Hyspan

Engineered Motion. Proven Reliability.

Metal Bellows Expansion Joints

Hyspan Precision Products™
Product Catalog

Series 1500 · 2500 · 3500 · 5500 · 7500 · 8500

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Note: This catalog covers Hyspan Precision Products standard and custom bellows product lines. For hose assemblies, ball joints, slip joints, and specialty products, refer to the applicable Hyspan product catalogs

Company Overview

Engineered Motion. Proven Reliability.

Hyspan Precision Products designs and manufactures metal expansion joints, flexible metal hose assemblies, and motion-control components for mission-critical piping and pressure systems worldwide. Founded in 1968 and headquartered in Chula Vista, California, Hyspan has built a 50+ year record of engineering quality and manufacturing capability across industrial, energy, defense, aerospace, and commercial markets.

As a member of the Expansion Joint Manufacturers Association (EJMA), Hyspan designs and manufactures in accordance with applicable ASME, military, and international codes and standards. Products are built to order in Hyspan's vertically integrated manufacturing facilities, with complete material traceability and documented inspection at every stage.

Core Capabilities

- All four expansion joint technologies
- Metal bellows expansion joints
- Flexible metal hose assemblies and braided connectors
- Ball joints and slip joints
- Venturis, VibraSnubbers, struts and pipe alignment guides
- Custom engineered assemblies — ¼" to 32 ft diameter, full vacuum to 5,000+ PSIG
- Exotic materials: Inconel 625, Hastelloy, Monel, Titanium, and others
- FEA/CFD analysis, fatigue life evaluation, seismic and vibration modeling

Certifications

Markets Served

- Energy & Petrochemical — refineries, FCCU, piping systems
- Power & Utility — steam, hot water, district energy
- Defense & Maritime — NAVSEA-qualified, naval shipboard systems
- Aerospace — AS9100D certified, fatigue-rated precision bellows
- Advanced Technology & Development — UHV, R&D
- Commercial & Industrial — HVAC, mechanical rooms, building systems
- Automotive — OEM exhaust and flexible assembly manufacturing

For custom requirements, specification review, or application engineering support, contact Hyspan at websales@hyspan.com or +1 619.421.1355

Series 1500 – Laminated Metal Bellows

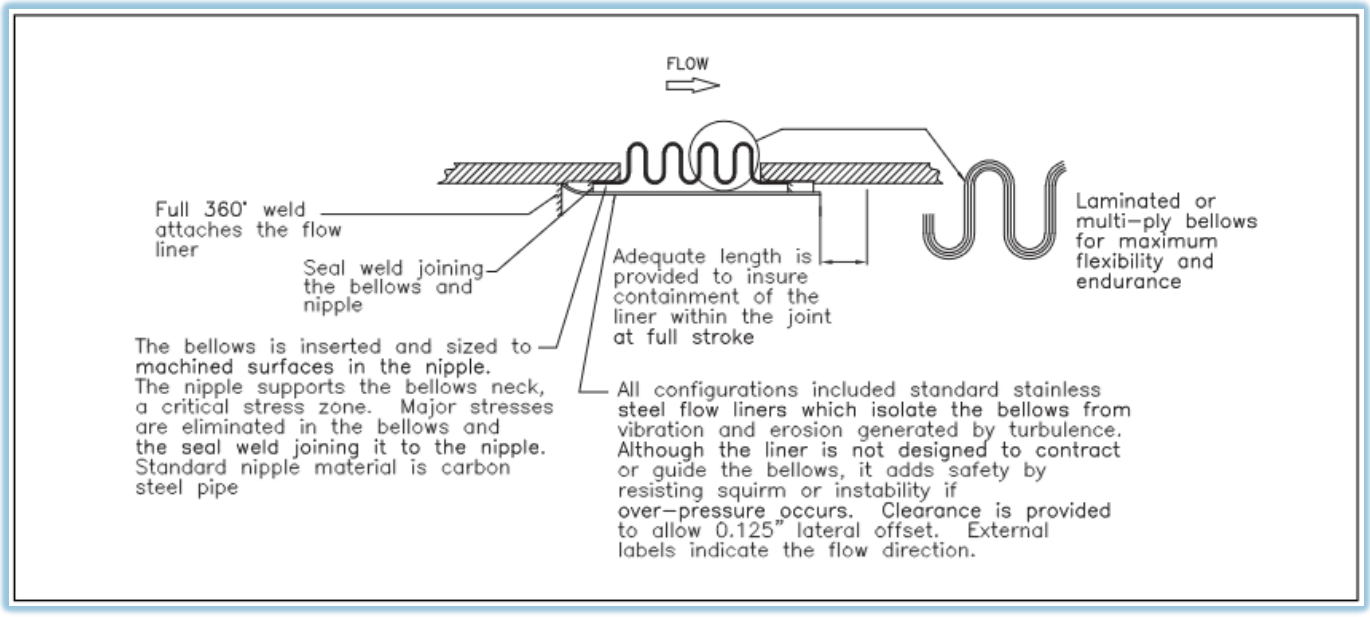
Nominal Sizes	2" – 14" NPS
Design Pressure	150 PSIG and 300 PSIG @ 500°F (full vacuum to 300 PSIG)
Axial Travel	Up to 3.0 inches compression
Movement	Axial (primary); lateral offset 0.125"
Bellows Construction	Laminated (multi-ply) ASTM A240 Type 321 SS (3" and under), Type 304 (over 3")
End Connections	Fixed flange (1501), weld end (1502), fixed/floating flange (1504)
Flow Liner	ASTM A240 Type 304 stainless steel (standard)
Warranty	Five-year limited replacement warranty

Product Description

Series 1500 Laminated Bellows Expansion Joints are designed for applications where the principal movement is axial. The bellows element uses up to 5+ individual laminations of precision stainless steel foil — a design that combines the high flexibility of thin material with the pressure resistance of multiple plies. Compared to a single-ply bellows of equivalent pressure rating, the laminated construction deflects twice as far and requires half the force to compress.

The bellows is installed on the inside diameter of the pipe nipple, which reinforces the bellows neck and attachment weld and reduces the effective area — resulting in a pressure thrust force that is 40–70% lower than comparable products. A stainless steel flow liner is standard on all Series 1500 joints. The liner eliminates added pressure drop, protects the bellows from turbulent flow, and reduces the risk of bellows instability and provides an added measure of protection during the event of over-pressurization.

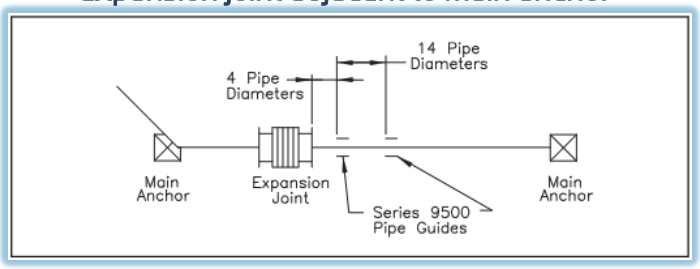
Design Features



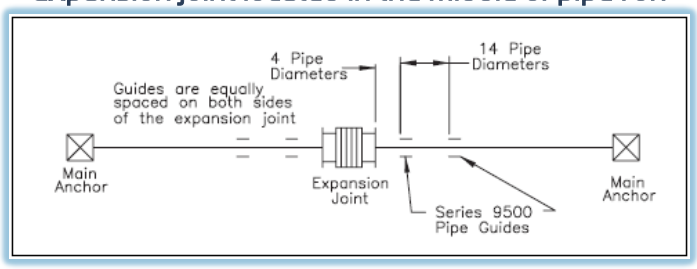
Applications

Series 1500 joints are designed for installations where the principal movement is axial. The piping system must include anchors to react pressure thrust and bellows spring force, supports for pipe and media weight, and guides to maintain alignment. See Series 9500 Alignment Guides catalog for guide spacing requirements.

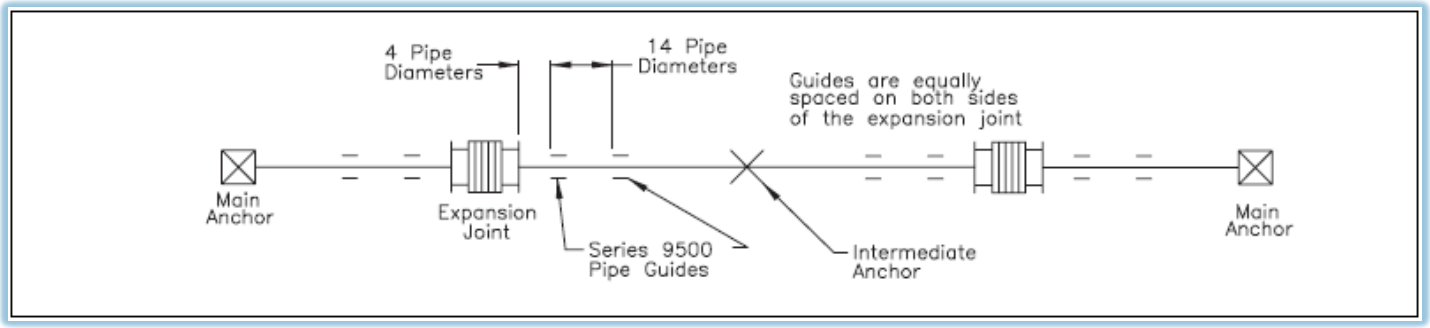
Expansion joint adjacent to main anchor



Expansion joint located in the middle of pipe run



Two or more expansion joints with intermediate anchors



Anchor Forces

Main anchors must resist both the pressure thrust force and the bellows spring force.

Intermediate anchors resist the spring force only.

Main Anchor Force

$$F_{ma} = F_{pt} + kx$$

F_{ma} = Main Anchor Load (lb_f)

F_{pt} = Press Thrust (lb_f)

k = Spring Rate (lb_f/in)

x = Axial Travel (in)

Intermediate Anchor Force

$$F_{ia} = kx$$

F_{ia} = Intermediate Anchor Load (lb_f)

k = Spring Rate (lb_f/in)

x = Axial Travel (in)

Series 1500 – Design Data Tables

Materials of Construction

Flanges: Flat face carbon steel, ASME A-36 plate. OD and drilling per ASME/ANSI B16.5. Table 2 designs — 150 lb drilling; Table 3 designs — 300 lb drilling.

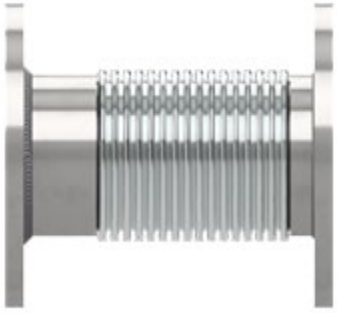
Pipe: Schedule 40 ASME A53 Grade B. Model 1502 weld preparation per ASME/ANSI B16.9.

Lap Joint Stub Ends: Schedule 40 ASME/ANSI B16.9 carbon steel.

Bellows: Laminated (multi-ply) ASTM A240 Type 321 stainless steel (3" and under), Type 304 (over 3" diameter).

Flow Liner: ASTM A240 Type 304 stainless steel.

1501
FIXED FLANGE



1502
WELD END

1504
FIXED/FLOATING
FLANGE

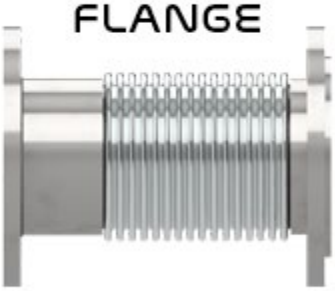


Table 1 — Pressure and Force Data (Types 1501, 1502, 1504)

Nominal Size NPS	Effective Area (square inches)	Tabulated Force (pounds) for Individual Pressures												
		50 PSI	75 PSI	100 PSI	125 PSI	150 PSI	175 PSI	200 PSI	225 PSI	250 PSI	300 PSI	350 PSI	400 PSI	450 PSI
2	4.1	208	312	415	519	623	727	831	935	1039	1246	1454	1662	1870
2-1/2	5.8	290	436	581	726	872	1017	1162	1307	1453	1743	2034	2324	2615
3	8.8	445	667	889	1112	1334	1556	1779	2001	2223	2668	3113	3557	4002
4	15.4	774	1161	1548	1935	2322	2709	3097	3484	3871	4645	5419	6193	6967
5	23.5	1179	1769	2358	2948	3538	4127	4717	5307	5896	7076	8255	9434	10614
6	33.3	1669	2504	3339	4173	5008	5843	6677	7512	8347	10016	11686	13355	15024
8	56.8	2840	4261	5681	7101	8522	9942	11362	12783	14203	17043	19884	22725	25565
10	87.2	4362	6544	8725	10906	13088	15269	17450	19631	21813	26175	30538	34900	39263
12	122	6146	9219	12291	15364	18437	21510	24583	27656	30729	36874	43020	49166	55312
14	152	7600	11400	15200	19000	22800	26600	30400	34200	38000	45600	53200	60800	68400
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Note: Tabulated data is force produced by pressure only. Refer to column 3 of tables 2 & 3 for force resulting from bellows stiffness.

Table 2 — Design Pressure: 150 PSIG • Test Pressure: 225 PSIG • Design Temperature: 500°F

Nominal Size NPS	Axial Deflection (inches)	Axial Spring Rate (lb/in)	Part Number 1501 1502 1504	1501 & 1504		1502	
				Overall Length (inches)	Weight (lbs)	Overall Length (inches)	Weight (lbs)
2	2 3	58 43	-131-2.0 -131-3.0	11 14	13 15	10.5 13.5	3 4
2 1/2	2 3	72 54	-135-2.0 -135-3.0	11 14	19 21	10.5 13.5	5 7
3	2 3	93 70	-140-2.0 -140-3.0	11 14	23 25	10.5 13.5	6 9
4	2 3	207 155	-148-2.0 -148-3.0	11 14	30 35	10.5 13.5	9 13
5	2 3	253 190	-155-2.0 -155-3.0	11 14	37 42	10.5 13.5	12 17
6	2 3	464 348	-160-2.0 -160-3.0	11 14	44 51	10.5 13.5	16 23
8	2 3	434 325	-167-2.0 -167-3.0	11 14	63 74	10.5 13.5	24 35
10	2 3	548 411	-174-2.0 -174-3.0	11.5 14.5	102 117	11 14	34 49
12	2 3	818 614	-180-2.0 -180-3.0	11.5 14.5	136 154	11 14	40 58
14	2 3	809 607	-181-2.0 -181-3.0	11.5 14.5	147 166	11 14	43 63
1	2	3	4	5	6	7	8

Table 3 — Design Pressure: 300 PSIG • Test Pressure: 450 PSIG • Design Temperature: 500°F

Nominal Size NPS	Axial Deflection (inches)	Axial Spring Rate (lb/in)	Part Number 1501 1502 1504	1501 & 1504		1502	
				Overall Length (inches)	Weight (lbs)	Overall Length (inches)	Weight (lbs)
2	2 2.5	125 109	-331-2.0 -331-2.5	12 13.5	17 18	11.5 13.0	3 4
2 1/2	2 2.5	153 134	-335-2.0 -335-2.5	12 13.5	23 24	11.5 13.0	6 7
3	2 2.5	197 172	-340-2.0 -340-2.5	12 13.5	28 29	11.5 13.0	7 9
4	2 2.5	519 454	-348-2.0 -348-2.5	12 13.5	39 42	11.5 13.0	10 13
5	2 2.5	634 555	-355-2.0 -355-32.5	12 13.5	46 50	11.5 13.0	14 17
6	2 2.5	652 570	-360-2.0 -360-2.5	12 13.5	71 76	11.5 13.0	18 23
8	2 2.5	934 817	-367-2.0 -367-2.5	12 13.5	99 106	11.5 13.0	28 35
10	2 2.5	1174 1027	-374-2.0 -374-2.5	12.5 14.0	141 151	11.5 13.5	39 49
12	2 2.5	1980 1733	-380-2.0 -380-2.5	12.5 14.0	184 196	11.5 13.5	46 58
14	2 2.5	2119 1854	-381-2.0 -381-2.5	12.5 14.0	199 212	11.5 13.5	50 63
1	2	3	4	5	6	7	8

Optional Features

Limit Rods — Restricts bellows over-travel and designed to react the full pressure thrust in the event of anchor failure. Must be adjusted to allow the design movement of the joint.

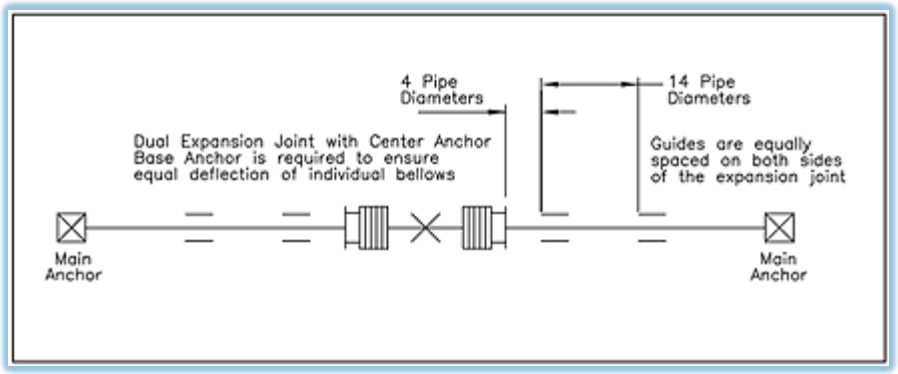
Shrouds — Protects bellows from falling objects, weld slag, or to allow external insulation without contact to the bellows.

