Externally Pressurized Compensator
for Carbon Steel Systems
Product: HP
OPERATION, INSTALLATION AND MAINTENANCE INSTRUCTIONS

1. **General**
   a. The HP compensator 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 additional movement.
   b. Built-in liner: The pipe serves as a liner to protect the bellows.
   c. Built-in housing: The outer casing acts as a shield, protecting the bellows.
   d. HP Compensators are available in threaded, flanged or weld ends.
2. **Application**
   a. HP Compensators are available in 2” or 3” axial movement joints. Dual HP compensators are rated up to 4” axial movements.
   b. HP Compensators are designed for axial compression only.
   c. HP Compensators are not designed for lateral, angular movement, or torques. Install only one joint between anchors.
   d. Standard HP compensators are set up to handle pipe growth / expansion for high temperature systems such as hot water and steam. For example, a 3” axial joint is designed for 3” compression and ½” of extension. For chilled systems this needs to be reset or cold sprung to ½” compression and 3” 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 compensators 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. Do not remove shipping bar before the installation of guides and anchors.
   e. HP compensators are not flow directional.
4. **Vertical Installation**
   a. Consult Metraflex for guide spacing recommendations.
   b. When installing HP compensators on a vertical application, the traveling end should be installed on the top to allow for proper drainage.
5. **Anchors**
   a. Always make sure that the anchors and guides are properly installed before testing. If testing is conducted before anchors and guides are installed then the test will result in hydrostatic end loads that will cause the joint to overextend, crushing the bellows. If this happens the joint must be replaced, even if it passes a pressure test, because it will be indeterminable for how many cycles the joint will be able to function successfully.
   b. For anchor selection see anchor load calc.

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6. **Guides**
   a. All HP compensators require guiding and anchoring in accordance with EJMA (Expansion Joint Manufacturers Association) guidelines for horizontal pipe runs, see guide spacing table and the 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 250 PSIG. 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 it 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. For steam systems it is recommended to make provisions for draining condensate from the housing.
   b. If testing is conducted before anchors and guides are installed the test will result in hydrostatic end loads 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.
9. **Maintenance**
   a. HP compensators have no serviceable parts and do not require maintenance.

Anchor Load Calc.

(Spring Rate X Movement) + (Effective area X test pressure) + Safety Factor = 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 mutiply the effective are by the test pressure. This is the force pushing out on the anchors. The effective areas of the bellows can be be found on “Bellow Data

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Table".

Size	Comp	Extension	Effective Area IN^2	Spring Rate lbs. / Inch
.75"	2"	.5"	1.5	81
1"	2"	.5"	2.1	88
1.25"	2"	.5"	3.3	75
1.5"	2"	.5"	4.3	121
2"	2"	.5"	6.3	143
2.5"	2"	.5"	8.8	178
3"	2"	.5"	13.1	230
4"	2"	.5"	20.8	484
Size	Comp	Extension	Effective Area IN^2	Spring Rate lbs. / Inch
.75"	3"	.5"	1.5	58
1"	3"	.5"	2.1	63
1.25"	3"	.5"	3.3	52
1.5"	3"	.5"	4.3	82
2"	3"	.5"	6.3	117
2.5"	3"	.5"	8.8	132
3"	3"	.5"	13.1	161
4"	3"	.5"	20.8	341

Bellows Data Table

Guide Spacing: To prevent the pipe from exceding it's columnar strength, and buckling the piping 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".

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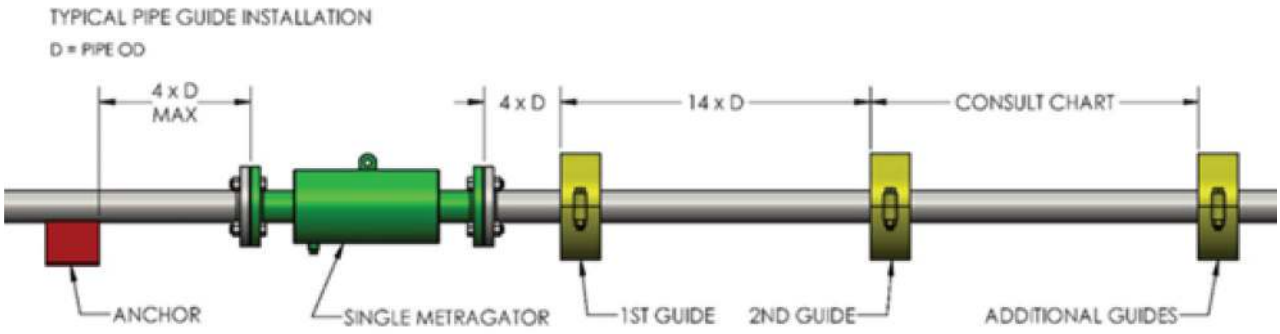
Guide Spacing Table for Horizontal Installations.

Pipe size	Maximum Distance To 1st Guide / Anchor	Maximum Distance To 2nd Guide	Distance Between Additional Pipe guides In Feet			
			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

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

Typical guide spacing diagram



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