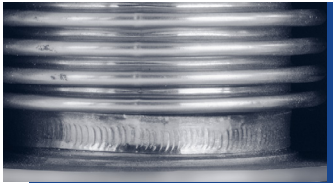
Hyspan®

Series 8500

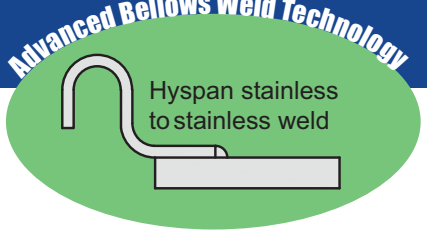
Expansion Compensators

Catalog 674J

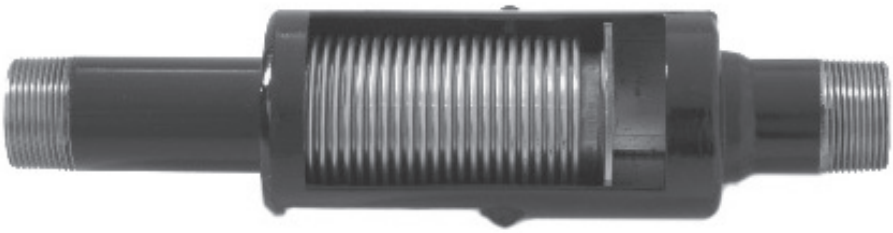


Hyspan

Advanced Bellows Weld Technology



Series 8500 Expansion Compensators



Type 8503 Cutaway

Warranty
Full three year replacement warranty—see back cover.

- Sizes 3/4" through 4"
- Threaded, welded, flanged, and grooved steel pipe joints
- Male and female copper sweat ends
- Design pressure: 200 psig—see Copper Tube, Page 6
- Axial travel: 2" and 3"
- Fully enclosed and externally pressurized, multiply stainless steel bellows
- Internal guides maintain alignment
- Compact space-saving design

Temperature changes in heat transfer system piping, tubing, heaters, radiators, solar panels, and other equipment create expansion and contraction that must be absorbed.

Expansion Compensators provide a maintenance-free, compact, economical, and reliable method of eliminating this problem.

The compact design of Expansion Compensators permits installation within tight spaces, and the inline construction minimizes pressure drop and heat loss. The metal bellows is fully enclosed, and internal and external guides maintain alignment.

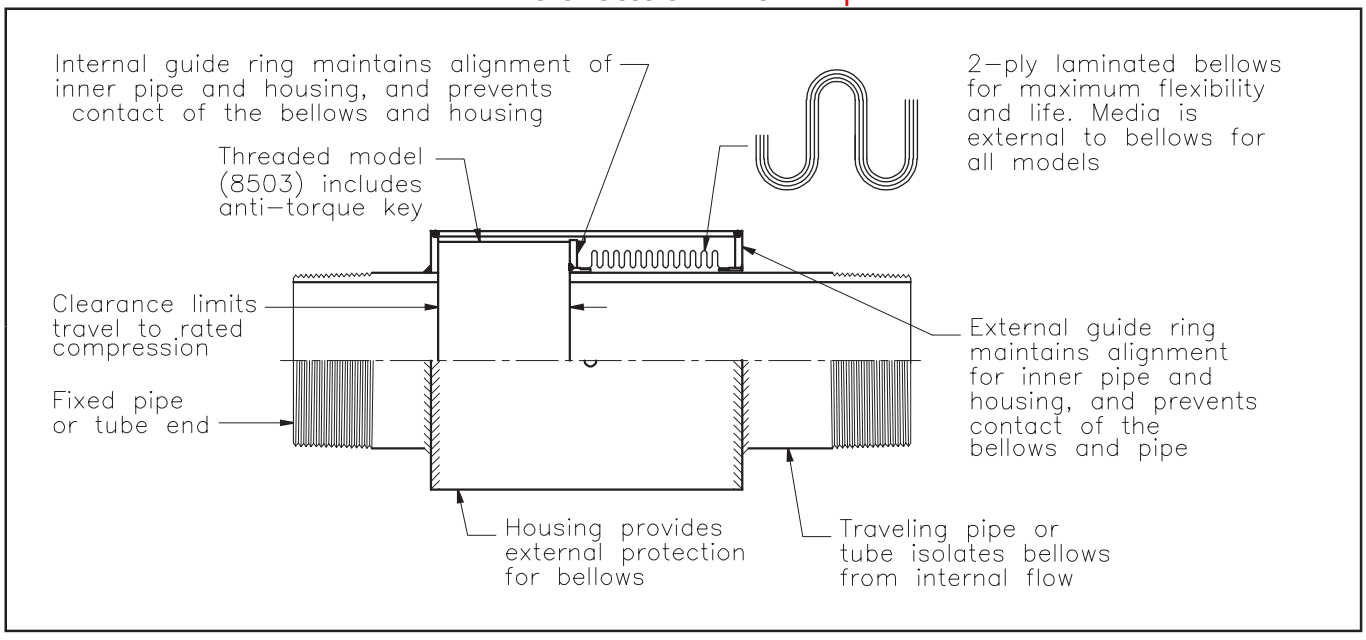
All welded or high-temperature brazed construction eliminates the need for maintenance. They are assembly line produced for economy, and they are available from stock.

