

EXTERNALLY PRESSURIZED BELLOWS COMPENSATORS (Catalog #674)

Freight Regulations require all damages from shipping be reported to shipping carrier within five (5) days of delivery.

APPLICATION

Series 8500 Externally Pressurized Bellows Compensators are designed for axial motion applications. Axial motion is parallel to the pipe centerline. Standard compensators are designed for 2" or 3" axial compression (pipe or tube expansion) and 0.5" extension. If the primary movement is extension (pipe or tube contraction) the compensator can be preset at the factory. Alignment guides, supports, and anchors are required for safe operation and warranty. The piping system must include anchors to react the force produced by pressure thrust and the bellows spring constant, supports to react the weight of the pipe and media, and guides to ensure that the pipe/tube alignment is maintained.

Steam systems must also include adequate traps to remove condensate. Liquid systems must also include surge compensation. Consult the system design drawings and specifications to ensure the correct installation. If there is any doubt about the correct application, please contact the design engineer or Hyspan representative.

INSTALLATION

Operating Conditions

Series 8500 Expansion Compensators have a label attached stating the Design Pressure, Test Pressure, and Maximum Operating Temperature. Compensators are available for 2" and 3" axial travel. Consult the purchase specification for the allowable travel of the product purchased. The operating and test conditions of the system must be limited to the values specified for the Part Number. Be certain that the system conditions and test conditions do not exceed the design values. *Write the S/O# & P/N# below. These numbers should be retained as a permanent record since it identifies the specific product manufactured and the date of fabrication. (S/O# (Sales Order Number) is located on the packing slip)*

S/O#: _____ P/N#: _____

Operating Pressure must not exceed design pressure.

Movement must be within the allowable limits. Unless ordered with a factory preset or special motions, movements are measured from the catalog overall length. Movements are limited to axial motion only.

Orientation flow can be in either direction. For vertical service (steam self-draining) install moving end (long pipe) up. For liquid service, install moving end (long pipe) down to avoid air entrapment.

Media and the external environment must be compatible with the expansion compensator materials of construction. Consult metallurgical data if corrosive substances are present.

Brazing & Soldering Type 8509 & 8510 copper tube end compensators incorporate silver brazed joints in the manufacturing process. Do not exceed 1000°F during installation. Solder attachments are to be cleaned to remove residual flux from the joint area, acidic corrosion of the bellows, and an unclean appearance. Cleaning is usually performed using hot water (120°F) accompanied by wire brush if needed.

INSTALLATION PROCEDURE & CHECKLIST:

Use the following procedures in the sequence listed:

- 1. PREPARATION: Verify system conditions.** Is the expansion compensator rating for pressure, temperature, motion, and media satisfactory for the system requirements?
- 2. PREPARATION: Verify all piping system components are included.** Does the piping system include alignment guides, supports, anchors, and traps (where applicable) in accordance with the system drawing? [Support data for expansion compensator, alignment guides, anchors on pages 3 and 4.](#)
- 3. PREPARATION: Verify expansion compensator location.** Locate with access for future removal and replacement, and concern for human safety. Does the intended expansion compensator location match the project drawings? [Support data for expansion compensators, alignment guides, anchors on pages 3 and 4.](#)
- 4. PREPARATION: Verify the piping is aligned, guided, and supported.** Align and support the piping adjacent to the expansion compensator. **DO NOT PUSH THE PIPE OR THE JOINT TO ALIGN THE EXPANSION COMPENSATOR. THE EXPANSION COMPENSATOR SHOULD HAVE NO SIDE LOADS.** Whenever possible, install all of the piping, alignment guides, supports, and anchors prior to cutting the pipe opening to install the expansion compensator. [Support data for expansion compensators, alignment guides, anchors on pages 3 and 4.](#)
- 5. PREPARATION: Unpack and remove compensator from protective covers.** Remove flange or weld end caps and packing materials. **DO NOT REMOVE SHIPPING BARS YET.** Be certain that the expansion compensator interior is free of foreign material. Be certain the compensator is not damaged.
- 6. PREPARATION: Confirm the motions and preset the joint length if needed:** The factory set shipped length of the expansion compensator provides for the rated axial compression (tube or pipe expansion) 2 inches or 3 inches and 0.5 inch of extension (pipe or tube contraction). This travel is satisfactory for most hot water installations. **If the installation temperature is different than 70°F., or adjusted motions are needed, consult Hyspan.** Confirm the compensator can accept the revised motions. Remove the shipping bar attachment to the slide pipe/tube carefully as it resists a factory set spring force. Adjust the length as needed; reinstall the shipping bar to the slide pipe/tube.
- 7. INSTALL: the expansion compensator in the system.** Be certain that the mating attachments do not induce a lateral or angular load to the expansion compensator, meaning do NOT pull the pipe/tube or the compensator in such a way that it loads the compensator sideways/laterally or at an angle when installing. **DO NOT TWIST OR TORQUE THE EXPANSION COMPENSATOR FOR THREADING, OR TO ALIGN FLANGE DRILLING.** NOTE: The long sliding pipe of the expansion compensator may touch the adjacent housing guide ring. This is normal.
- 8. INSTALL: Remove shipping restraints.** Leave these restraints installed until after the installation of the compensator is complete—**CAUTION: the shipping restraints are not designed to react the pressure thrust of the compensator; they must be removed prior to pressure testing.** Remove the shipping bars from the housing and traveling nipple by cautiously cutting, grinding, or heating the solder as needed. The welds or solder on the traveling nipple should be made smooth to avoid binding at the external ring. The expansion compensator should not change length once the bars are removed and before the system is operated.
- 10. INSPECT: the system and expansion compensator prior to testing.** Confirm the expansion compensators, pipe guides, supports and anchors are in accordance with the specification provided for these items. Confirm they are installed in the correct position.

