.96	1223	36.4
	6"	143		935	
	8"	103		663	
5"	4"	235	46.35	1615	46.7
	6"	166		1269	
	8"	120		987	
6"	4"	269	58.9	1803	59.4
	6"	189		1417	
	8"	138		1102	
8"	4"	332	88.82	2592	93
	6"	235		2036	
	8"	166		1584	
10"	4"	400	124.62	2834	129.7
	6"	280		2125	
	8"	200		1417	
12"	4"	463	166.63	2854	172.5
	6"	326		2219	
	8"	235		1540	



Guide Spacing: To prevent the pipe from exceeding its columnar strength and buckling it needs to be guided to restrain lateral forces. These forces are developed by the internal pressure of the fluid and the spring load of the bellows as discussed in “Anchor Load Calc” above.

In accordance with EJMA guidelines, the first guide should be installed 4 pipe diameters from the joint, the second guide should be installed 14 pipe diameters from the joint, additional guides should be placed based on pressure. The guide spacing values can be found on the below “Guide Spacing Table”.

Guide Spacing Table

Pipe size	Maximum	Maximum	Distance Between Additional Pipe guides			
	Distance To	Distance To	In Feet			
	1st Guide / Anchor	2nd Guide	At 50 PSI	At 100 PSI	At 150 PSI	At 300 PSI
1"	4"	1' - 4"	21	15	12	10
1.25"	5"	1' - 5"	23	17	13	12
1.5"	6"	1' - 9"	28	20	17	13
2"	8"	2' - 4"	32	23	18	15
2.5"	10"	2' - 11"	35	28	22	19
3"	1' - 0"	3' - 6"	38	28	23	20
4"	1' - 4"	4' - 8"	52	38	31	22
5"	1' - 8"	5' - 8"	63	45	38	25
6"	2' - 0"	7' - 0"	68	48	40	28
8"	2' - 8"	9' - 4"	87	62	45	38
10"	3' - 4"	11' - 8"	107	75	60	48
12"	4' - 0"	14' - 0"	118	85	70	50
14"	4' - 8"	16' - 4"	122	88	72	55
16"	5' - 4"	18' - 8"	137	96	80	60
18"	6' - 0"	21' - 0"	145	105	85	65
20"	6' - 8"	23' - 4"	160	118	90	70
24"	8' - 0"	28' - 0"	181	125	105	75

We recommend that the joint be placed adjacent to one anchor to eliminate the first and second guide.

Typical guide spacing diagram