Hyspan stainless to stainless bellows weld technology:

- maximizes service life
- minimizes corrosion of dissimilar materials

Design Features

Canadian Registration Number: 0D9278.59870YTNADD3

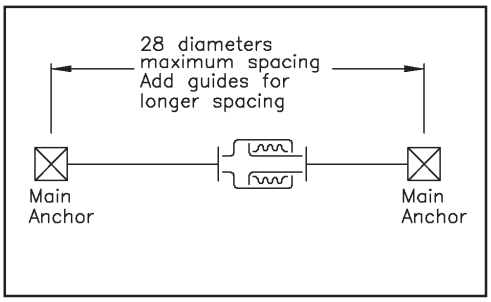


Applications

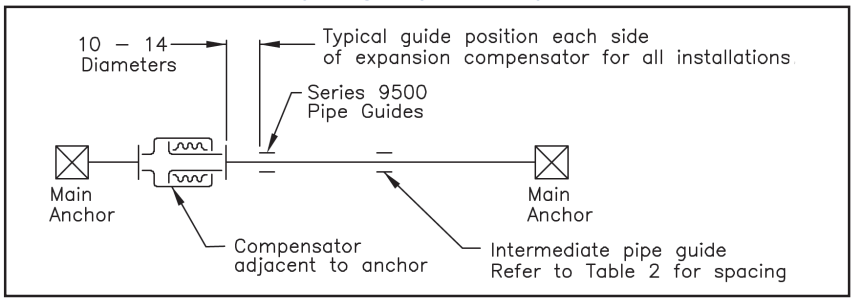
Series 8500 Expansion Compensators are designed for installations where the principal movement is axial. Standard joints are designed for 2" or 3" axial compression (pipe expansion) and 0.5" extension. If the primary movement is extension (pipe contraction), the compensator can be preset at the factory. 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 alignment is maintained.

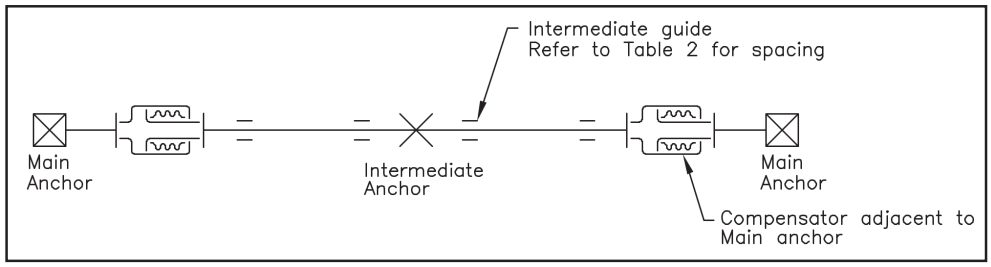
Refer to Table 2 for the intermediate guide spacing in the center of pipe runs.