Dual Center Anchor Base Configurations

Where the expansion or contraction of a straight run exceeds the capability of a single joint, two single joints separated by an intermediate anchor can be installed — or a Dual Center Anchor Base configuration can be used, which incorporates two bellows and an intermediate anchor in a single assembly.

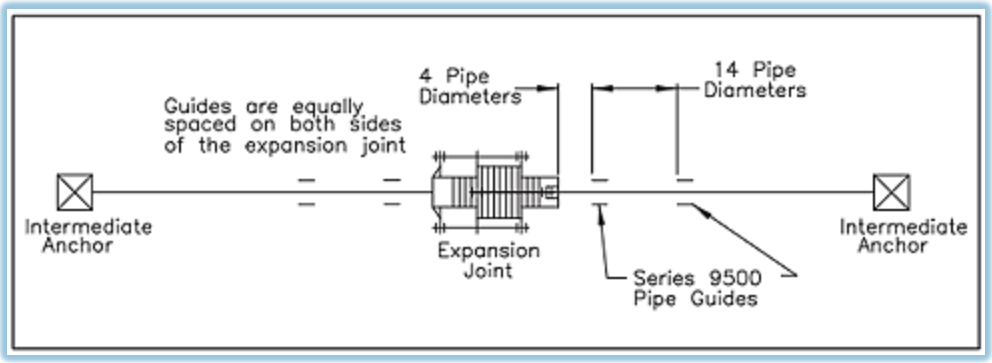
1505
FLANGED DUAL
WITH ANCHOR BASE

1506
WELD END DUAL
WITH ANCHOR BASE



In-Line Pressure Balanced Configuration

Where main anchors cannot react the full pressure thrust, Series 1500 joints are available as in-line pressure balanced assemblies. This configuration links two line-size bellows and one double-area balancing bellows via internal linkage to internally react the pressure thrust. An intermediate anchor is still required to resist the bellows spring force.



Installation Notes

- Confirm design pressure, temperature, and travel limits do not exceed system conditions or test conditions.
- System must include guides, supports, and anchors per Page 3 application diagrams.
- Flow direction is indicated on the exterior of the joint. Confirm orientation before installation.
- Shipping restraints are painted yellow — labeled 'Shipping Bars, Remove After Installation.' Leave in place until installation is complete, remove before pressure testing.
- Limit rods, if included, must be adjusted to allow full design movement.
- Post-installation: verify bellows is undamaged, joint is correctly located, guides and supports are free to move, flow direction is correct, shipping restraints are removed.

Series 2500 — Low Pressure / Exhaust Bellows



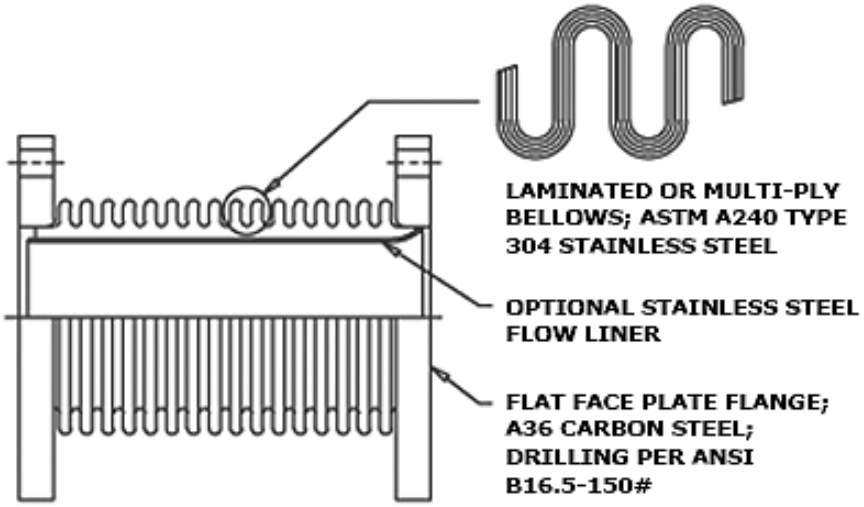
Nominal Sizes	3" – 48" NPS (round); rectangular configurations available
Design Pressure	Full vacuum to 15 PSIG (including test pressure)
Temperature	Up to 775°F (carbon steel fittings); 1,100°F (Type 2510); 1,250°F (all-stainless)
Movement	Axial, lateral, angular
Bellows Construction	Laminated 3-ply, ASTM A240 Type 304 stainless steel
End Connections	Fixed flange (2509), Vanstone flange (2510), weld end (2511)
Flow Liner	Optional — recommended per EJMA guidelines for high-velocity applications
Tie Rods	Optional — function as limit rods or tie rods depending on factory settings

Product Description

Series 2500 Laminated Bellows Expansion Joints are designed for low-pressure applications including engine exhaust systems, fan connections, ventilation ducting, and air handling systems. The laminated construction permits axial, lateral, and angular movement without exerting high spring forces on the system, and the internal damping provided by the laminations limits resonance from vibration — making them particularly well-suited for direct installation on engine exhaust manifolds, turbochargers, and fan inlet/discharge connections.

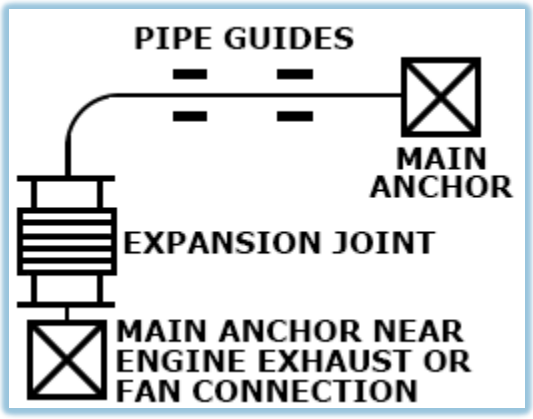
Series 2500 Round Expansion Joints are similar designs with single-ply bellows — less suitable for vibration applications but effective for general ducting and piping from 6" to 48" diameter.

Design Features



Applications

The high flexibility and internal damping of the laminated construction permits absorption of lateral movement from thermal expansion or mechanical motion — making the Series 2500 ideal for lateral offset installations on engine exhausts and fan discharge connections. Joints can also be installed in axial applications; consult the design data table for maximum axial compression and extension values.



For lateral offset applications, Hyspan recommends adding tie rods to the joint to react pressure thrust. Tie rods set as 'limit rods' restrict over-travel; set as 'factory settings' they also restrict axial extension.

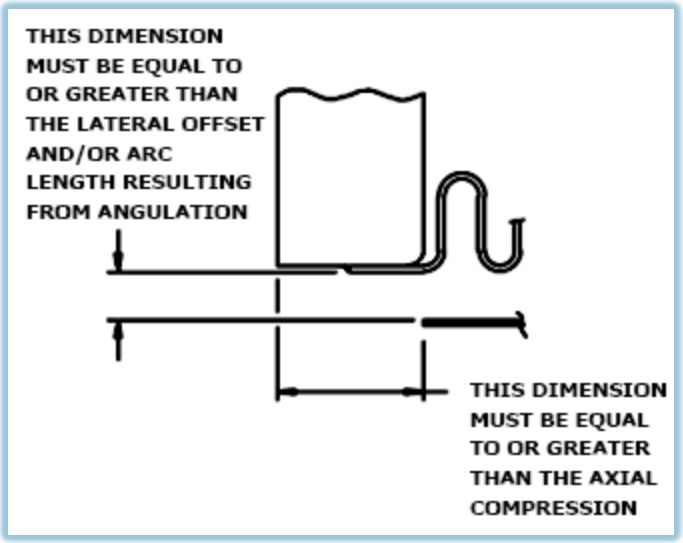
Tie Rods

Tie rods react pressure thrust in unanchored systems such as lateral offset exhaust installations. In service they do not react pressure thrust, but are designed to react the full pressure thrust in the event of an anchor failure. Hyspan uses the term 'Tie Rods' to refer to both tie rods and limit rods — the factory setting determines behavior. Tie rod factory settings do not permit axial extension; limit rod settings permit axial compression and extension per the rated travel.

Flow Liners

Flow liners are optional on Series 2500 joints. They isolate the bellows from the flow, reduce pressure loss, eliminate flow-induced vibration, and insulate the bellows by creating a dead air space. Liners are recommended per EJMA guidelines for:

- Gas flow exceeding 4 ft/sec per inch of diameter (up to 6" NPS)
- Gas flow exceeding 25 ft/sec (over 6" NPS)
- Liquid flow exceeding 2 ft/sec per inch of diameter (up to 6" NPS)
- Liquid flow exceeding 10 ft/sec (over 6" NPS)
- All applications where flow turbulence is generated within 10 pipe diameters of the joint



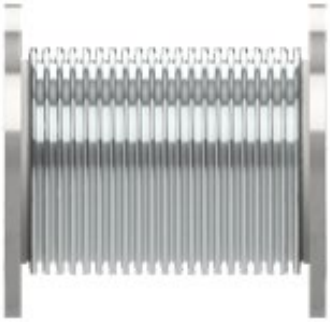
Series 2500 — Design Data Tables

Materials of Construction

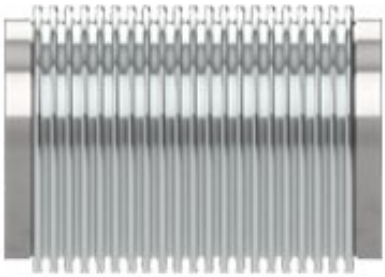
Bellows: Type 304 stainless steel, ASTM A240. Flanges and Vanstone ends: ASTM A-36 carbon steel plate (standard), stainless steel optional. Weld ends: ASTM A53 carbon steel pipe. Optional materials include stainless steel flanges and pipe for high-temperature or corrosive service.

2509
FIXED FLANGE

2510
VANSTONE FLANGE



2511
WELD END



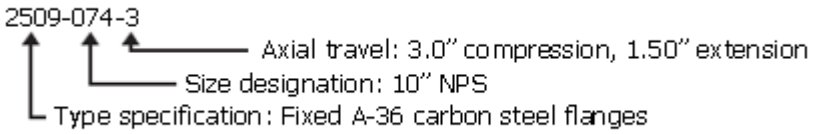
Nominal Size (NPS)	Part Number 2509 2510 2511	Axial Compression (inches)	Axial Extension (inches)	Lateral Off-Set (inches)	Axial Spring Rate (lb./in.)	Lateral Spring Rate (lb./in.)	Part No. 2509 & 2510		Part No. 2511	
							Overall Length (inches)	Weight (lbs.)	Overall Length (inches)	Weight (lbs.)
3	040-1 040-3 040-5	1.25 3.00 5.00	0.63 1.50 2.50	0.32 1.79 5.13	310 159 78	795 75 12	5.0 9.0 14.0	12	7.0 11.0 16.0	7
4	048-1 048-3 048-5	1.25 3.00 5.13	0.63 1.50 2.57	0.25 1.40 4.14	303 131 78	1260 100 20	5.0 9.0 14.0	16	7.0 11.0 16.0	8
5	055-1 055-3 055-5	1.25 3.00 5.13	0.63 1.50 2.57	0.21 1.16 3.41	355 153 91	2163 172 35	5.0 9.0 14.0	18	7.0 11.0 16.0	11
6	060-1 060-3 060-5	1.31 3.00 5.25	0.66 1.50 2.63	0.18 1.00 2.94	378 178 94	3261 278 51	5.0 9.0 14.0	30	7.0 11.0 16.0	14
8	067-1 067-3 067-5	1.31 3.00 5.31	0.66 1.50 2.66	0.14 0.78 2.30	348 162 94	4979 419 84	5.0 9.0 14.0	40	7.0 11.0 16.0	18
10	074-3 074-5	3.00 5.31	1.50 2.66	0.63 1.87	191 112	752 151	9.0 14.0	53	11.0 16.0	30
12	080-3 080-5	3.25 5.56	1.63 2.78	0.55 1.62	134 76	776 149	9.0 14.0	71	12.0 17.0	35
14	081-3 081-5	3.25 5.63	1.63 2.82	0.50 1.49	125 72	873 172	9.0 14.0	87	12.0 17.0	45
16	082-3 082-5	3.25 5.63	1.63 2.82	0.44 1.31	131 76	1179 233	9.0 14.0	104	12.0 17.0	52
18	083-3 083-5	3.25 5.63	1.63 2.82	0.40 1.17	139 81	1558 309	9.0 14.0	109	12.0 17.0	61
1	2	3	4	5	6	7	8	9	10	11

Ordering Instructions

Select the configuration and end connection type (2509 fixed flange, 2510 Vanstone, 2511 weld end) from the design data table. Specify nominal size, axial travel, and any optional features (tie rods, flow liner, stainless construction).

Example:

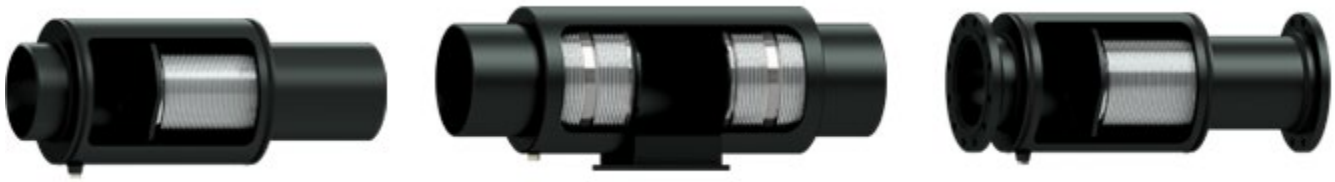
- 10" nominal diameter
- Single fixed flange
- Standard 304 stainless steel bellows
- A-36 carbon steel flanges
- 3.00" axial compression
- 1.50" axial extension



Installation Notes

- System pressure must not exceed 15 PSIG including test conditions.
- Guides, supports, and anchors are required — Series 2500 joints are lightweight construction; improper support will cause damage.
- Flow direction for joints with flow liners is from the fixed (welded) end to the free end — direction marked on exterior.
- Shipping restraints (yellow, labeled) must be left in place until installation is complete and removed before pressure testing.
- If tie rods are included, verify installation allows the design movement of the joint

Series 3500 – Externally Pressurized



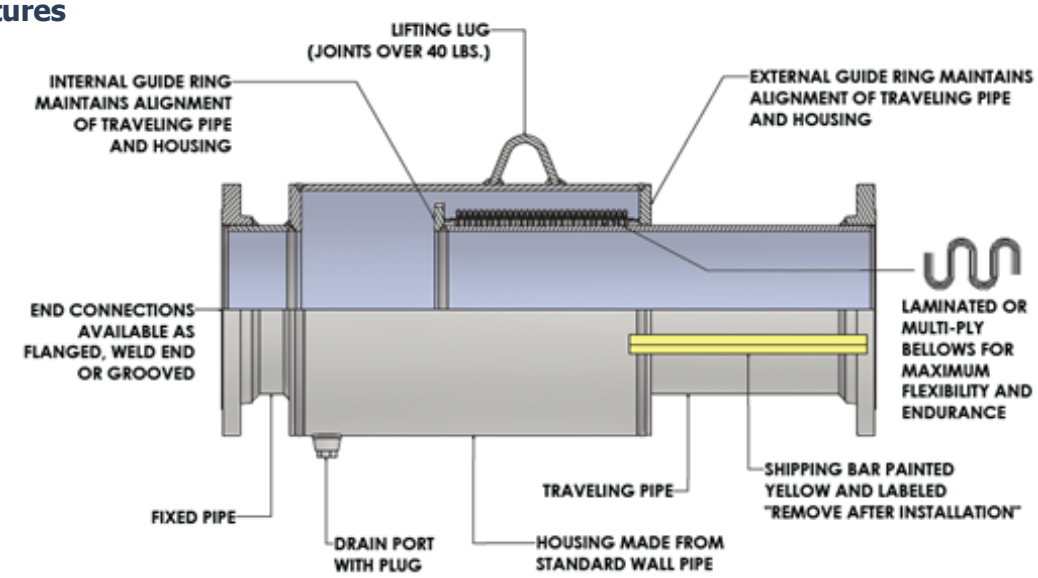
Nominal Sizes	2" – 24" NPS (standard); larger sizes available
Design Pressure	150 PSIG and 300 PSIG @ 500°F
Axial Travel	4", 6", and 8" (single); 8", 12", 16" (dual anchor base)
Movement	Axial only
Bellows Construction	3 or 4-ply laminated, ASTM A240 Type 321 stainless steel
End Connections	Fixed flange (3501), weld end (3502); grooved end optional
Housing	Standard weight carbon steel pipe — fully encloses bellows
Drain Port	Standard — 3000 lb thread-o-let, ASME A105 steel forging
Warranty	Five-year limited replacement warranty (standard catalog construction)

Product Description

Series 3500 Externally Pressurized Expansion Joints were introduced to the piping industry by Hyspan in 1972 and have become an industry standard design. The bellows element is fully enclosed within a standard-weight pipe housing that protects it from both the internal flow and the external environment. Because the process media contacts the exterior of the bellows (not the interior), the joint is self-draining and bellows squirm or instability is inherently resisted due to external pressurization.

Internal and external guide rings maintain precise alignment of the traveling pipe and housing throughout the stroke. This proven, close-tolerance design is manufactured without expensive high-nickel alloys for standard steam, hot water, and chilled water service, making it an economical and reliable solution for the most common piping applications.

