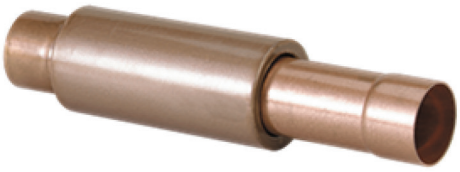
Externally Pressurized Compensator for Copper Systems
Product: HPFF

OPERATION, INSTALLATION AND MAINTENANCE INSTRUCTIONS



1. General:

a. The HPFF 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 more movement then internally pressurized bellows.

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.

d. HPFF Compensators are available with sweat ends.

2. Application

a. HPFF Compensators are available in 2” or 3” axial movement joints.

b. HPFF Compensators are designed for axial compression only.

c. HPFF Compensators are not designed for lateral, angular movement, or torques. Install only one joint between anchors.

d. Standard HPFF compensators are set up to handle pipe growth / expansion for hot systems. 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 and we will reset the movement.

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. HPFF 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: Always make sure that the anchors and guides are properly installed before testing. 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.

6. **Guides**
   a. All HPFF compensators 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. 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. 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.
   b. Apply flux sparingly. HPFF expansion compensators have stainless steel components, and the flux used to prepare a copper joint is extremely corrosive to stainless steel. Exposing the stainless-steel components to flux will lead premature failure.
   c. Exposure temperatures exceeding 1,000º F. may damage internal expansion compensator joints. Use cold strapping or other heat sink procedures to avoid exposure temperatures exceeding 1,000º F.

9. **Maintenance:** HPFF compensators have no serviceable parts and do not require maintenance.

Contact Metraflex or your local Metraflex Representative with ANY questions.

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 “Bellows 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 Table”.

Bellows Data Table

HPFF2 - Copper Body, 304 Stainless Steel Bellows

PART NO.	Pipe Size (in)	Pressure / Temp	Compression	Extension	Effective Area (in2)	Spring Rate (lbs/in)	Weight
HPFF20075	.75"	150 PSIG at 400 deg F.	2"	.5"	1.1	82	0.75
HPFF20100	1"	150 PSIG at 400 deg F.	2"	.5"	1.7	89	1
HPFF20125	1.25"	150 PSIG at 400 deg F.	2"	.5"	2.4	75	1.5
HPFF20150	1.5"	150 PSIG at 400 deg F.	2"	.5"	3.2	74	2
HPFF20200	2"	150 PSIG at 400 deg F.	2"	.5"	5.1	168	3
HPFF20250	2.5"	150 PSIG at 400 deg F.	2"	.5"	7.6	188	4
HPFF20300	3"	150 PSIG at 400 deg F.	2"	.5"	10.6	251	4.5
HPFF20400	4"	150 PSIG at 400 deg F.	2"	.5"	17.9	341	9

HPFF3 - Copper Body, 304 Stainless Steel Bellows

PART NO.	Pipe Size (in.)	Pressure / Temp	Compression	Extension	Effective Area (in2)	Spring Rate (lbs/in)	Weight
HPFF30075	.75"	150 PSIG at 400 deg F.	3"	0.5"	1.1	58	1
HPFF30100	1"	150 PSIG at 400 deg F.	3"	0.5"	1.7	63	1.5
HPFF30125	1.25"	150 PSIG at 400 deg F.	3"	0.5"	2.4	54	2
HPFF30150	1.5"	150 PSIG at 400 deg F.	3"	0.5"	3.2	52	3
HPFF30200	2"	150 PSIG at 400 deg F.	3"	0.5"	5.1	118	4
HPFF30250	2.5"	150 PSIG at 400 deg F.	3"	0.5"	7.6	110	5
HPFF30300	3"	150 PSIG at 400 deg F.	3"	0.5"	10.6	175	6
HPFF30400	4"	150 PSIG at 400 deg F.	3"	0.5"	17.9	241	12

Guide Spacing: To prevent the pipe from exceding it's columnar strenght 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 "Guide Spacing Table" on the next page.

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