Short run between heaters or solar panels



Run requiring only one compensator





Run requiring more than one compensator

See Page 6 for calculation methods for travel required and anchor forces.

Table 1 Thermal Expansion

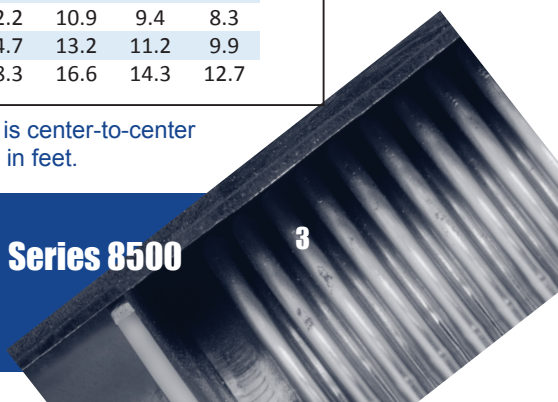
Saturated Steam Pressure		Temperature Deg F	Deg C	Copper Tube	Carbon Steel Pipe
		–300	–185		
		–250	–157		
		–200	–129	–2.85	
		–150	–101	–1.81	
		–100	–73	–1.81	
		–50	–46	–1.32	–0.84
		0	–18	–0.75	–0.49
		25	–4	–0.47	–0.32
Vacuum (inches of mercury)	29.7	32	0	–0.39	–0.27
	29.6	50	10	–0.19	–0.14
	29.2	70	21	–0	0
	28.0	100	38	0.38	0.23
	26.0	125	52	0.66	0.42
	22.4	150	66	0.94	0.61
	16.3	175	80	1.23	0.80
	6.0	200	93	1.51	0.99
	0	212	100	1.65	1.10
Pressure (psig)	4	225	107	1.80	1.21
	5	250	121	2.09	1.40
	31	275	135	2.38	1.61
	52	300	149	2.67	1.82
	120	350	177	3.27	2.26
	150	358	181	3.37	2.33
	300	417	214	4.09	2.86
	666	500	260	5.09	3.62

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

Table 2 Intermediate Guide Spacing

	Nominal Size (inches)	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
	3	38.8	33.5	29.9	25.2	22.0
	4	47.1	40.7	36.4	30.8	27.0
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

Note: Guide spacing is center-to-center measured in feet.



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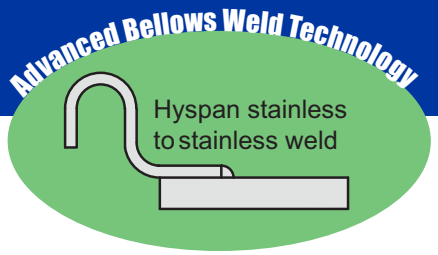
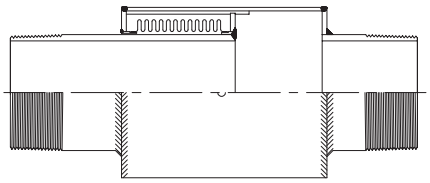
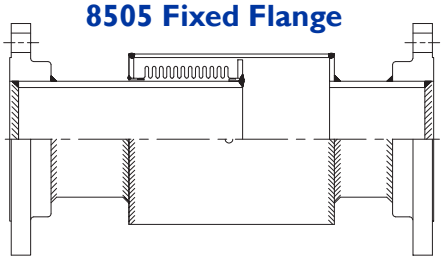