- Inspect the expansion compensator for visible damage.
- Inspect the alignment guides. They must be free to move as the pipe/tube expands and contracts.
- Confirm the guide is positioned correctly to allow required expansion and contraction motions.
- Inspect pipe supports for correct position and strength to support weight of the pipe/tube and media.
- Inspect anchors for rigidity – once pressure is applied to the system, they must not deflect or let the pipe/tube move at the anchor locations.

11. TEST: HYDRO/PRESSURE TEST: Each Hyspan Series 8500 expansion compensator is factory pressure tested to check for leaks. The joint can be pressure tested to the full test rating, not to exceed 1.5 times the design pressure, without detriment to the compensator; however, be certain the pump used is fully controllable and does not induce pressure spikes above the test pressure rating with a non-dampened gauge. Be certain all water is drained from the system upon completion of the hydro test, especially if steam will be applied.

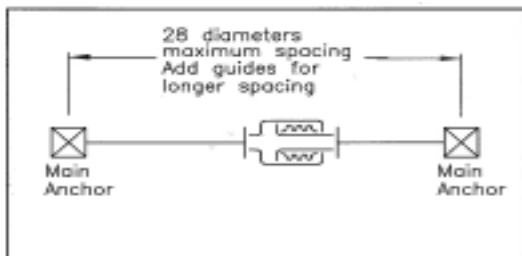
12. INSPECT: the system and expansion compensator during and after pressure testing.

Confirm the expansion compensators, pipe guides, supports, and anchors are in accordance with the specification provided for these items.

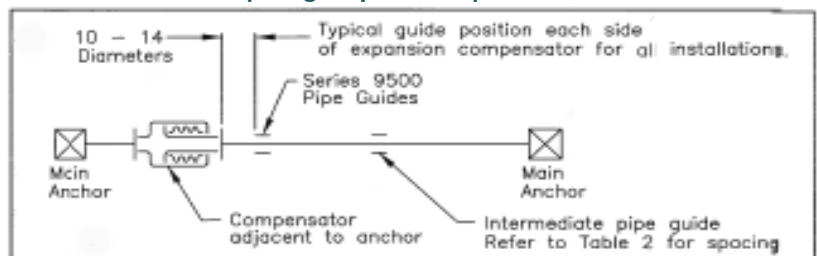
- Inspect the expansion compensator for visible damage and incorrect length. NOTE: If the joint extends during testing immediately stop the test and check the anchors. They may require strengthening.
- Inspect the alignment guides to be certain they move as the pipe expands and contracts. Confirm the guide allows required movement as the pipe expands and contracts.
- Inspect pipe supports for correct position and mounting to support the weight of the pipe/tube and media.
- Inspect anchors for bending, cracks, or other indications of failure.

MAINTENANCE: Series 8500 expansion compensators do not require maintenance other than routine cleaning and painting to prevent external corrosion. If water is introduced into a steam system, the expansion joint must be drained before the steam is applied to prevent flashing and/or water hammer.

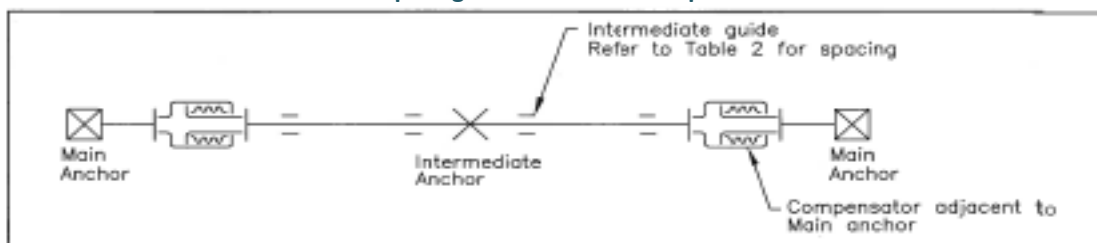
Short run between heaters or solar panels