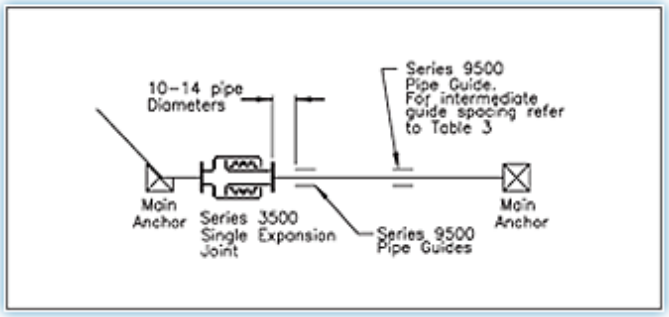
Design Features



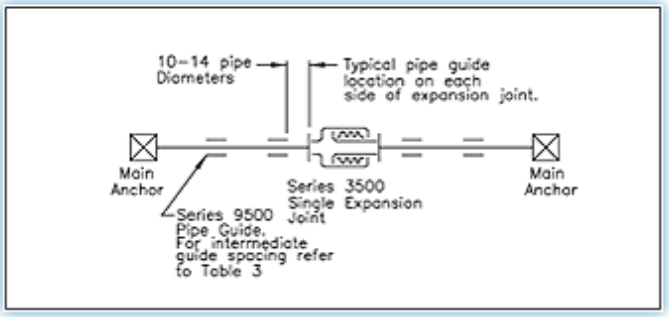
Applications

Series 3500 joints are designed for installations where the principal movement is axial. The piping system must include anchors, supports, and intermediate pipe guides per the spacing tables. Four standard configurations cover the most common piping geometries.

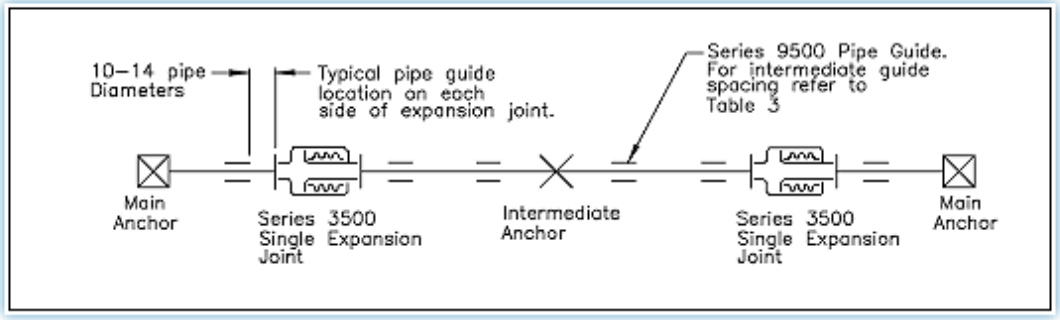
Single 3501/3502 adjacent to main anchor



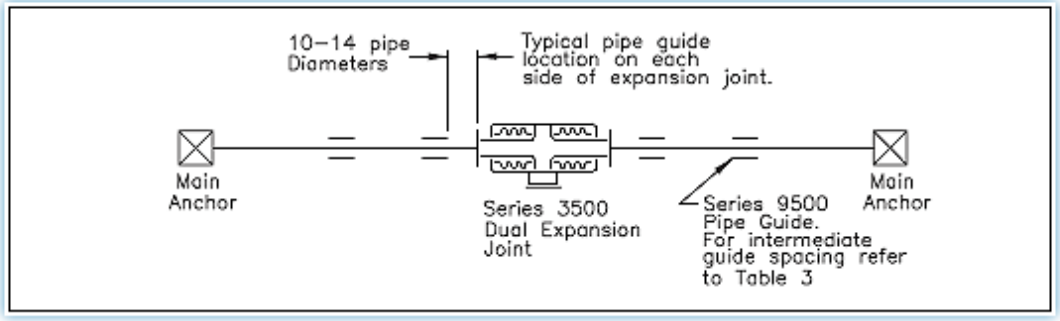
Single 3501/3502 located in middle of a run



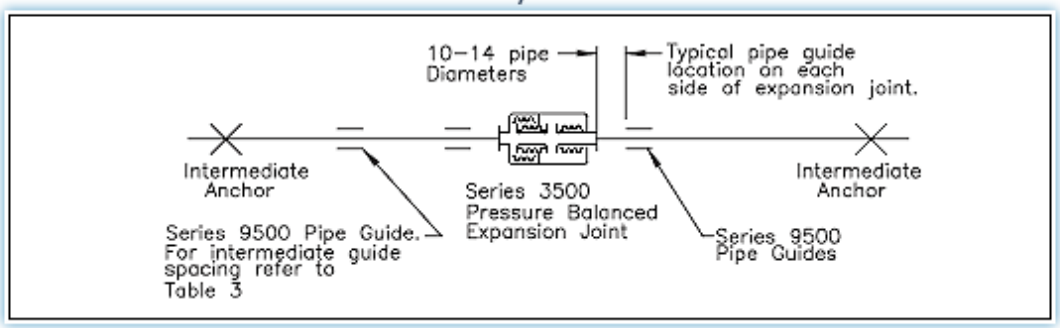
Two or more single 3501/3502 with intermediate anchors



Dual Anchor Base 3505/3506 located in the center of a run



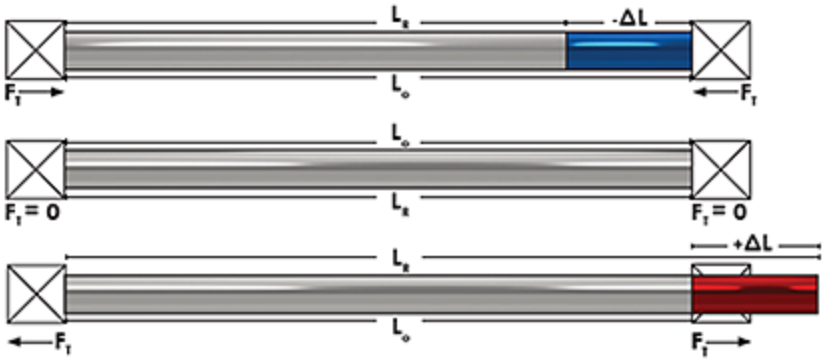
In-Line Pressure Balanced 3501PB/3502PB with intermediate anchors



Travel Required

In order to determine the correct amount of linear travel required for your expansion joint, the thermal growth (ΔL) of your pipe run anchor-to-anchor must be calculated.

ΔL is defined as the linear deformation (elongation or contraction) of a pipe resulting from a change in temperature, proportional to the pipe's original length and the material's coefficient of linear thermal expansion.



Mathematically, it is expressed as:

$$\Delta L = \alpha L_o \Delta T$$

where:

ΔL = Thermal growth of pipe (*in*)

α = Coefficient of thermal expansion

$\alpha_{carbon\ steel} = \sim 6.5 \cdot 10^{-6}/°F$

$\alpha_{stainless\ steel} = \sim 9.6 \cdot 10^{-6}/°F$

$\alpha_{copper} = \sim 9.9 \cdot 10^{-6}/°F$

L_o = Length of pipe run anchor to anchor (*ft*)

$\Delta T = T_{final} - T_{initial}$

T_{final} = Design Temperature (°F)

$T_{initial}$ = Install Temperature (°F)

L_R = Resultant length of pipe = $L_o + \Delta L$

F_T = Thermal force acting on anchors (*lbf*)

Example 1:

A carbon steel pipe run of 100 feet is installed at 70°F between two main anchor points. The design temperature of the system during operation is 500°F. What is the minimum amount of travel required, in inches, for an axial expansion joint to compensate this growth?

Solution:

$L_o = 100$ feet
$T_{initial} = 70°F$
$T_{final} = 500°F$
$\alpha_{carbon\ steel} = 6.5 \times 10^{-6}/°F$

$\Delta L = \alpha L_o \Delta T = (6.5 \times 10^{-6}) \times (100 \times 12) \times (500 - 70) =$ **3.35** inches of thermal expansion is the minimum value required.

Example 2:

A stainless steel pipe run of 150 feet is installed at 70°F between two main anchor points. The design temperature of the system during operation is -200°F. What is the minimum amount of travel required, in inches, for an axial expansion joint to compensate this growth?

Solution:

$L_o = 150$ feet
$T_{initial} = 70°F$
$T_{final} = -200°F$
$\alpha_{stainless\ steel} = 9.6 \times 10^{-6}/°F$

$\Delta L = \alpha L_o \Delta T = (9.6 \times 10^{-6}) \times (150 \times 12) \times (-200 - 70) =$ **-4.67** inches of thermal contraction is the minimum value required.

Anchor Forces

Piping systems incorporating Type 3501-3506 expansion joints must include structural reactions or main anchors as shown in the applications diagrams that are sufficient to withstand the full pressure thrust based on the effective area of the expansion joint, and the spring force produced by the deflection of the bellows.

The pressure thrust force must be based on the highest pressure anticipated doing service and testing.

Piping systems incorporating dual anchor base expansion joints (3505 & 3506), multiple single joints (3501 & 3502) in long runs, and pressure balanced joints (3501PB & 3502PB) must include structural reactions or intermediate anchors as shown in the applications diagrams. Intermediate anchors react the force produced by the bellows spring constant.

Note: *Reference page 5 for main & intermediate anchor force equations.*

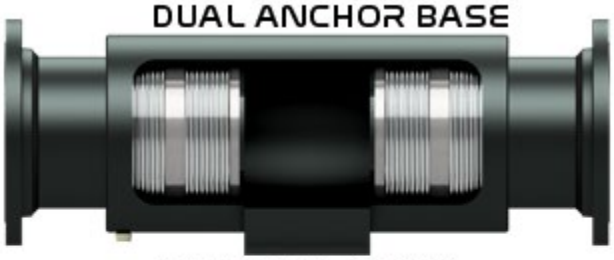
Series 3500 — Design Data Tables

Materials of Construction

Flanges: Flat face carbon steel ASME A-36. 150 lb drilling for 150 PSIG designs; 300 lb drilling for 300 PSIG designs. Pipe nipples and housing: ASME A53 Grade B standard weight. Bellows: 3 or 4-ply laminated ASTM A240 Type 321 stainless. Guide rings: ASME A-36 steel plate.

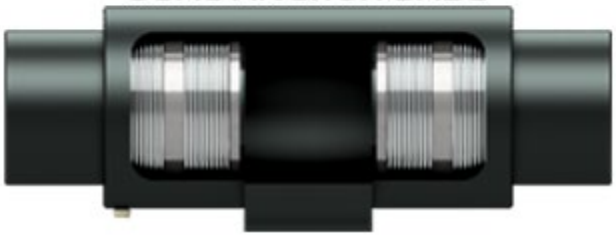
3501 FIXED FLANGE

3505 FIXED FLANGE
DUAL ANCHOR BASE



3502 WELD END

3506 WELD END
DUAL ANCHOR BASE



Ordering Instructions

Select the type (3501 fixed flange, 3502 weld end, 3505/3506 dual anchor base) and axial travel from Tables 5–8. Specify nominal size and pressure rating. Single joints ordered with anchor base are identified with the AB suffix (3501AB, 3502AB). In-line pressure balanced joints use the PB suffix (3501PB, 3502PB).

Example:

- Single expansion joint
- Steel pipe weld ends
- 150 PSIG @ 500°F maximum
- 4.0″ axial travel maximum
- 2″ NPS

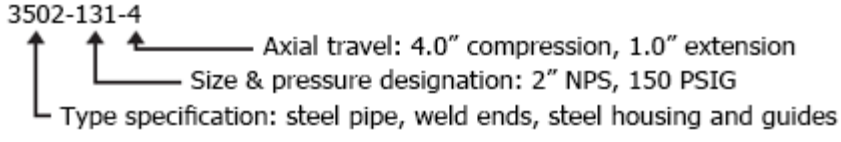


Table 2 — Pressure and Force Data

Nominal Size (NPS)	Effective Area (square inches)	Tabulated Force (pounds) for Individual Pressure						
		50 psig	100 psig	150 psig	200 psig	250 psig	300 psig	450 psig
2	8.2	408	817	1225	1633	2042	2451	3690
2 1/2	10.6	533	1067	1599	2133	2666	3200	4770
3	13.7	685	1369	2054	2738	3423	4107	6165
4	22.7	1135	2269	3404	4538	5673	6807	10215
5	35.3	1763	3526	5288	7051	8814	10577	15885
6	50.3	2513	5027	7540	10053	12566	15080	22635
8	80.5	4026	8052	12077	16103	20129	24155	36225
10	115	5773	11547	17320	23093	28867	34640	54750
12	164	8228	16456	24684	32912	41140	49368	73800
14	206	10300	20599	30899	41199	51498	61798	92700
16	258	12901	25802	38702	51603	64504	77405	116100
18	318	15905	31810	47715	63620	79525	95430	143100
20	390	19529	39057	58586	78114	97643	117171	175500
24	541	27059	54119	81178	108238	135297	162357	243450
1	2	3	4	5	6	7	8	9

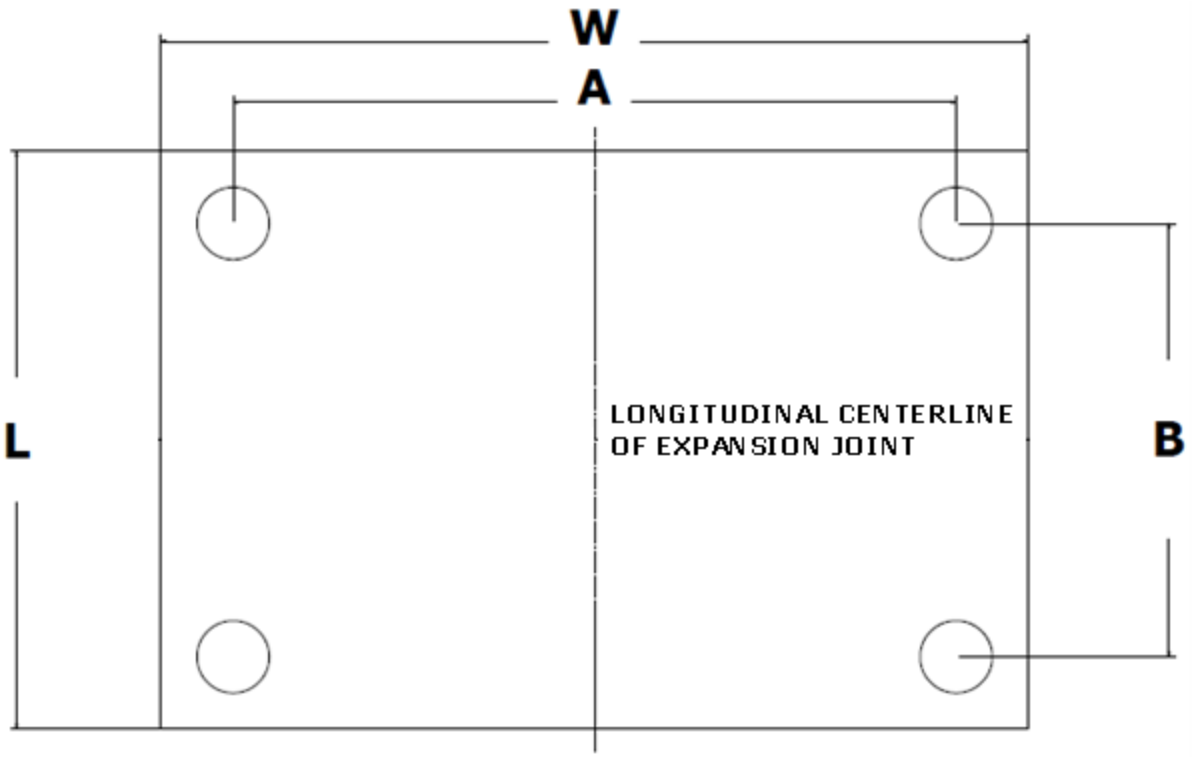
Table 3 — Intermediate Pipe Guide Spacing

Nominal Size (NPS)	150 psig Design (See pages 8 & 9)			300 psig Design (See pages 10 & 11)				
	System Pressure (psig)			System Pressure (psig)				
	50	100	150	50	100	150	200	300
2	24	18	15	21	17	14	13	11
2 1/2	29	23	19	26	21	18	16	14
3	38	29	25	31	26	22	20	17
4	46	35	29	39	31	27	24	21
5	48	38	33	41	34	30	27	23
6	58	45	38	50	41	36	32	27
8	78	60	50	70	56	47	42	35
10	100	75	63	90	71	60	53	44
12	115	85	70	103	80	67	59	49
14	108	83	70	99	79	67	60	50
16	121	92	77	112	88	75	66	55
18	132	100	84	123	96	81	72	60
20	146	109	90	127	100	85	75	63
24	167	123	102	147	114	97	86	71
1	2	3	4	5	6	7	8	9

Note:

(1) The values listed are the center-to-center distances measured in feet.
(2) Pipe guide spacing is a function of the expansion joint spring rate and effective area. The tabulated values are for Series 3500 expansion joints at the system design pressure listed.
(3) The pressures listed are design values. Guide spacing has been calculated for the test pressure (1.5 X design).
(4) Refer to specialty catalog for complete details on Hyspan Series 9500 Pipe Guides and their application.