Steel Pipe Applications

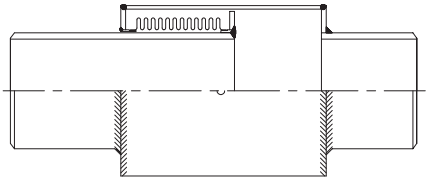
8503 Male Pipe Threads



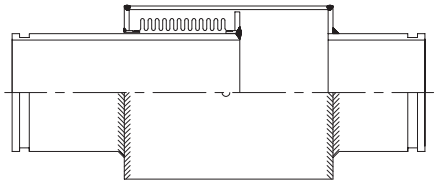
8505 Fixed Flange



8504 Weld End



8506 Grooved Ends



Bellows: Laminated (multiply) ASTM A240 Type 321 or 304 stainless steel
Pipe: Schedule 40 ASTM A53 Grade B
Type 8503 threads per ASME B1.20.1
Type 8504 weld prep 37.5° per ASME B16.25
Type 8506 grooved per ANSI/AWWA C606-87
Flanges: ASME A105 raised face dimensioned per ASME B16.5, 150 LB
Housing, Guides, & Stops: Carbon steel sheet & tube
Note: Type 8503 includes an anti-torque stop

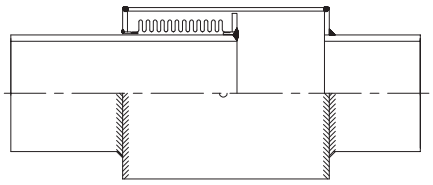
Hyspan stainless to stainless bellows weld technology:

- maximizes service life
- minimizes corrosion of dissimilar materials

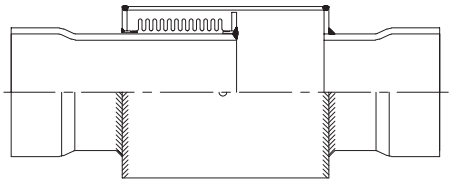
Copper Tube End Applications

NSF/ANSI 372–Lead Free

8509 Male Tube Ends (Press-fitting friendly)



8510 Female Tube Ends



Bellows: Laminated (multiply) ASTM A240
Type 321 or 304 stainless steel
Copper Tube: ASTM B88
Housing & Guides: ASTM A240 Type 304 or 321 stainless steel
Note: Designed for sweat connection per ASME B16.2

Table 3 Pressure & Force Data
Types 8503, 8504, 8505 & 8506

Part # 8503 8504 8505 8506	Nominal Size (NPS)	Effective Area (in^2)	Tabulated Pressure Thrust (pounds) 100 (psig)	150 (psig)	200 (psig)	300 (psig)
-214	3/4	1.5	150	225	300	450
-219	1	2.1	210	315	420	630
-224	1 1/4	3.3	330	495	660	990
-227	1 1/2	4.3	430	645	860	1290
-231	2	6.3	630	945	1260	1890
-235	2 1/2	8.8	880	1320	1760	2640
-240	3	13.1	1310	1965	2620	3930
-248	4	20.8	2080	3120	4160	6240
1	2	3	4	5	6	7

Table 4 Pressure & Force Data
Types 8509 & 8510

Part Number 8509 8510	Copper Tube Size	Effective Area (in^2)	Tabulated Pressure Thrust (pounds) 100 (psig)	150 (psig)	200 (psig)	300 (psig)
-212	3/4	1.1	110	165	220	330
-216	1	1.7	170	255	340	510
-220	1 1/4	2.4	240	360	480	720
-223	1 1/2	3.2	320	480	640	960
-229	2	5.1	510	765	1020	1530
-233	2 1/2	7.6	760	1140	1520	2280
-237	3	10.6	1060	1590	2120	3180
-245	4	17.9	1790	2685	3580	5370
1	2	3	4	5	6	7

Note: Tabulated data in Tables 3 & 4 is the force produced by pressure only. Refer to the Axial Spring rate tabulated in Tables 5 & 6 for the force resulting from the bellows stiffness.