Run requiring only one compensator



Run requiring more than one compensator



Intermediate Pipe Guide Spacing per Table 2 Below

Table 2

	Nominal Size	Pressure (psig)				
		50	75	100	150	200
Models 8503 – 8506 Schedule 40 Carbon Steel Pipe	3/4	7.7	7.3	6.9	6.3	5.8
	1	11.9	11.0	10.3	9.2	8.4
	1 - 1/4	16.3	14.7	13.5	11.7	10.5
	1 - 1/2	19.4	17.2	15.6	13.4	11.9
	2	26.8	23.2	20.7	17.5	15.4
	2 - 1/2	31.3	27.5	24.8	21.2	18.8
Models 8509 – 8510 Type L Copper Tube	3/4	2.4	2.3	2.2	2.1	1.9
	1	4.0	3.7	3.5	3.2	2.9
	1 - 1/4	5.7	5.2	4.9	4.3	3.9
	1 - 1/2	7.5	6.8	6.2	5.4	4.9
	2	10.0	9.0	8.3	7.2	6.5
	2 - 1/2	13.9	12.2	10.9	9.4	8.3
	3	16.8	14.7	13.2	11.2	9.9
	4	20.6	18.3	16.6	14.3	12.7

Alignment Guides:
first system guide should be located 10-14 diameters from compensator

Notes:
(1) The values listed are the center to center distance measured in feet.
(2) The tabulated values are for Series 8500 expansion compensators at the system design pressure listed.

TRAVEL REQUIRED

The axial expansion or contraction of pipe or tube is determined by the change in temperature. The Table below includes a tabulation of linear change in inches for 100 feet of commonly used materials based on an installation temperature of 70°F. For installation temperature above 70°F subtract the expansion for the installation temperature from the service temperature, and add for installations below 70°F. The Intermediate Guide Spacing in Table 2 is the minimum recommended intermediate guide spacing required to ensure that the pipe or tube travel is aligned with the compensators. *Important: Hyspan compensators are manufactured with restraints to insure the rated movements. For cold applications or other special conditions the factory must be notified in order to properly preset the units for extension applications.*

Thermal expansion or contraction (inches) =
Length of run between anchors (feet) X
Linear change ÷ 100

Thermal Expansion

	Saturated Steam Pressure	Temperature		Copper Tube	Carbon Steel Pipe
		Deg F	Deg C		
Vacuum (inches of mercury)		-325	-198		
		-300	-185		
		-250	-157		
		-200	-129	-2.85	
		-150	-101	-1.81	
		-100	-73	-1.81	
		-50	-46	-1.32	-0.34
		0	-18	-0.75	-0.49
		25	-4	-0.47	-0.32
		29.7	32	0	-0.27
		29.6	50	10	-0.19
		29.2	70	21	-0.4
Pressure (psig)		28.0	100	38	0.38
		26.0	125	52	0.66
		22.4	150	66	0.94
		16.3	175	80	1.23
		6.0	200	93	1.51
		0	212	100	1.65
		4	225	107	1.80
		5	250	121	2.09
		31	275	135	2.38
		52	300	149	2.67
		120	350	177	3.27
		150	358	181	3.37
	300	417	214	4.09	
	666	500	260	5.09	

Linear thermal expansion of pipe or tube per 100 feet between 70°F & tabulated temperature

ANCHOR FORCES

Systems incorporating expansion compensators must include structural reactions or main anchors as shown on the application diagrams (Page 3) with sufficient strength to withstand the full pressure thrust based on the effective area of the compensator, and the spring force produced by deflecting the bellows element. The highest pressure anticipated during service or testing should be used, and the maximum stroke for the most conservative design. Ideally, intermediate anchors have balanced forces on each side; however, it is recommended that the maximum force produced by the compensator spring rate should be utilized for design.

$$\text{Main Anchor Force (lbs)} = \frac{\text{Pressure Force (lbs)}}{\text{(Table 3 Models 8503-6 or Table 4 Models 8509 \& 10)}} + \left\{ \begin{array}{l} \text{Spring Rate (lb/in)} \\ \text{(Column 2 Table 5 Models 8503-6 or} \\ \text{Column 3 Table 6 Model 8509 \& 10)} \end{array} \right\} \times \text{Axial Travel (inches)}$$

$$\text{Intermediate Anchor Force (lbs)} = \left\{ \begin{array}{l} \text{Spring Rate (lb/in)} \\ \text{(Column 2 Table 5 Models 8503-6 or} \\ \text{Column 3 Table 6 Model 8509 \& 10)} \end{array} \right\} \times \text{Axial Travel (inches)}$$