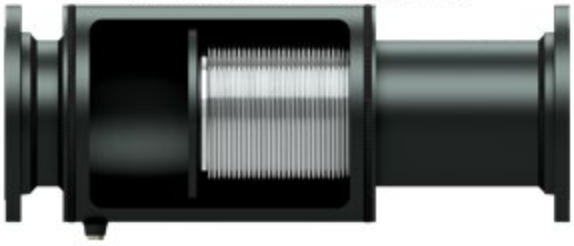
Table 4 — Dimensional Data



Nom Size (NPS)	Housing Outside Diameter (inches)		Centerline Height (inches) 3501AB, 3502AB 3505, 3506	Drain Port Size (NPS)	Anchor Base Pattern 3501AB, 3502AB, 3505, 3506				
	Part No. 3501, 3502 3505, 3506	Part No. 3501PB 3502PB			Hole Diameter (inches)	Base Length (L) (inches)	Base Width (W) (inches)	Hole Spacing (inches)	
								A	B
2	4.50		3.88	1/2	0.625	6.0	7.0	5.0	4.0
2 1/2	5.56		4.88	1/2	0.625	6.0	7.0	5.0	4.0
3	6.63		4.88	1/2	0.625	6.0	7.5	5.5	4.0
4	8.63	10.75	5.50	1/2	0.625	6.0	9.5	7.5	4.0
5	8.63	12.75	6.50	1/2	0.625	6.0	9.5	7.5	4.0
6	10.75	14.00	6.50	3/4	0.875	8.0	12.0	10.0	6.0
8	12.75	18.00	8.50	3/4	0.875	8.0	12.0	10.0	6.0
10	16.00	20.00	9.75	3/4	0.875	10.0	16.0	14.0	8.0
12	18.00	24.00	12.00	3/4	0.875	10.0	18.0	16.0	8.0
14	20.00	26.00	12.00	3/4	0.875	10.0	20.0	18.0	8.0
16	22.00	29.00	13.50	1	1.125	12.5	22.0	18.0	10.0
18	24.00	32.00	14.75	1	1.125	12.5	24.0	18.0	10.0
20	26.00	35.00	16.00	1	1.125	16.5	26.0	22.0	14.0
24	29.25	40.50	18.75	1	1.125	16.5	26.0	22.0	14.0
1	2	3	4	5	6	7	8	9	10

Table 5 — Type 3501 & 3502, 150 PSIG

3501 FIXED FLANGE



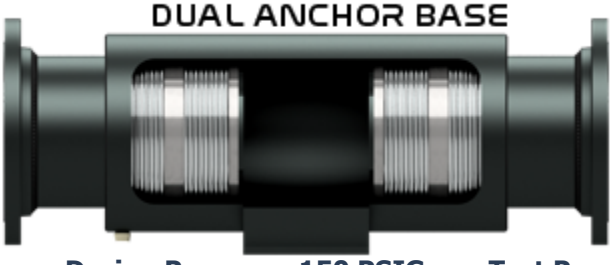
3502 WELD END

Design Pressure: 150 PSIG • Test Pressure: 225 PSIG • Design Temperature: 500°F

Nominal Size (NPS)	Axial Spring Rate (1) (lb/in)	Part Number 3501 3502 3503	Axial Compr. (inches)	Axial Ext. (inches)	3501		3502	
					Overall Length (inches)	Weight (lbs)	Overall Length (inches)	Weight (lbs)
2	33 22 17	-131-4 -131-6 -131-8	4 6 8	1 2 2	24.75 33.75 40.25	31 40 47	24.25 33.25 39.75	23 32 39
2 1/2	79 54 35	-135-4 -135-6 -135-8	4 6 8	1 2 2	24.75 33.75 40.25	44 56 65	24.13 33.13 39.63	33 46 54
3	66 40 31	-140-4 -140-6 -140-8	4 6 8	1 2 2	24.75 33.75 40.25	60 77 87	24.13 33.13 39.63	46 63 74
4	121 74 57	-148-4 -148-6 -148-8	4 6 8	1 2 2	24.75 33.75 40.25	89 114 131	24.13 33.13 39.63	70 95 112
5	313 196 139	-155-4 -155-6 -155-8	4 6 8	1 2 2	24.75 33.75 40.25	95 119 139	24.13 33.13 39.63	73 98 118
6	348 218 155	-160-4 -160-6 -160-8	4 6 8	1 2 2	26.50 35.25 41.75	141 174 202	25.88 34.63 41.13	110 142 171
8	380 234 176	-167-4 -167-6 -167-8	4 6 8	1 2 2	26.50 35.25 41.75	190 242 275	25.75 34.50 41.00	145 196 230
10	452 267 203	-174-4 -174-6 -174-8	4 6 8	1 2 2	26.50 35.25 41.75	259 326 370	25.75 34.50 41.00	202 268 313
12	418 253 183	-180-4 -180-6 -180-8	4 6 8	1 2 2	28.75 37.25 44.50	344 428 478	28.00 36.50 43.75	261 345 395
14	1193 738 515	-181-4 -181-6 -181-8	4 6 8	1 2 2	28.75 37.25 44.50	429 516 584	28.00 36.50 43.75	301 388 456
16	1314 813 567	-182-4 -182-6 -182-8	4 6 8	1 2 2	28.75 37.25 44.50	492 589 666	28.00 36.50 43.75	338 436 512
18	1438 888 619	-183-4 -183-6 -183-8	4 6 8	1 2 2	29.50 38.00 45.25	528 636 721	28.75 37.25 44.50	374 482 567
20	1206 748 529	-184-4 -184-6 -184-8	4 6 8	1 2 2	29.50 38.00 45.25	596 717 811	28.75 37.25 44.50	415 536 631
24	1409 874 616	-186-4 -186-6 -186-8	4 6 8	1 2 2	29.50 38.00 45.25	742 883 993	28.75 37.25 44.50	468 609 719
1	2	3	4	5	6	7	8	9

Table 6 — Type 3505 & 3506, 150 PSIG (Dual Anchor Base)

3505 FIXED FLANGE
DUAL ANCHOR BASE



3506 WELD END
DUAL ANCHOR BASE

Design Pressure: 150 PSIG • Test Pressure: 225 PSIG • Design Temperature: 500°F

Nominal Size (NPS)	Axial Spring Rate (1) (lb/in)	Part Number 3505 3506	Total Axial Compr. (2) (inches)	Total Axial Ext. (2) (inches)	3505		3506	
					Overall Length (inches)	Weight (lbs)	Overall Length (inches)	Weight (lbs)
2	33 22 17	-131-8 -131-12 -131-16	8 12 16	2 4 4	42.00 60.00 73.00	56 75 87	41.50 59.50 72.50	49 66 79
2 1/2	79 54 35	-135-8 -135-12 -135-16	8 12 16	2 4 4	41.75 59.75 72.75	77 102 119	41.13 59.13 72.13	66 90 108
3	66 40 31	-140-8 -140-12 -140-16	8 12 16	2 4 4	41.75 59.75 72.75	104 137 158	41.13 59.13 72.13	89 123 144
4	121 74 57	-148-8 -148-12 -148-16	8 12 16	2 4 4	41.75 59.75 72.75	151 202 235	41.13 59.13 72.13	132 181 215
5	313 196 139	-155-8 -155-12 -155-16	8 12 16	2 4 4	41.75 59.75 72.75	161 209 251	41.13 59.13 72.13	139 187 229
6	348 218 155	-160-8 -160-12 -160-16	8 12 16	2 4 4	44.25 61.75 74.75	246 311 368	43.63 61.13 74.13	212 277 334
8	380 234 176	-167-8 -167-12 -167-16	8 12 16	2 4 4	44.00 61.50 74.50	323 425 493	43.25 60.75 73.75	274 376 444
10	452 267 203	-174-8 -174-12 -174-16	8 12 16	2 4 4	43.00 60.50 73.50	445 578 667	42.25 59.75 72.75	382 516 604
12	418 253 183	-180-8 -180-12 -180-16	8 12 16	2 4 4	47.50 64.50 79.00	588 755 853	46.75 63.75 78.25	490 661 759
14	1193 738 515	-181-8 -181-12 -181-16	8 12 16	2 4 4	46.25 63.25 77.75	699 875 1009	45.50 62.50 77.00	558 734 870
16	1314 813 567	-182-8 -182-12 -182-16	8 12 16	2 4 4	46.25 63.25 77.75	822 1020 1170	45.50 62.50 7.00	654 852 1004
18	1438 888 619	-183-8 -183-12 -183-16	8 12 16	2 4 4	47.75 64.75 79.25	900 1116 1286	47.00 64.00 78.50	721 941 1109
20	1206 748 529	-184-8 -184-12 -184-16	8 12 16	2 4 4	47.75 64.75 79.25	1047 1288 1477	47.00 64.00 78.50	838 1083 1270
24	1409 874 616	-186-8 -186-12 -186-16	8 12 16	2 4 4	47.75 64.75 79.25	1241 1523 1743	47.00 64.00 78.50	934 1219 1436
1	2	3	4	5	6	7	8	9

Note:

(1) Force per inch of compression resulting from the bellows spring constant. Refer to Table 2 for pressure thrust force.
(2) For Type 3505 and 3506 travel stated is the total. Travel each side of the anchor is ½ the tabulated value.
(3) Refer to Table 4 for housing diameter, drain port size and anchor base details.

Table 7 — Type 3501 & 3502, 300 PSIG

3501 FIXED FLANGE

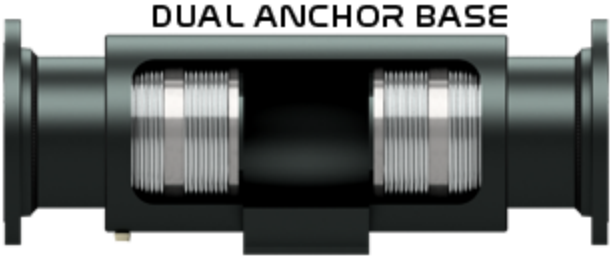
3502 WELD END

Design Pressure: 300 PSIG • Test Pressure: 450 PSIG • Design Temperature: 500°F

Nominal Size (NPS)	Axial Spring Rate (1) (lb/in)	Part Number 3501 3502	Axial Compr. (inches)	Axial Ext. (inches)	3501		3502	
					Overall Length (inches)	Weight (lbs)	Overall Length (inches)	Weight (lbs)
2	68 47 35	-331-4 -331-6 -331-8	4 6 8	1 2 2	24.75 33.75 40.25	35 44 51	24.25 33.25 39.75	24 34 41
2 1/2	137 93 59	-335-4 -335-6 -335-8	4 6 8	1 2 2	24.75 33.75 40.25	48 61 70	24.13 33.13 39.63	32 47 56
3	195 117 85	-340-4 -340-6 -340-8	4 6 8	1 2 2	24.75 33.75 40.25	70 88 99	24.13 33.13 39.63	48 66 77
4	293 177 135	-348-4 -348-6 -348-8	4 6 8	1 2 2	24.75 33.75 40.25	105 131 149	24.13 33.13 39.63	72 98 115
5	606 377 263	-355-4 -355-6 -355-8	4 6 8	1 2 2	24.75 33.75 40.25	113 138 160	24.13 33.13 39.63	75 100 122
6	685 426 297	-360-4 -360-6 -360-8	4 6 8	1 2 2	26.50 35.25 41.75	175 208 238	25.88 34.63 41.13	111 145 175
8	745 457 340	-367-4 -367-6 -367-8	4 6 8	1 2 2	26.50 35.25 41.75	229 283 318	25.75 34.50 41.00	148 202 236
10	892 516 389	-374-4 -374-6 -374-8	4 6 8	1 2 2	26.50 35.25 41.75	307 376 421	25.75 34.50 41.00	205 275 320
12	1045 628 441	-380-4 -380-6 -380-8	4 6 8	1 2 2	28.75 37.25 44.50	434 523 573	28.00 36.50 43.75	267 355 406
14	1879 1157 794	-381-4 -381-6 -381-8	4 6 8	1 2 2	28.75 37.25 44.50	522 614 684	28.00 36.50 43.75	308 398 469
16	2073 1275 874	-382-4 -382-6 -382-8	4 6 8	1 2 2	28.75 37.25 44.50	598 701 779	28.00 36.50 43.75	345 447 527
18	2503 1535 1046	-383-4 -383-6 -383-8	4 6 8	1 2 2	29.50 38.00 45.25	727 840 930	28.75 37.25 44.50	340 495 583
20	3283 2014 1373	-384-4 -384-6 -384-8	4 6 8	1 2 2	29.50 38.00 45.25	891 1023 1128	28.75 37.25 44.50	435 566 670
24	3860 2368 1611	-386-4 -386-6 -386-8	4 6 8	1 2 2	29.50 38.00 45.25	1106 1259 1382	28.75 37.25 44.50	492 645 766
1	2	3	4	5	6	7	8	9

Table 8 — Type 3505 & 3506, 300 PSIG (Dual Anchor Base)

3505 FIXED FLANGE
DUAL ANCHOR BASE



3506 WELD END
DUAL ANCHOR BASE

Design Pressure: 300 PSIG • Test Pressure: 450 PSIG • Design Temperature: 500°F

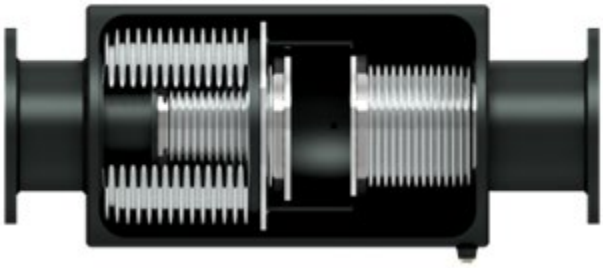
Nominal Size (NPS)	Axial Spring Rate (1) (lb/in)	Part Number 3505 3506	Total Axial Compr. (2) (inches)	Total Axial Ext. (2) (inches)	3505		3506	
					Overall Length (inches)	Weight (lbs)	Overall Length (inches)	Weight (lbs)
2	68 47 35	-331-8 -331-12 -331-16	8 12 16	2 4 4	42.00 60.00 73.00	58 79 93	41.50 59.50 72.50	50 68 81
2 1/2	137 93 59	-335-8 -335-12 -335-16	8 12 16	2 4 4	41.75 59.75 72.75	82 107 125	41.13 59.13 72.13	67 92 110
3	195 117 85	-340-8 -340-12 -340-16	8 12 16	2 4 4	41.75 59.75 72.75	115 150 172	41.13 59.13 72.13	92 127 149
4	293 177 135	-348-8 -348-12 -348-16	8 12 16	2 4 4	41.75 59.75 72.75	169 221 236	41.13 59.13 72.13	136 186 222
5	606 377 263	-355-8 -355-12 -355-16	8 12 16	 4 4	41.75 59.75 72.75	182 231 275	41.13 59.13 72.13	143 192 236
6	685 426 297	-360-8 -360-12 -360-16	8 12 16	2 4 4	44.25 61.75 74.75	280 347 406	43.63 61.13 74.13	216 283 342
8	745 457 340	-367-8 -367-12 -367-16	8 12 16	2 4 4	44.00 61.50 74.50	364 471 540	43.25 60.75 73.75	280 387 456
10	892 516 389	-374-8 -374-12 -374-16	8 12 16	2 4 4	43.00 60.50 73.50	494 633 724	42.25 59.75 72.75	388 527 619
12	1045 628 441	-380-8 -380-12 -380-16	8 12 16	2 4 4	47.50 64.50 79.00	679 852 954	46.75 63.75 78.25	503 681 783
14	1879 1157 794	-381-8 -381-12 -381-16	8 12 16	2 4 4	46.25 63.25 77.75	792 976 1115	45.50 62.50 77.00	571 755 896
16	2073 1275 874	-382-8 -382-12 -382-16	8 12 16	2 4 4	46.25 63.25 77.75	929 1135 1292	45.50 62.50 77.00	669 875 1034
18	2503 1535 1046	-383-8 -383-12 -383-16	8 12 16	2 4 4	47.75 64.75 79.25	1180 1320 1500	47.00 64.00 78.50	738 967 1142
20	3283 2014 1373	-384-8 -384-12 -384-16	8 12 16	2 4 4	47.75 64.75 79.25	1348 1610 1820	47.00 64.00 78.50	878 1144 1349
24	3860 2368 1611	-386-8 -386-12 -386-16	8 12 16	2 4 4	47.75 64.75 79.25	1612 1918 2071	47.00 64.00 78.50	981 1292 1529
1	2	3	4	5	6	7	8	9

Series 3500PB - Pressure Balanced Joints

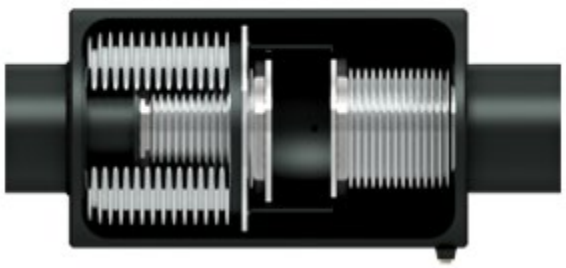
Series 3500 pressure balanced joints internally react the pressure thrust by linking a second bellows with twice the effective area of the expansion bellows. This eliminates the need for main anchors to resist pressure thrust — only intermediate anchors are required for the bellows spring force. Available in sizes 4"–24".