Table 5 Steel Pipe Ends—Models 8503, 8504, 8505 & 8506

Design Pressure: 200 psig Test Pressure: 300 psig Temperature Range: -400 °F to 500 °F

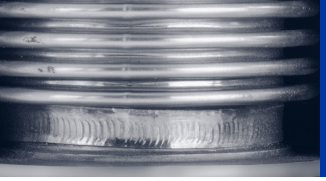
Nominal Size (NPS)	Axial Spring Rate (lb/in)	Outside Diameter (inches)	Part Number	Axial Compr. (inches)	8503, 8504, 8506 Overall Length (inches)	8503, 8504, 8506 Weight (lbs)	8505 Overall Length (inches)	8505 Weight (lbs)
3/4	81	2.375	-214-2	2.0	12.750	2.5	13.125	5.0
	58		-214-3	3.0	16.500	3.0	16.875	5.5
1	88	2.875	-219-2	2.0	12.750	4.0	13.125	7.5
	63		-219-3	3.0	16.500	4.7	16.875	8.3
1 1/4	75	2.875	-224-2	2.0	12.750	4.5	13.125	8.5
	52		-224-3	3.0	16.500	5.4	16.875	9.4
1 1/2	121	3.500	-227-2	2.0	14.000	5.8	14.375	10.8
	82		-227-3	3.0	17.500	6.5	17.875	11.5
2	143	4.000	-231-2	2.0	14.000	7.0	14.375	15.5
	117		-231-3	3.0	17.500	8.5	17.875	17.0
2 1/2	187	5.000	-235-2	2.0	15.500	12.3	16.000	23.5
	132		-235-3	3.0	18.750	14.8	19.250	26.0
3	230	5.563	-240-2	2.0	15.500	15.5	16.000	30.0
	161		-240-3	3.0	19.250	18.5	19.750	33.0
4	484	6.625	-248-2	2.0	16.375	21.0	16.875	41.0
	341		-248-3	3.0	19.250	25.0	19.750	45.0
1	2	3	4	5	6	7	8	9

Table 6 Copper Tube Ends—Models 8509 & 8510

Design Pressure: 200 psig Test Pressure: 300 psig Temperature Range: -320 °F to 500 °F

Copper Tube Size	Actual Tube O.D. (inches)	Axial Spring Rate (lb/in)	Outside Diameter (inches)	Part Number	Axial Compr. (inches)	8509 & 8510 Overall Length (inches)	8509 & 8510 Weight (lbs)
3/4	.875	56	1.50	-212-2	2.0	11.188	1.0
		40		-212-3	3.0	14.875	1.0
1	1.125	62	1.88	-216-2	2.0	11.500	1.4
		44		-216-3	3.0	15.125	1.8
1 1/4	1.375	52	2.26	-220-2	2.0	12.500	2.0
		37		-220-3	3.0	16.250	2.6
1 1/2	1.625	62	2.51	-223-2	2.0	13.188	2.5
		43		-223-3	3.0	16.688	3.1
2	2.125	109	3.02	-229-2	2.0	13.625	3.8
		78		-229-3	3.0	18.125	4.9
2 1/2	2.625	214	4.02	-233-2	2.0	13.500	6.0
		148		-233-3	3.0	16.750	7.3
3	3.125	171	4.53	-237-2	2.0	14.000	7.8
		119		-237-3	3.0	17.750	9.7
4	4.125	235	5.61	-245-2	2.0	14.625	12.4
		166		-245-3	3.0	18.625	15.5
1	2	3	4	5	6	7	8

Note: Standard construction is designed for 2” or 3” axial compression and 0.5” axial extension. Refer to Ordering Instructions on Page 7 to order factory preset for axial extension.