Table 9 — Type 3501PB & 3502PB, 150 PSIG

3501PB - FIXED FLANGE



3502PB - WELD END

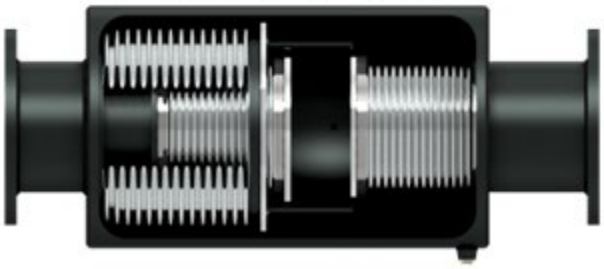


Design Pressure: 150 PSIG • Test Pressure: 225 PSIG • Design Temperature: 500°F

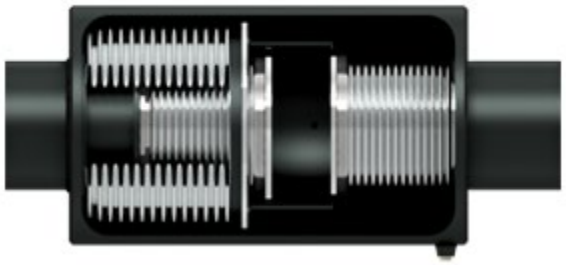
Nominal Size (NPS)	Axial Spring Rate (1) (lb/in)	Part Number 3501PB 3502PB	Axial Compr. (inches)	Axial Ext. (inches)	3501PB		3502PB	
					Overall Length (inches)	Weight (lbs)	Overall Length (inches)	Weight (lbs)
4	638 408 320	-148-4 -148-6 -148-8	4 6 8	1 2 2	41.0 57.0 68.0	218 296 349	39.0 55.0 66.0	196 274 328
5	885 576 473	-155-4 -155-6 -155-8	4 6 8	1 2 2	41.0 57.0 68.0	278 264 441	39.0 55.0 66.0	255 339 417
6	1056 688 569	-160-4 -160-6 -160-8	4 6 8	1 2 2	43.0 59.0 70.0	336 436 528	39.0 55.0 66.0	302 400 492
8	1577 1014 786	-167-4 -167-6 -167-8	4 6 8	1 2 2	43.0 59.0 70.0	488 656 766	39.0 55.0 66.0	437 605 715
10	1930 1241 965	-174-4 -174-6 -174-8	4 6 8	1 2 2	43.0 59.0 70.0	587 776 916	40.0 56.0 67.0	521 720 850
12	2822 1796 1518	-180-4 -180-6 -180-8	4 6 8	1 2 2	48.0 64.0 75.0	798 1055 1212	42.0 57.0 69.0	705 962 1109
14	4726 3038 2363	-181-4 -181-6 -181-8	4 6 8	1 2 2	48.0 64.0 75.0	939 1197 1405	42.0 57.0 69.0	794 1053 1260
16	5116 3289 2558	-182-4 -182-6 -182-8	4 6 8	1 2 2	48.0 64.0 75.0	1097 1386 1613	42.0 57.0 69.0	922 1221 1438
18	5766 3706 2882	-183-4 -183-6 -183-8	4 6 8	1 2 2	49.0 64.0 76.0	1191 1518 1771	42.0 57.0 69.0	1013 1341 1597
20	5040 3241 2520	-184-4 -184-6 -184-8	4 6 8	1 2 2	49.0 64.0 76.0	1340 1699 1978	42.0 57.0 69.0	1130 1489 1768
24	5674 3648 2837	-186-4 -186-6 -186-8	4 6 8	1 2 2	50.0 65.0 77.0	1559 1980 2306	42.0 57.0 69.0	1285 1706 1928
1	2	3	4	5	6	7	8	9

Table 10 — Type 3501PB & 3502PB, 300 PSIG

3501PB - FIXED FLANGE



3502PB - WELD END



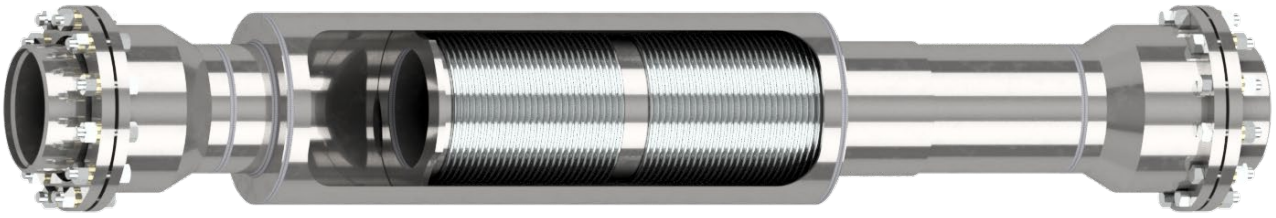
Design Pressure: 300 PSIG • Test Pressure: 450 PSIG • Design Temperature: 500°F

Nominal Size (NPS)	Axial Spring Rate (1) (lb/in)	Part Number 3501PB 3502PB	Axial Compr. (inches)	Axial Ext. (inches)	3501PB		3502PB	
					Overall Length (inches)	Weight (lbs)	Overall Length (inches)	Weight (lbs)
4	1467 886 675	-348-4 -348-6 -348-8	4 6 8	1 2 2	42.0 58.0 69.0	232 314 368	39.0 55.0 66.0	200 282 336
5	3028 1884 1314	-355-4 -355-6 -355-8	4 6 8	1 2 2	42.0 58.0 69.0	297 387 467	39.0 55.0 66.0	261 350 430
6	3424 2132 1483	-360-4 -360-6 -360-8	4 6 8	1 2 2	44.5 60.5 70.5	367 470 557	39.0 55.0 66.0	310 413 500
8	3725 2285 1699	-367-4 -367-6 -367-8	4 6 8	1 2 2	44.5 60.5 70.5	526 701 818	39.0 55.0 66.0	450 625 742
10	4458 2580 1947	-374-4 -374-6 -374-8	4 6 8	1 2 2	44.5 60.5 70.5	634 854 980	40.0 56.0 67.0	540 760 886
12	5223 3139 2205	-380-4 -380-6 -380-8	4 6 8	1 2 2	46.5 63.0 73.0	880 1151 1307	42.0 57.0 69.0	726 997 1153
14	9397 5783 3968	-381-4 -381-6 -381-8	4 6 8	1 2 2	50.0 65.0 77.5	1015 1288 1504	42.0 57.0 69.0	815 1088 1309
16	10367 6373 4369	-382-4 -382-6 -382-8	4 6 8	1 2 2	50.0 65.0 77.5	1170 1482 1728	42.0 57.0 69.0	935 1247 1493
18	12515 7677 5229	-383-4 -383-6 -383-8	4 6 8	1 2 2	50.0 65.0 77.5	1359 1701 1971	42.0 57.0 69.0	1040 1382 1652
20	16414 10072 6864	-384-4 -384-6 -384-8	4 6 8	1 2 2	51.5 66.5 79.0	1621 2016 2338	42.0 57.0 69.0	1195 1590 1912
24	19300 11840 8057	-386-4 -386-6 -386-8	4 6 8	1 2 2	51.5 66.5 79.0	1940 2408 2716	42.0 57.0 69.0	1363 1831 2159
1	2	3	4	5	6	7	8	9

Note:

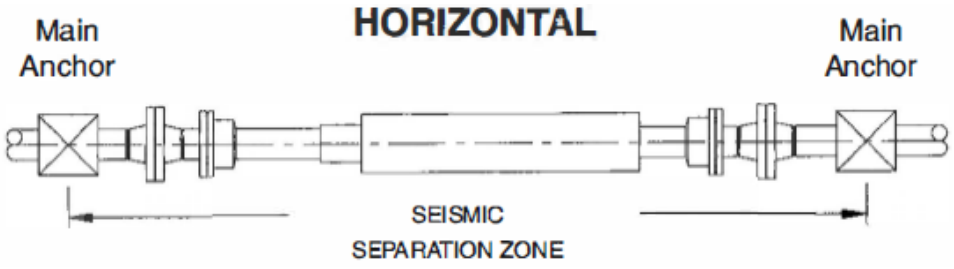
(1) Force (lbs) per inch of compression (pipe extension) resulting from bellows spring constant.
(2) Refer to Table 4 for housing outside diameter and drain port size.
(3) Refer to page 5 for anchor force formulas.
(4) Refer to Applications section for correct installation.

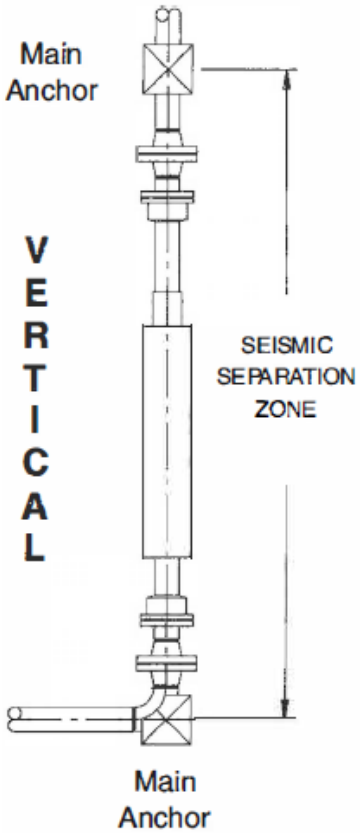
Series 3500IS — In-Line Seismic Expansion Joint



Nominal Sizes	2½" – 12" NPS
Design Pressure	150 PSIG @ 400°F
Motion Capability	±6", ±12", ±18", or ±24" axial and lateral (all planes)
End Connections	Flanged (3501IS), weld end (3502IS), grooved (3507IS)
Construction	No change in pipe direction required; pipe construction throughout; no exposed bellows element
Installation	Horizontal or vertical; suitable for retrofit of existing buildings

The Series 3500IS combines Hyspan Barco ball joints at each end (for lateral offset) with a Series 3500 externally pressurized expansion joint (for axial motion). The result is a fully enclosed, maintenance-free, in-line assembly capable of absorbing large multi-plane seismic motions without requiring a change in piping direction. Designed for fire system service (no rubber components).

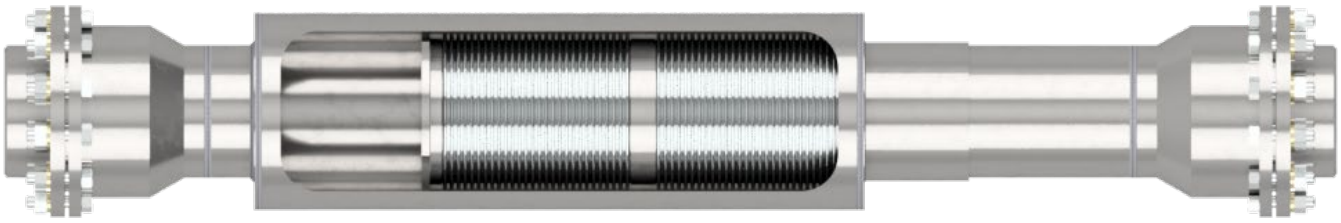




Pressure and Force Data

Nominal Size (NPS)	Effective Area (in.²)	Tabulated Force (lbs.)		
		50 psig	150 psig	225 psig
2 1/2	10.6	533	1,599	2,385
3	13.7	685	2,054	3,082
4	22.7	1,135	3,404	5,108
5	35.3	1,763	5,288	7,943
6	50.3	2,513	7,540	11,318
8	80.5	4,026	12,077	18,112
10	115	5,773	17,320	25,875
12	164	8,228	24,684	36,900

Series 3500IS Design Data — Table 1



Design Pressure: 150 PSIG • Test Pressure: 225 PSIG • Design Temperature: 400°F

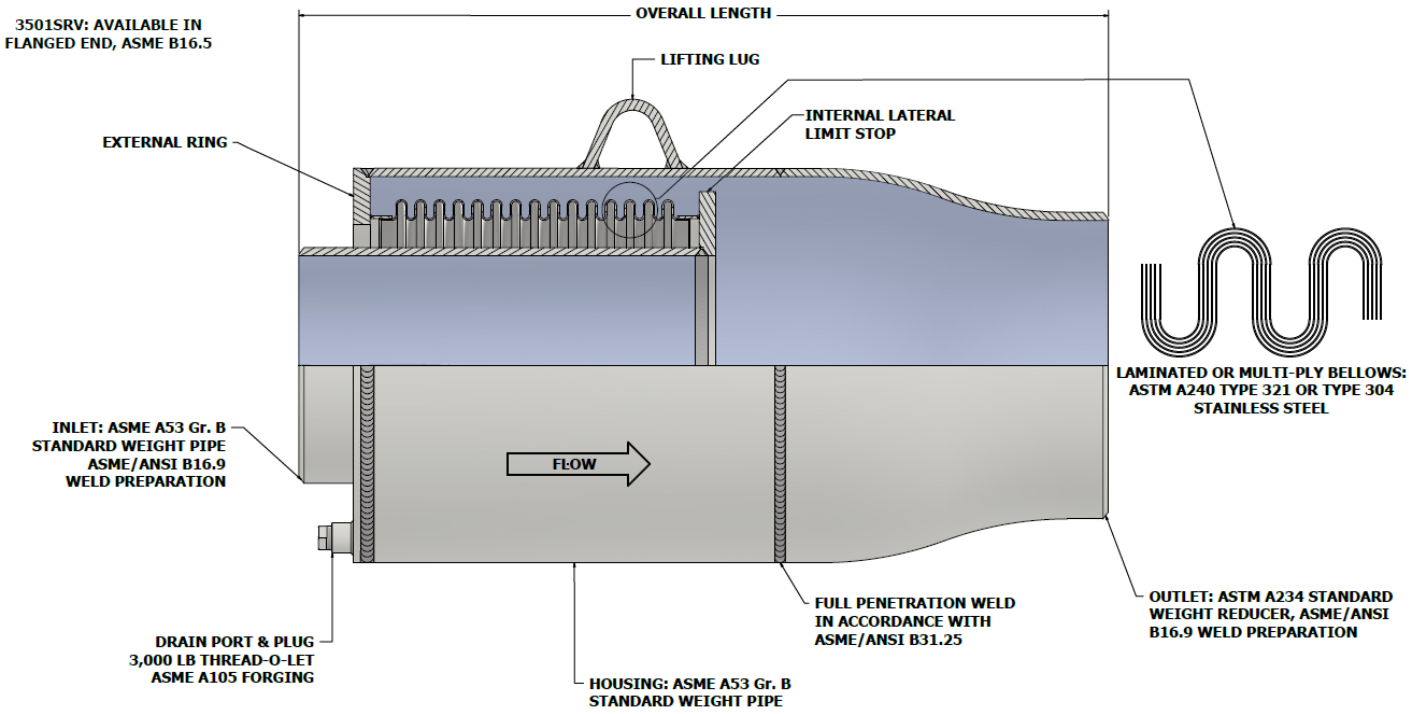
Nominal Size (NPS)	Part No.(1) 3501 IS 3502 IS 3507 IS	Maximum Outside Diameter (inches)	Axial Spring Rate (lb./in.)	Break Away Force(2) (lb.)	3501 IS Flanged		3502 iS Weld End		3507 IS Grooved End	
					Overall Length (inches)	Weight (lbs)	Overall Length (inches)	Weight (lbs)	Overall Length (inches)	Weight (lbs)
2 1/2	-135-6	6.19	46	88	62.0	112	56.5	96	56.0	96
	-135-12		22	24	104.5	164	99.0	148	98.5	148
	-135-18		15	16	150.5	216	145.0	200	144.5	200
	-135-24		13	12	196.5	274	191.0	258	190.5	258
3	-140-6	7.19	36	175	63.5	157	58.0	137	57.5	137
	-140-12		19	47	106.0	224	100.5	204	100.0	204
	-140-18		12	32	152.0	296	146.5	276	146.0	276
	-140-24		11	24	198.0	367	192.5	347	192.0	347
4	-148-6	9.75	65	323	70.5	310	64.5	280	63.88	280
	-148-12		33	94	109.0	405	103.0	375	102.38	375
	-148-18		21	63	155.0	514	149.0	484	148.38	484
	-148-24		22	47	201.0	610	195.0	580	194.38	580
5	-155-6	11.28	166	480	73.0	400	66.0	362	65.25	362
	-155-12		85	141	111.0	502	104.0	464	103.25	464
	-155-18		53	94	157.0	635	150.0	597	149.25	597
	-155-24		43	71	203.0	738	196.0	700	195.25	700
6	-160-6	12.38	181	601	76.5	521	69.5	473	68.75	473
	-160-12		94	180	113.38	669	106.38	621	105.63	621
	-160-18		58	120	159.38	840	152.38	792	151.63	792
	-160-24		48	90	205.38	988	198.38	940	197.63	940
8	-167-6	14.75	200	509	83.5	794	75.5	716	74.5	716
	-167-12		92	165	116.0	991	108.0	913	107.0	913
	-167-18		66	110	162.0	1,225	154.0	1,147	153.0	1,147
	-167-24		60	83	208.0	1,411	200.0	1,333	199.0	1,333
10	-174-6	17.12	232	969	84.0	1,081	76.0	977	75.0	977
	-174-12		113	314	116.5	1,324	108.5	1,220	107.5	1,220
	-174-18		77	209	162.5	1,657	154.5	1,553	153.5	1,553
	-174-24		68	157	208.5	1,902	200.5	1,798	199.5	1,798
12	-180-6	19.75	250	1,496	87.0	1,475	78.0	1,315	77.0	1,315
	-180-12		137	468	123.38	1,797	114.38	1,637	113.38	1,637
	-180-18		83	329	164.38	2,294	155.38	2,084	154.38	2,084
	-180-24		68	247	210.38	2,678	201.38	2,518	200.38	2,518
1	2	3	4	5	6	7	8	9	10	11

Series 3500SRV — Safety Relief Valve Connectors

Series 3500SRV connectors are designed for the special requirements of safety valve escapement piping. When safety relief valves vent steam, a sudden pressure surge and temperature change occurs in the escapement piping. Hyspan connectors are installed vertically or horizontally near the safety valve to isolate the valve from thermal expansion and shock/vibration movements.

All-welded construction with a fully enclosed multi-ply bellows. The inlet pipe includes a heavy flow liner. The outlet diameter is two pipe sizes larger than the inlet to accommodate the typical size transition in escapement piping.

Design Features



3501SRV - FIXED FLANGE

3502SRV - WELD END

Standard Design:

- 150 PSIG @ 500°F
- 2" axial compression
- 1" lateral offset
- Concurrent motions
- 1,000 EJMA cycles

Part Number 3502SRV	Inlet Diameter (NPS)	Outlet Diameter (NPS)	Overall Length (in)	Housing OD (in)	Effective Area (in²)	Axial Spring Rate (lb/in)	Lateral Spring Rate (lb/in)	Weight (lbs)
-131	2	4	26	8.63	20.7	140	86	100
-140	3	5	27	10.75	33.7	260	116	110
-148	4	6	28	12.75	44.8	281	167	153
-160	6	10	33	14.00	73.7	299	249	209
-167	8	12	36	16.00	107.3	331	346	274
-174	10	14	37	18.00	153.9	458	686	333
-180	12	16	44	20.00	201.9	707	1060	424
1	2	3	4	5	6	7	8	9

Installation Notes — Series 3500

- Principal movement must be axial — system must include guides, supports, and anchors per application diagrams.
- Standard design is factory-set for axial compression. Preset for extension applications must be specified at order.
- Flow direction can be from either end. On anchor-base models (3501AB, 3502AB), attach the free end to the pipe that expands. Drain port must be at the bottom.
- Shipping restraints (yellow bars, labeled) must remain installed until after installation is complete — remove before pressure testing. Restraints are welded; remove by cutting and grinding flush.
- Post-installation: confirm restraints removed, joint free to move, drain port at bottom, anchors and guides correct per design.

Series 5500 — Bellows Pump Connectors

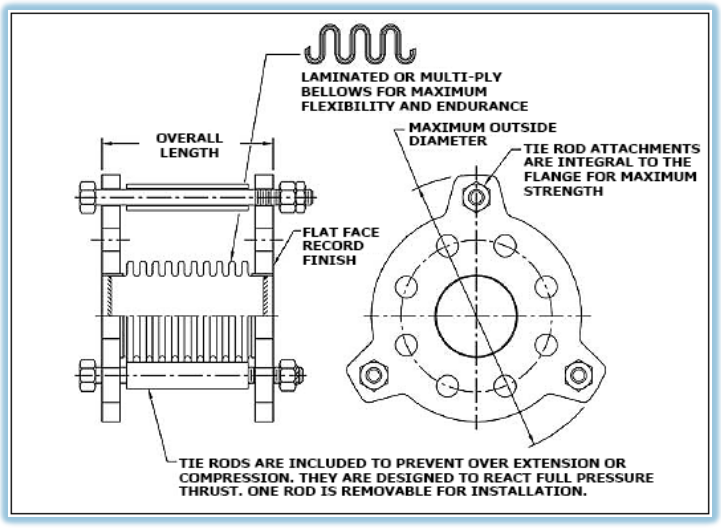
Nominal Sizes	1½" – 24" NPS
Design Pressure	Full vacuum to 150 PSIG and 300 PSIG @ 500°F
Movement	Axial compression (0.50"–1.00"), axial extension (0.25"), installation offset (0.13")
Bellows Construction	Laminated 3-ply minimum, ASTM A240 Type 321 (3" and under), Type 304 (over 3")
End Connections	Fixed flange (5501R), Vanstone flange (5502R)
Limit Rods	Integral — 3 rods standard (sizes 1½"–14"); 4 rods (16" and over); one rod removable for installation
Vanstone Material	ASTM A240 Type 304 stainless steel — all-wetted stainless surface
Warranty	24-month limited warranty from delivery / 12 months from first use (whichever is shorter)

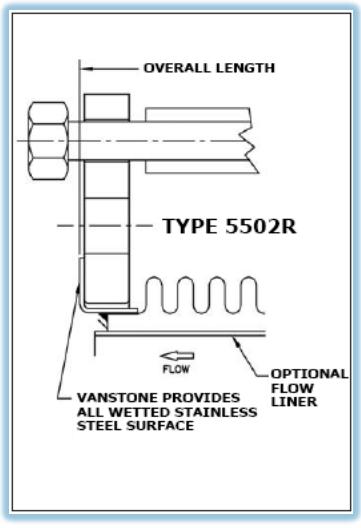
Product Description

Series 5500 Bellows Pump Connectors are designed for installation directly adjacent to mechanical equipment — pumps, compressors, fans — to isolate vibration, absorb small pipe movements, and provide flexibility for installation misalignment. The laminated bellows (3-ply minimum) provides maximum flexibility and fatigue resistance. Integral limit rods prevent over-travel and are designed to react the full pressure thrust in the event of a pipe movement exceedance — but are installed loose during normal operation to allow full benefit of the bellows movement.

Standard configurations are available from inventory. Vanstone ends provide an all-wetted stainless steel surface in contact with the flow media, making the 5502R particularly suited for corrosive service.

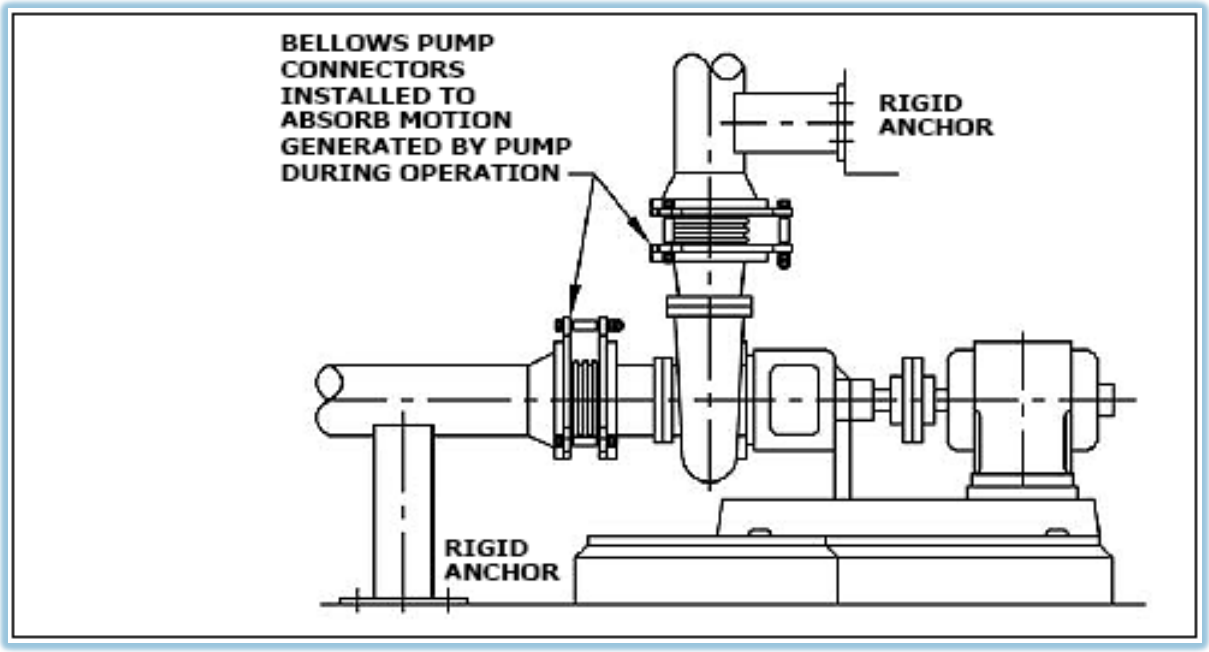
Design Features





Application

Bellows pump connectors connect rigid piping to mechanical equipment that has thermal growth or mechanical movement. The rigid anchor must be capable of reacting both the pressure thrust force and the bellows spring force. Install the connector directly at the equipment flange — limit rods should be loose (zero gap with 0.25" clearance per instructions).



Flow Liners

Flow liners are an optional feature on Series 5500 connectors. They minimize pressure loss, prevent bellows resonance in turbulent flow, prevent erosion from abrasive media, and prevent direct high-temperature impingement on the bellows. Flow liners are recommended per EJMA guidelines (see Series 2500 section for velocity thresholds). Series 5500 flow liners are designed for unidirectional flow — confirm flow direction is marked on the exterior and oriented correctly.

Table 1 — Allowable Movements

	Allowable Movements - inches		
Nominal Sizes (NPS)	1½"-8"	10"-16"	18"-24"
Axial Compression	0.50	0.75	1.00
Axial Extension	0.25	0.25	0.25
Installation Offset	0.13	0.13	0.13

Offset is measured from the centerline

Table 2 — Pressure and Force Data

Bellows Pump Connectors • Types 5501R, 5502R & 5506R • 150 & 300 PSIG

Nominal Size NPS	Effective Area ($in.^2$)	50 PSI	75 PSI	100 PSI	150 PSI	225 PSI	300 PSI	450 PSI
1 ½	3.6	180	270	360	540	810	1080	1620
2	5.6	280	420	560	840	1260	1680	2520
2 ½	7.8	390	585	780	1170	1755	2340	3510
3	11.6	580	870	1160	1740	2610	3480	5220
4	19	950	1425	1900	2850	4275	5700	8550
5	28	1400	2100	2800	4200	6300	8400	12600
6	40	2000	3000	4000	6000	9000	12000	18000
8	66	3300	4950	6600	9900	14850	19800	29700
10	101	5050	7575	10100	15150	22725	30300	45450
12	147	7350	11025	14700	22050	33075	44100	66150
14	177	8850	13275	17700	26550	39825	53100	79650
16	229	11450	17175	22900	34350	51525	68700	103050
18	287	14350	21525	28700	43050	64575	86100	129150
20	355	17750	26625	35500	53250	79875	106500	159750
24	501	25050	37575	50100	75150	112725	150300	225450
1	2	3	4	5	6	7	8	9

Table 3 — 150 PSIG Design Data

Design Pressure: Full Vacuum to 150 PSIG • Test Pressure: 225 PSIG • Design Temperature: 500°F

Nominal Size NPS	Part Number 5501R 5502R	Overall Length (1) (inches)	Axial Spring Rate (lb./in.)	Outside Diameter (2) (inches)	Number of Rods	Weight (lbs.)
1 ½	-127	3.5	360	7.5	3	13
2	-131	3.5	435	8.5	3	16
2 ½	-135	3.5	643	9.5	3	22
3	-140	4.0	860	10.0	3	24
4	-148	4.5	968	11.5	3	26
5	-155	4.5	1168	12.5	3	29
6	-160	5.0	1274	14.0	3	40
8	-167	5.0	1440	17.0	3	51
10	-174	6.0	1619	19.5	3	65
12	-180	6.0	1725	23.0	3	91
14	-181	8.0	2004	25.5	3	163
16	-182	8.0	2220	28.0	3	204
18	-183	9.0	2397	30.0	3	245
20	-184	9.0	2492	33.0	3	260
24	-186	9.0	2819	37.5	4	290
1	2	3	4	5	6	7

Table 4 — 300 PSIG Design Data

Design Pressure: Full Vacuum to 300 PSIG • Test Pressure: 450 PSIG • Design Temperature: 500°F

Nominal Size NPS	Part Number 5501R 5502R	Overall Length(1) (inches)	Axial Spring Rate (lb./in.)	Outside Diameter(2) (inches)	Number of Rods	Weight (lbs.)
1 ½	-327	3.5	360	8.63	3	16
2	-331	3.5	433	9.00	3	16
2 ½	-335	3.5	1268	10.00	3	25
3	-340	4.0	1491	10.75	3	28
4	-348	4.5	1544	13.00	3	35
5	-355	4.5	1871	14.00	3	42
6	-360	5.0	2927	16.00	3	57
8	-367	5.0	3687	19.00	3	79
10	-374	6.0	3922	21.75	3	113
12	-380	6.0	5520	25.50	3	179
14	-381	8.0	6311	28.50	3	212
16	-382	8.0	7831	31.00	4	293
18	-383	9.0	8613	33.75	4	363
20	-384	9.0	10,126	36.50	4	433
24	-386	9.0	11,005	43.50	4	490
1	2	3	4	5	6	7

Note:

(1) Overall length is measured from flange face to flange face, including the Vanstone for Type 5502R.

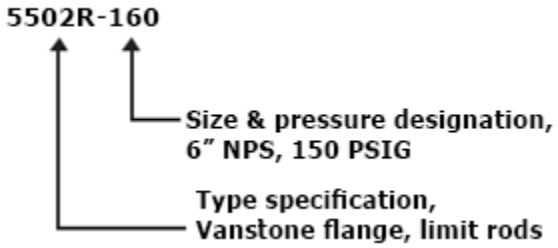
(2) Maximum outside diameter includes limit rod lug attachments.

(3) Type 5506R is available designed for full vacuum to 150 PSIG at 500°F as a replacement for rubber expansion joints, nominal sizes 2" through 14". Sizes 2" through 8" are 6.0" overall length; sizes 10" through 14" are 8.0" overall length. All other dimensions and performance data are the same as Type 5502R.

Ordering Example

Example:

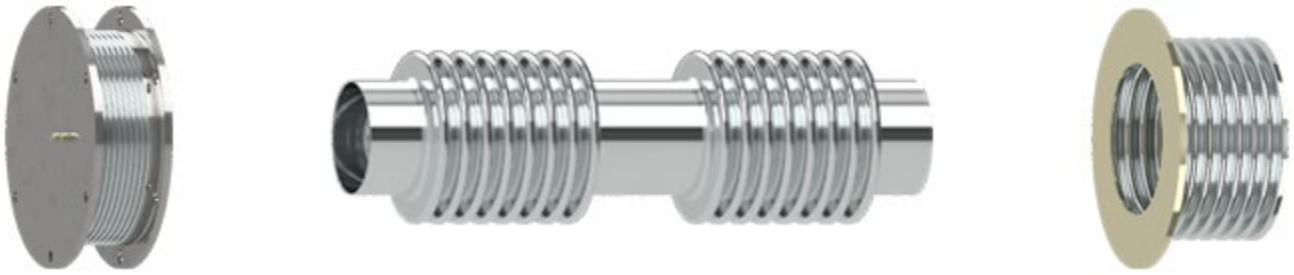
6" Bellows Pump Connector at 500°F maximum, 5502R-160 Vanstone 150# flange both ends, limit rods



Installation Notes

- Install in the neutral (manufactured) position whenever possible. Misalignment up to the limits in Table 1 is acceptable.
- Flow direction can be either direction for joints without flow liners. With liners, flow must be from fixed end to free end.
- Limit rods must be installed loose — zero gap, 0.25" clearance per the rod adjustment diagram. Jam nuts tight after setting.
- Shipping restraints: sizes 1½"–6" use wood spacers between flanges; sizes 8" and over use steel bars (painted yellow). Remove before pressure testing.
- Post-installation: confirm connector is undamaged, located correctly, anchor rigidly secured, shipping restraints removed, flow direction correct if liner installed.

Series 7500 — Formed Metal Bellows



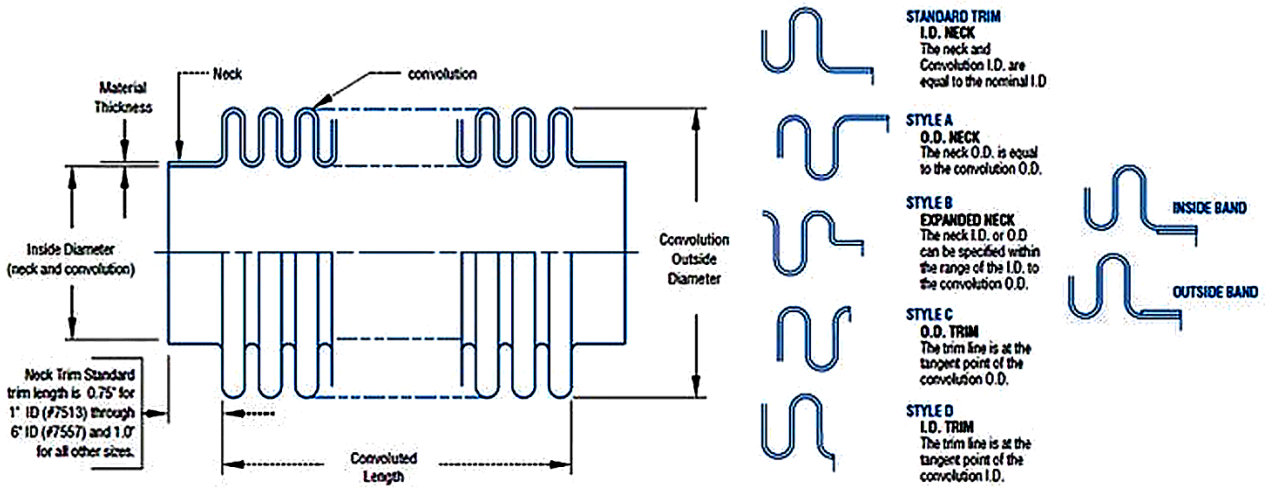
Standard Size Range	1" to 96" inside diameter
Pressure Range	Full vacuum to rated maximum per material and configuration (see tables)
Temperature	Cryogenic to high-temperature service — material dependent
Movement	Axial extension/compression, lateral offset, angular rotation, or combinations
Standard Material	ASTM A240 Type 321 stainless steel (performance data basis)
Optional Materials	Alloy 600, 625, 800, 825, C-276, Hastelloy, Nickel 200, Beryllium Copper, weldable Aluminum
Vacuum Capability	Leakage rates < 1×10^{-10} STD ATM CC/SEC at 1×10^{-6} TORR (UHV capable)
Multi-Ply Construction	Up to 5+ plies — increases pressure/spring rate/stability in direct proportion; same deflection

Product Description

Series 7500 Formed Metal Bellows are manufactured to order across the full range of industrial and scientific bellows applications — from small-diameter instrument bellows to 96" diameter wind tunnel assemblies. All operations are performed at Hyspan's own facilities under rigid quality control, ensuring consistent dimensional accuracy and performance across the complete size range.