Copper Tube Pressure Limits, Models 8509 and 8510

ASME B31.3 for Type L Copper Tubing has the following pressure and temperature limits (applies to Table 6, Page 5):

Design Temperature for 200 psig as follows:

- 3/4" and 1" Sizes: 400°F
- 1 ¼" - 2" Sizes: 350°F
- 2 ½" - 3" Sizes: 300°F
- 4" Size: 175 °F (300°F for Max. 180 psig / 200°F for Max. 192 psig)

Calculated stresses for the following Standard Materials:
Bellows: ASTM A240-321 and A240-304/304L
Stubs: Copper ASTM B88
Housing: ASTM A240-321 and A240-304

Alternatives:
Joints Available with Bellows Material of:

- ASTM A240-316/316L
- ASTM A240-321
- ASTM B443-625 GR.1

Travel Required

The axial expansion or contraction of pipe or tube is determined by the change in temperature. Table 1 on Page 3 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 temperatures 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 on Page 3 is the minimum recommended guide spacing required to ensure that the pipe or tube travel is translated to, and 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.

$$\textbf{Thermal expansion or contraction (inches)} = \text{Length of run between anchors (feet)} \times \text{Linear change from Table 1} \div 100$$

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.

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

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

Ordering Instructions

Refer to Tables 5 & 6 on Page 5 for the steel pipe or copper tube end configuration required for your application. If the travel required is unknown, see the method of calculation on Page 6.

Example

Threaded steel pipe ends
200 psig at 500°F maximum
2.0" axial travel maximum
2" NPS

8503-231-2

- 8503 — Model specification, male pipe thread both ends, steel pipe, steel housing, and guides
- 231 — Size designation, 2" NPS (Table 5)
- 2 — Axial travel, 2.0" compression, 0.5" extension

- Model(s) 8503, 8504, 8505, and 8506 are available with all stainless steel construction for low temperature or highly corrosive service. Must be specified by written description.
- All Series 8500 compensators are available with multiply Alloy 625 bellows for highly corrosive media. Must be specified by written description.

Installation Procedure

Operating Conditions: Series 8500 Expansion Compensators are supplied with 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. Be certain that the system conditions and test conditions do not exceed these values.

Guides, Supports, Anchors: Series 8500 Expansion Compensators are designed for applications where the principal movement is axial to the centerline of the compensator, and the system includes guides, supports, and anchors. Refer to Applications on Page 3 for system requirements.

Flow Direction: The flow can be in either direction for Series 8500 Expansion Compensators.

Brazing & Soldering: Type 8509 & 8510 copper tube end compensators incorporate silver brazed joints in the manufacturing process. Do not exceed 1000°F during installation.

Shipping Restraints: External restraints are installed at the factory to insure installation at the correct length and alignment. They are labeled: *Shipping Bars, Remove After Installation*. Leave these restraints installed until after the installtion of the compensator is complete—but they must be removed prior to pressure testing.
CAUTION: *Shipping Bars are not designed to react the pressure thrust of the compensator—they must be removed prior to testing. Normally the Shipping Bars are installed by welding and brazing—carefully remove any excess weld or braze metal.*

Post Installation Inspection:

1. Inspect the expansion joint for damage
2. Is the compensator installed at the correct location; and are the anchors, guides, and supports installed in accordance with the system design?
3. Are the guides and support free to allow movement of the compensator?
4. Are the Shipping Restraints/Bars removed?

(For more complete installation / inspection instructions, please refer to Series 8500 on our website at www.hyspan.com)

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Series 8500 Expansion Compensators Catalog 674J

Hyspan Associations & Options:

THREE YEAR LIMITED WARRANTY

This warranty (abbreviated here) is given by HYSPAN PRECISION PRODUCTS, INC. (HYSPAN) for the benefit of the purchasers for use of its Series 8500 Expansion Compensators manufactured by HYSPAN to standard catalog construction or standard construction with laminated Alloy 625 bellows. The product is warranted to be free from defects in material and workmanship for a period of three (3) years from the date of shipment by HYSPAN in accordance with the conditions stated on HYSPAN'S official website; www.hyspan.com.

For complete warranty terms and conditions, please see Series 8500 warranty at www.hyspan.com.