The Series 7500 catalog provides performance data (pressure, spring rate, stability pressure, axial deflection) for standard sizes and material thicknesses. Bellows may be ordered directly from this catalog using the stock number system, or Hyspan engineering can assist with custom configurations not covered in the standard tables.

Standard Bellows Nomenclature

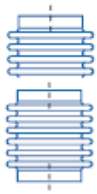


Standard Tolerances

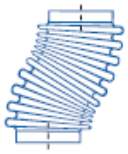
Inside Diameter	Stock Number	Neck ID	Convolution ID & OD	Convoluted Length	Trim Length
1″ – 4″	7513 – 7544	0.01	0.03	0.06	0.03
4.125″ – 6″	7545 – 7557	0.01	0.04	0.06	0.03
6.25″ – 12″	7558 – 7577	0.02	0.06	0.09	0.06
12.25″ – 24″	7578 – 7586	0.03	0.09	0.12	0.09
26″ – 48″	7587 – 7598	0.06	0.12	0.12	0.09
50″ – 96″	7599 – 75110	0.12	0.18	0.18	0.12

Bellows Movements

Series 7500 bellows accommodate five types of movement: axial extension or compression along the longitudinal centerline; lateral displacement perpendicular to the centerline with ends parallel; angular rotation about a perpendicular axis; combined axial, lateral, and angular within rated limits; and torsion (twisting about the centerline — not recommended).



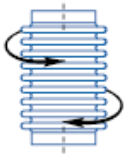
AXIAL
Extension or compression from the manufactured length along the longitudinal centerline with ends parallel.



LATERAL
Displacement perpendicular to the longitudinal centerline with the ends parallel.

ANGULAR
Rotation of the longitudinal centerline about the perpendicular axis.

COMBINED
Axial, lateral, and angular movements can be combined within the rated movements.



TORSION OR TWISTING AROUND THE CENTERLINE
(Not recommended.)

Explanation of Tabulated Data

The performance tables of the Series 7500 catalog use 11 columns. Key column definitions:

- Column 1 — Stock Number: identifies nominal ID and material thickness. Suffix letters: D=0.006", G=0.008", J=0.010", K=0.012", L=0.014", N=0.018", R=0.025", S=0.030", T=0.036", W=0.040", X=0.048", Z=0.060"
- Column 7 — Maximum Pressure (PSI): highest internal or external pressure recommended. Test pressure = 1.5× this value. For externally pressurized bellows, squirm does not apply; use Column 7 directly.
- Column 8 — Stability/Squirm Pressure (PSI): tabulated for 1" convoluted length. For other lengths, divide by the square of the convoluted length. Multiply by number of plies for multi-ply construction.
- Column 9 — Axial Spring Rate (lbs/in): tabulated for 1" convoluted length. Divide by actual convoluted length for other lengths. Multiply by number of plies for multi-ply.
- Column 10 — Lateral Spring Rate (lbs/in): tabulated for 1" convoluted length. MULTIPLY TABULATED VALUE BY 1,000 then divide by the CUBE of the convoluted length for actual rate.
- Column 11 — Axial Deflection (inches): allowable ±deflection per inch of convoluted length for 2,000 cycles. Multiply by actual convoluted length. For other cycle counts, apply correction factors from the catalog.

Multi-Ply (Laminated) Construction

Any standard-size bellows can be fabricated with multi-ply construction up to five plies of equal thickness. Maximum pressure, spring rate, and stability pressure increase in direct proportion to the number of plies, while axial deflection per inch of convoluted length remains unchanged. Multi-ply construction is recommended for vibration or rapid cyclic motion due to inherent inter-ply damping.

Note: Multi-ply construction is not recommended for UHV helium leak test applications due to possible out-gassing from undetectable inner-ply leaks.

Series 7500 — Performance Data Tables (1" – 96" ID)

The following tables provide performance data for all standard Series 7500 formed metal bellows. Data is calculated for Type 321 stainless steel at 70°F. For other materials or service temperatures substantially different from ambient, contact Hyspan engineering.

All Columns 8, 9, 10, and 11 apply to 1" convoluted length — apply the corrections described in the Explanation of Tabulated Data section above for actual convoluted lengths.

Stock number	Inside diameter (inches)	Convolution O.D. (inches)	Effective area (square Inche)	Material thickness (inches)	Maximum convoluted length (inches)	Maximum pressure (PSI)	Stability* pressure (PSI)	Axial* spring rate (lbs/in.)	Lateral* spring rate (lbs/in.)	Axial*deflection +or- for 2,000 cycles (inches)
1	2	3	4	5	6	7	8	9	10	11
7513B	1	1.33	1.09	0.005	6	64	108	138	0.23	0.42
7513D				0.006		90	180	227	0.36	0.36
7513G				0.008		153	397	523	0.83	0.25
7513J				0.010		237	792	1013	1.53	0.19
7514B	1.05	1.43	1.21	0.005	6	64	108	94	0.21	0.43
7514D				0.006		88	180	157	0.35	0.35
7514G				0.008		153	433	364	0.82	0.24
7514J				0.010		237	828	708	1.51	0.19
7515B	1.063	1.44	1.23	0.005	6	64	108	96	0.23	0.42
7515D				0.006		88	180	158	0.37	0.35
7515G				0.008		153	432	358	0.84	0.24
7515J				0.010		237	828	675	1.59	0.19
7516D	1.125	1.5	1.35	0.006	6	88	180	172	0.45	0.35
7516G				0.008		153	432	382	0.99	0.24
7516J				0.010		238	664	743	1.92	0.18
7516K				0.012		348	1548	1223	3.16	0.15
7517D	1.188	1.59	1.51	0.006	6	78	180	175	0.51	0.38
7517G				0.008		133	396	399	1.16	0.26
7517J				0.010		207	792	736	2.13	0.20
7517K				0.012		309	1512	1267	3.67	0.16
7518D	1.25	1.65	1.65	0.006	8	78	180	193	0.61	0.37
7518G				0.008		132	432	414	1.31	0.26
7518J				0.010		208	830	789	2.49	0.20
7518K				0.012		306	1476	1325	4.18	0.16
7519D	1.312	1.71	1.79	0.006	8	76	180	197	0.67	0.37
7519G				0.008		132	432	447	1.53	0.26
7519J				0.010		208	864	835	2.86	0.20
7519K				0.012		307	1548	1439	4.93	0.16
7520D	1.375	1.78	1.95	0.006	8	76	216	198	0.74	0.36
7520G				0.008		132	468	455	1.70	0.26
7520J				0.010		210	1512	845	3.15	0.19
7520K				0.012		307	1620	1446	5.40	0.16
7521D	1.437	1.84	2.13	0.006	8	76	216	181	0.74	0.36
7521G				0.008		133	504	418	1.70	0.26
7521J				0.010		211	972	759	3.10	0.19
7521K				0.012		309	1692	1326	5.41	0.16
7521L				0.014		429	2700	2052	8.37	0.13
7522D	1.5	2	2.33	0.006	8	43	108	156	0.70	0.45
7522G				0.008		73	1512	363	1.62	0.38
7522J				0.010		118	540	678	3.03	0.30
7522K				0.012		172	936	1184	5.29	0.24
7522L				0.014		240	1512	1844	8.23	0.20
7523D	1.625	2.13	2.77	0.006	8	42	108	157	0.83	0.45
7523G				0.008		75	288	327	1.73	0.38
7523J				0.010		118	576	640	3.38	0.30
7523K				0.012		174	1008	1087	5.75	0.24
7523L				0.014		243	1620	1665	8.81	0.20

Stock number	Inside diameter (inches)	Convolution O.D. (inches)	Effective area (square Inche)	Material thickness (inches)	Maximum convoluted length (inches)	Maximum pressure (PSI)	Stability* pressure (PSI)	Axial* spring rate (lbs/in.)	Lateral* spring rate (lbs/in.)	Axial*deflection +or- for 2,000 cycles (inches)
1	2	3	4	5	6	7	8	9	10	11
7524D	1.66	2.15	2.85	0.006	8	45	128	175	0.95	0.45
7524G				0.008		79	321	378	2.06	0.37
7524J				0.010		126	641	711	3.87	0.29
7524K				0.012		184	1090	1183	6.44	0.23
7524L				0.014		256	1792	1893	10.31	0.19
7525D	1.75	2.33	3.14	0.006	8	28	64	166	1.00	0.45
7525G				0.008		49	192	373	2.24	0.44
7525J				0.010		78	384	705	4.23	0.42
7525K				0.012		112	640	1169	7.01	0.34
7525L				0.014		156	1026	1870	11.22	0.29
7526D	1.875	2.43	3.64	0.006	8	28	64	134	0.93	0.45
7526G				0.008		49	192	296	2.06	0.44
7526J				0.010		78	385	552	3.84	0.41
7526K				0.012		114	704	945	6.57	0.33
7526L				0.014		157	1088	1472	10.23	0.28
7527D	1.9	2.5	3.8	0.006	8	36	128	107	0.78	0.47
7527G				0.008		58	256	237	1.72	0.44
7527J				0.010		88	512	460	3.34	0.33
7527K				0.012		126	896	786	5.71	0.27
7527L				0.014		174	1472	1187	8.62	0.23
7528D	2	2.65	4.15	0.006	10	28	100	112	0.89	0.47
7528G				0.008		48	200	258	2.05	0.46
7528J				0.010		72	400	470	3.74	0.38
7528K				0.012		102	800	822	6.53	0.31
7528L				0.014		141	1200	1270	10.08	0.26
7529D	2.125	2.78	4.72	0.006	10	34	100	92	0.84	0.47
7529G				0.008		37	300	204	1.85	0.45
7529J				0.010		85	600	397	3.58	0.35
7529K				0.012		120	1000	693	6.26	0.28
7529L				0.014		162	1600	1039	9.38	0.23
7530D	2.25	2.9	5.21	0.006	10	34	100	126	1.26	0.47
7530G				0.008		37	300	281	2.80	0.45
7530J				0.010		85	600	522	5.19	0.34
7530K				0.012		120	1100	874	8.69	0.27
7530L				0.014		163	1700	1370	13.60	0.22
7531D	2.375	3.02	5.71	0.006	10	34	200	135	1.48	0.47
7531G				0.008		55	300	302	3.30	0.45
7531J				0.010		85	700	569	6.22	0.34
7531K				0.012		120	1100	962	10.51	0.27
7531L				0.014		162	1800	1469	16.04	0.22
7531N				0.018		271	3800	3051	33.31	16
7532D	2.5	3.15	6.26	0.006	10	58	200	139	1.66	0.47
7532G				0.008		55	400	309	3.70	0.44
7532J				0.010		84	700	583	6.98	0.34
7532K				0.012		120	1200	984	11.79	0.27
7532L				0.014		162	1800	1538	18.41	0.22
7532N				0.018		273	3900	3122	37.38	16

Stock number	Inside diameter (inches)	Convolution O.D. (inches)	Effective area (square Inche)	Material thickness (inches)	Maximum convoluted length (inches)	Maximum pressure (PSI)	Stability* pressure (PSI)	Axial* spring rate (lbs/in.)	Lateral* spring rate (lbs/in.)	Axial*deflection +or- for 2,000 cycles (inches)
1	2	3	4	5	6	7	8	9	10	11
7533D	2.625	3.28	6.84	0.006	10	33	200	149	1.96	0.47
7533G				0.008		55	400	306	4.01	0.44
7533J				0.010		84	700	595	7.79	0.33
7533K				0.012		120	1200	985	12.89	0.27
7533L				0.014		163	1900	1571	20.54	0.22
7533N				0.018		273	3800	3574	46.65	0.16
7534D	2.75	3.4	7.42	0.006	10	33	200	153	2.18	0.47
7534G				0.008		55	400	340	4.83	0.43
7534J				0.010		84	700	637	9.04	0.33
7534K				0.012		120	1300	1050	14.90	0.27
7534L				0.014		163	2000	1674	23.75	0.22
7534N				0.018		274	3900	3740	53.04	0.16
7535D	2.875	3.5	7.97	0.006	10	36	200	178	2.73	0.47
7535G				0.008		60	500	396	6.05	0.40
7535J				0.010		93	900	742	11.32	0.31
7535K				0.012		132	1500	1257	19.17	0.24
7535L				0.014		180	2400	1996	30.43	0.20
7535N				0.018		274	4100	3905	59.98	0.16
7536D	3	3.75	8.94	0.006	10	26	100	130	2.23	0.47
7536G				0.008		42	300	274	4.70	0.46
7536J				0.010		64	600	525	8.98	0.40
7536K				0.012		90	1002	875	14.96	0.32
7536L				0.014		121	1600	1367	23.36	0.26
7536N				0.018		202	3507	2824	48.27	0.19
7537D	3.125	3.88	9.63	0.006	10	25	200	132	2.44	0.47
7537G				0.008		42	301	291	5.35	0.47
7537J				0.010		64	601	527	9.70	0.39
7537K				0.012		90	1100	890	16.39	0.31
7537L				0.014		121	1700	1390	25.59	0.26
7537N				0.018		202	3600	2873	52.88	0.19
7538D	3.25	4.02	10.37	0.006	10	24	100	150	2.98	0.47
7538G				0.008		39	300	355	7.05	0.47
7538J				0.010		60	600	639	12.67	0.41
7538K				0.012		84	1000	1037	20.57	0.33
7538L				0.014		112	1600	1620	32.11	0.27
7538N				0.018		189	3500	3345	66.31	0.20
7539D	3.375	4.17	11.11	0.006	10	24	200	152	3.24	0.48
7539G				0.008		40	400	361	7.67	0.47
7539J				0.010		60	700	648	13.78	0.43
7539K				0.012		84	1100	1081	22.97	0.33
7539L				0.014		112	1800	1682	35.73	0.27
7539N				0.018		184	3700	3396	72.12	0.20
7540D	3.5	4.3	11.94	0.006	10	24	200	143	3.28	0.48
7540G				0.008		40	400	340	7.77	0.47
7540J				0.010		60	700	611	13.95	0.41
7540K				0.012		84	1200	998	22.78	0.33
7540L				0.014		112	1800	1553	35.44	0.27
7540N				0.018		184	3200	3257	74.32	0.22
7540R				0.025		366	9700	9146	209.11	0.13

Stock number	Inside diameter (inches)	Convolution O.D. (inches)	Effective area (square Inche)	Material thickness (inches)	Maximum convoluted length (inches)	Maximum pressure (PSI)	Stability* pressure (PSI)	Axial* spring rate (lbs/in.)	Lateral* spring rate (lbs/in.)	Axial*deflection +or- for 2,000 cycles (inches)
1	2	3	4	5	6	7	8	9	10	11
7541D				0.006		21	144	123	3.04	0.48
7541G				0.008		35	310	280	6.92	0.46
7541J				0.010		51	578	513	12.64	0.45
7541K	3.625	4.48	12.89	0.012	10	72	1020	851	20.97	0.36
7541L				0.014		97	1597	1319	32.50	0.30
7541N				0.018		159	3371	2761	68.02	0.22
7541R				0.025		313	8400	7903	194.83	0.15
7542D				0.006		21	200	129	3.38	0.48
7542G				0.008		34	300	294	7.70	0.47
7542J				0.010		51	600	537	14.07	0.45
7542K	3.75	4.6	13.68	0.012	10	72	1000	916	23.96	0.36
7542L				0.014		97	1600	1415	37.00	0.30
7542N				0.018		159	3500	2946	77.04	0.22
7542R				0.025		313	8700	8170	214.05	0.15
7543D				0.006		21	200	130	3.63	0.48
7543G				0.008		34	300	298	8.28	0.47
7543J				0.010		51	600	544	15.13	0.45
7543K	3.875	4.73	14.53	0.012	10	72	1100	927	25.77	0.36
7543L				0.014		97	1700	1432	39.79	0.30
7543N				0.018		159	3600	2983	82.85	0.22
7543R				0.025		313	9000	8438	234.49	0.15
7544D				0.006		16	100	102	3.12	0.48
7544G				0.008		27	300	233	7.10	0.47
7544J				0.010		39	500	460	13.98	0.47
7544K	4	5	15.9	0.012	10	54	900	740	22.49	0.44
7544L				0.014		72	1300	1146	34.82	0.37
7544N				0.018		117	2700	2347	71.30	0.27
7544R				0.025		225	6700	6338	195.50	0.18
7545D				0.006		16	100	103	3.34	0.48
7545G				0.008		27	300	246	7.92	0.47
7545J				0.010		39	500	448	14.40	0.47
7545K	4.125	5.13	16.81	0.012	10	54	900	750	24.09	0.45
7545L				0.014		72	1400	1161	37.30	0.36
7545N				0.018		117	2800	2378	76.38	0.27
7545R				0.025		225	6900	6532	209.56	0.18
7546D				0.006		16	100	108	3.67	0.48
7546G				0.008		27	300	256	8.69	0.47
7546J				0.010		39	500	482	16.32	0.47
7546K	4.25	5.25	17.71	0.012	10	54	900	802	27.16	0.44
7546L				0.014		72	1400	1210	40.95	0.37
7546N				0.018		117	2900	2477	83.86	0.27
7546R				0.025		225	7100	6724	227.58	0.18
7547D				0.006		16	100	109	3.91	0.48
7547G				0.008		27	300	259	9.27	0.47
7547J				0.010		39	600	487	17.41	0.47
7547K	4.375	5.38	18.67	0.012	10	54	900	788	28.14	0.44
7547L				0.014		72	1400	1234	44.05	0.36
7547N				0.018		117	3000	2506	89.44	0.27
7547R				0.025		225	7300	6918	246.61	0.18

Stock number	Inside diameter (inches)	Convolution O.D. (inches)	Effective area (square Inche)	Material thickness (inches)	Maximum convoluted length (inches)	Maximum pressure (PSI)	Stability* pressure (PSI)	Axial* spring rate (lbs/in.)	Lateral* spring rate (lbs/in.)	Axial*deflection +or- for 2,000 cycles (inches)
1	2	3	4	5	6	7	8	9	10	11
7548G	4.5	5.5	19.62	0.008	10	26	300	270	10.14	0.47
7548J				0.010		39	600	507	19.04	0.47
7548K				0.012		54	900	820	30.77	0.43
7548L				0.014		72	1300	1284	48.16	0.36
7548N				0.018		78	3100	2600	97.52	0.27
7548R				0.025		226	8200	6697	251.15	0.18
7549G	4.625	5.63	20.6	0.008	10	25	300	273	10.77	0.47
7549J				0.010		39	600	493	19.48	0.47
7549K				0.012		54	1000	828	32.69	0.43
7549L				0.014		72	1500	1297	51.17	0.36
7549N				0.018		115	3100	2627	103.61	0.27
7549R				0.025		226	8500	6766	266.84	0.18
7550G	4.75	5.75	21.6	0.008	10	25	300	283	11.74	0.47
7550J				0.010		39	600	513	21.22	0.47
7550K				0.012		54	1000	861	35.62	0.43
7550L				0.014		72	1500	1348	55.76	0.36
7550N				0.018		115	3200	2730	112.90	0.27
7550R				0.025		174	8700	7121	294.44	0.19
7551G	4.875	5.88	22.7	0.008	10	25	300	286	12.42	0.47
7551J				0.010		39	600	517	22.47	0.47
7551K				0.012		54	1000	869	37.71	0.43
7551L				0.014		72	1600	1360	59.03	0.36
7551N				0.018		115	3300	2755	119.52	0.27
7551R				0.025		226	8900	7186	311.72	0.18
7552G	5	6	23.8	0.008	10	25	300	297	13.49	0.47
7552J				0.010		37	600	537	24.40	0.46
7552K				0.012		54	1000	902	40.95	0.42
7552L				0.014		72	1600	1373	62.34	0.36
7552N				0.018		115	3400	2911	132.10	0.27
7552R				0.025		228	9100	7460	338.54	0.18
7553G	5.25	6.25	25.9	0.008	10	25	300	298	14.82	0.47
7553J				0.010		37	600	563	27.94	0.47
7553K				0.012		52	1100	954	47.35	0.42
7553L				0.014		70	1700	1468	72.85	0.35
7553N				0.018		117	3500	3043	150.94	0.26
7553R				0.025		228	8800	8266	409.94	0.18
7553S				0.030		333	15500	14534	720.80	0.14
7554G	5.5	6.5	28.3	0.008	10	17	400	324	17.52	0.47
7554J				0.010		37	700	587	31.75	0.47
7554K				0.012		52	1100	996	53.80	0.40
7554L				0.014		70	1800	1532	82.77	0.35
7554N				0.018		117	3700	3175	171.50	0.26
7554R				0.025		228	9200	8650	467.09	0.18
7554S				0.030		333	16200	15216	821.65	0.14
7555G	5.563	6.56	28.8	0.008	10	25	369	330	18.22	0.45
7555J				0.010		37	640	599	33.03	0.45
7555K				0.012		52	1100	1015	55.98	0.40
7555L				0.014		70	1800	1562	86.11	0.34
7555N				0.018		117	3700	3237	178.42	0.24
7555R				0.025		228	10800	8401	463.06	0.16
7555S				0.030		333	16400	15388	848.46	0.14

Stock number	Inside diameter (inches)	Convolution O.D. (inches)	Effective area (square Inche)	Material thickness (inches)	Maximum convoluted length (inches)	Maximum pressure (PSI)	Stability* pressure (PSI)	Axial* spring rate (lbs/in.)	Lateral* spring rate (lbs/in.)	Axial*deflection +or- for 2,000 cycles (inches)
1	2	3	4	5	6	7	8	9	10	11
7556G				0.008		19	300	337	19.80	0.47
7556J				0.010		30	500	612	35.89	0.47
7556K				0.012		42	900	1037	60.81	0.46
7556L	5.75	6.85	30.7	0.014	10	55	1400	1596	93.55	0.41
7556N				0.018		91	3000	3366	197.24	0.31
7556R				0.025		178	8000	8693	509.40	0.21
7556S				0.030		261	12800	12008	714.85	0.17
7557G				0.008		22	400	337	21.74	0.48
7557J				0.010		34	700	654	42.12	0.47
7557K				0.012		48	1200	1066	68.66	0.44
7557L	6	7.1	33.7	0.014	10	64	1800	1571	101.13	0.37
7557N				0.018		103	3800	3278	210.96	0.27
7557R				0.025		198	10500	8341	536.78	0.18
7557S				0.030		289	16100	15119	972.95	0.15
7558G				0.008		22	400	350	24.32	0.48
7558J				0.010		34	700	679	47.13	0.47
7558K				0.012		48	1200	1068	74.08	0.44
7558L	6.25	7.35	36.3	0.014	10	64	1900	1631	113.16	0.37
7558N				0.018		103	3900	3371	233.83	0.27
7558R				0.025		198	10700	8768	608.19	0.18
7558S				0.030		289	16800	15757	1092.90	0.15
7559G				0.008		22	400	363	27.10	0.48
7559J				0.010		34	800	668	49.80	0.47
7559K				0.012		48	1300	1107	82.55	0.44
7559L	6.5	7.6	39	0.014	10	63	2000	1691	126.10	0.37
7559N				0.018		103	4000	3495	260.58	0.27
7559R				0.025		199	10900	9090	677.76	0.18
7559S				0.030		291	17500	16395	1222.29	0.15
7560G				0.008		22	400	365	28.24	0.48
7560J				0.010		34	800	670	51.84	0.47
7560K				0.012		48	1300	1112	85.96	0.44
7560L	6.625	7.73	40.4	0.014	10	63	2000	1737	134.22	0.37
7560N				0.018		103	4100	3510	271.24	0.27
7560R				0.025		199	11000	9130	705.54	0.18
7560S				0.030		291	17800	16714	1290.64	0.15
7561G				0.008		22	400	376	30.09	0.48
7561J				0.010		34	800	691	55.29	0.47
7561K				0.012		48	1300	1146	91.65	0.44
7561L	6.75	7.85	41.8	0.014	10	63	2000	1766	141.21	0.37
7561N				0.018		102	4200	3619	289.29	0.27
7561R				0.025		199	10300	9661	772.27	0.18
7561S				0.030		291	18100	17032	1361.48	0.15
7562G				0.008		22	400	389	33.29	0.48
7562J				0.010		34	800	715	61.17	0.47
7562K				0.012		48	1300	1175	100.47	0.44
7562L	7	8.1	44.7	0.014	10	63	2100	1827	156.22	0.36
7562N				0.018		102	4300	3743	320.04	0.27
7562R				0.025		199	11100	9260	791.86	0.18
7562S				0.030		291	16000	17507	1496.97	0.15

Stock number	Inside diameter (inches)	Convolution O.D. (inches)	Effective area (square Inche)	Material thickness (inches)	Maximum convoluted length (inches)	Maximum pressure (PSI)	Stability* pressure (PSI)	Axial* spring rate (lbs/in.)	Lateral* spring rate (lbs/in.)	Axial*deflection +or- for 2,000 cycles (inches)
1	2	3	4	5	6	7	8	9	10	11
7563G				0.008		16	300	415	40.35	0.48
7563J				0.010		25	600	758	73.75	0.47
7563K				0.012		34	1000	1252	121.79	0.47
7563L	7.5	8.7	50.9	0.014	10	46	1500	1948	189.36	0.45
7563N				0.018		75	3200	3955	384.51	0.33
7563R				0.025		144	9100	9873	959.76	0.23
7563S				0.030		210	14100	18855	1832.84	0.18
7564G				0.008		16	300	310	34.63	0.48
7564J				0.010		24	600	556	62.15	0.47
7564K				0.012		34	1000	940	104.98	0.47
7564L	8	9.25	58.4	0.014	10	46	1600	1441	160.90	0.44
7564N				0.018		75	3400	2973	331.75	0.33
7564R				0.025		145	9500	7774	867.55	0.23
7564S				0.030		211	14200	14847	1656.75	0.18
7565G				0.008		16	300	307	36.28	0.48
7565J				0.010		24	600	573	67.71	0.47
7565K				0.012		34	1100	968	114.37	0.47
7565L	8.25	9.5	61.8	0.014	10	46	1700	1483	175.31	0.44
7565N				0.018		75	3500	3112	367.75	0.33
7565R				0.025		145	9600	8000	945.19	0.23
7565S				0.030		211	14100	14609	1726.06	0.18
7566G				0.008		16	400	315	39.44	0.48
7566J				0.010		24	700	590	73.73	0.47
7566K				0.012		34	1100	995	124.31	0.44
7566L	8.5	9.75	65.4	0.014	10	45	1700	1525	190.54	0.44
7566N				0.018		75	3600	3200	399.71	0.33
7566R				0.025		145	9700	8225	1027.34	0.23
7566S				0.030		211	14100	15020	1876.07	0.18
7567G				0.008		16	400	320	41.14	0.48
7567J				0.010		24	700	598	76.93	0.47
7567K				0.012		34	1100	1009	129.70	0.46
7567L	8.63	9.88	67.2	0.014	10	45	1700	1547	198.80	0.44
7567N				0.018		75	3700	3245	417.03	0.33
7567R				0.025		145	9700	8342	1071.88	0.23
7567S				0.030		211	14100	15234	1957.40	0.18
7568J				0.010		24	700	606	79.96	0.47
7568K				0.012		34	1100	1022	134.81	0.46
7568L	8.75	10	69	0.014	10	45	1800	1567	206.63	0.44
7568N				0.018		75	3700	3287	433.47	0.33
7568R				0.025		145	9700	8556	1128.04	0.22
7568S				0.030		211	14000	15432	2034.53	0.18
7569J				0.010		24	700	622	86.53	0.47
7569K				0.012		34	1200	1049	145.89	0.46
7569L	9	10.25	72.7	0.014	10	45	1800	1609	223.61	0.44
7569N				0.018		75	3800	3375	469.08	0.33
7569R				0.025		145	9800	8784	1220.71	0.22
7569S				0.030		211	14000	16003	2223.84	0.18
7570J				0.010		24	700	655	100.73	0.47
7570K				0.012		34	1200	1073	165.14	0.47
7570L	9.5	10.75	80.5	0.014	10	45	1900	1695	260.73	0.43
7570N				0.018		75	4200	3434	528.20	0.32
7570R				0.025		145	9800	9240	1421.01	0.22
7570S				0.030		226	14600	16834	2588.72	0.17

Stock number	Inside diameter (inches)	Convolution O.D. (inches)	Effective area (square Inche)	Material thickness (inches)	Maximum convoluted length (inches)	Maximum pressure (PSI)	Stability* pressure (PSI)	Axial* spring rate (lbs/in.)	Lateral* spring rate (lbs/in.)	Axial*deflection +or- for 2,000 cycles (inches)
1	2	3	4	5	6	7	8	9	10	11
7571J	10	11.25	89	0.010	12	24	720	677	114.75	0.47
7571K				0.012		33	1296	1126	190.83	0.47
7571L				0.014		45	2016	1779	301.30	0.43
7571N				0.018		75	4176	3667	620.96	0.32
7571R				0.025		145	11520	9817	1662.54	0.22
7571S				0.030		211	16992	17843	3021.50	0.18
7572J	10.25	11.5	93	0.010	12	24	720	693	123.04	0.46
7572K				0.012		33	1296	1183	209.96	0.45
7572L				0.014		45	2016	1821	323.07	0.43
7572N				0.018		75	4320	3753	665.83	0.32
7572R				0.025		145	11664	9609	1704.68	0.22
7572S				0.030		211	16992	18263	3239.84	0.19
7573J	10.5	11.75	97	0.010	12	24	720	709	131.72	0.47
7573K				0.012		33	1296	1210	224.77	0.47
7573L				0.014		45	2016	1863	345.87	0.43
7573N				0.018		75	4464	3839	712.82	0.32
7573R				0.025		145	11664	9830	1824.97	0.22
7573S				0.030		213	16848	18682	3468.45	0.18
7574J	10.75	12	102	0.010	12	24	739	692	134.33	0.47
7574K				0.012		33	1296	1212	235.40	0.47
7574L				0.014		45	2160	1904	369.71	0.43
7574N				0.018		75	4464	3925	761.96	0.32
7574R				0.025		145	11664	10051	1950.79	0.22
7574S				0.030		213	16848	19102	3707.58	0.18
7574T				0.036		313	34800	32670	6340.84	0.15
7575J	11	12.25	106	0.010	12	24	864	741	150.29	0.47
7575K				0.012		33	1440	1239	251.26	0.47
7575L				0.014		45	2160	1946	394.63	0.43
7575N				0.018		75	4608	4012	813.31	0.32
7575R				0.025		145	11808	10272	2082.26	0.22
7575S				0.030		213	16704	19717	3997.02	0.18
7575T				0.036		313	35700	33436	6777.77	0.15
7576J	11.5	12.75	115	0.010	12	24	864	751	165.82	0.47
7576K				0.012		33	1440	1292	285.10	0.47
7576L				0.014		45	2304	2030	447.77	0.42
7576N				0.018		75	5040	4184	922.83	0.32
7576R				0.025		145	11808	10713	2362.66	0.22
7576S				0.030		213	16560	20565	4535.26	0.18
7576T				0.036		313	37300	34966	7710.81	0.15
7577J	12	13.25	125	0.010	12	24	864	782	187.20	0.47
7577K				0.012		33	1440	1346	321.84	0.45
7577L				0.014		45	2304	2114	505.48	0.42
7577N				0.018		75	5328	4357	1041.77	0.32
7577R				0.025		145	11808	11293	2700.23	0.22
7577S				0.030		213	16272	21413	5119.78	0.18
7577T				0.036		315	38900	36496	8725.61	0.14

Stock number	Inside diameter (inches)	Convolution O.D. (inches)	Effective area (square Inche)	Material thickness (inches)	Maximum convoluted length (inches)	Maximum pressure (PSI)	Stability* pressure (PSI)	Axial* spring rate (lbs/in.)	Lateral* spring rate (lbs/in.)	Axial*deflection +or- for 2,000 cycles (inches)
1	2	3	4	5	6	7	8	9	10	11
7578J				0.010		28	1160	1088	270.12	0.48
7578K				0.012		39	1900	1784	443.27	0.45
7578L				0.014		52	2900	2756	684.35	0.37
7578N	12.25	13.5	130	0.018	12	85	6000	5658	1405.49	0.25
7578R				0.025		166	16100	15138	3760.03	0.19
7578S				0.030		243	28300	26502	6583.06	0.16
7578T				0.036		355	49800	46604	11576.60	0.13
7579J				0.010		18	721	696	183.42	0.48
7579K				0.012		25	1296	1136	299.20	0.48
7579L				0.014		34	2016	1747	460.20	0.47
7579N	12.5	14	138	0.018	12	54	4176	3647	960.62	0.37
7579R				0.025		105	9792	9325	2455.76	0.26
7579S				0.030		153	13838	17723	4667.31	0.21
7579T				0.036		222	30300	28312	7461.48	0.17
7580J				0.010		9	288	336	94.99	0.48
7580K				0.012		13	588	565	159.90	0.48
7580L				0.014		16	865	872	246.41	0.47
7580N	12.75	14.75	148	0.018	12	27	1872	1756	496.33	0.47
7580R				0.025		51	4900	4584	1295.51	0.43
7580S				0.030		73	9072	8755	2474.03	0.35
7580T				0.036		108	13500	12718	3602.92	0.19
7581N				0.018		27	2304	2100	720.65	0.48
7581R				0.025		48	3632	5037	1728.69	0.43
7581S	14	16.25	180	0.030	16	69	9472	9327	3200.63	0.35
7581T				0.036		97	17152	15372	5274.90	0.28
7581W				0.048		172	32000	33161	11379.00	0.20
7582N				0.018		25	2560	2309	1015	0.48
7582R				0.025		48	6400	5655	2487	0.39
7582S	16	18.25	230	0.030	16	67	11520	10556	4643	0.34
7582T				0.036		96	17920	17699	7786	0.27
7582X				0.048		174	31232	42064	18504	0.20
7583N				0.018		25	2816	2527	1386	0.48
7583R				0.025		48	7424	6265	3437	0.41
7583S	18	20.25	287	0.030	16	67	12288	11748	6445	0.34
7583T				0.036		96	18176	19932	10936	0.27
7583W				0.040		120	22016	24352	13360	0.24
7583X				0.048		174	29952	47563	26095	0.19
7584N				0.018		19	2250	2018	1367	0.48
7584R				0.025		36	6075	5179	3508	0.47
7584S				0.030		52	10125	9644	6532	0.40
7584T	20	22.5	354	0.036	15	75	15300	15829	10721	0.32
7584W				0.040		93	18675	19983	13535	0.29
7584X				0.048		133	25425	39029	26436	0.23
7584Z				0.060		235	38025	74622	50544	0.17

Stock number	Inside diameter (inches)	Convolution O.D. (inches)	Effective area (square Inche)	Material thickness (inches)	Maximum convoluted length (inches)	Maximum pressure (PSI)	Stability* pressure (PSI)	Axial* spring rate (lbs/in.)	Lateral* spring rate (lbs/in.)	Axial*deflection +or- for 2,000 cycles (inches)
1	2	3	4	5	6	7	8	9	10	11
7585N				0.018		19	2475	2176	1765	0.48
7585R				0.025		36	6750	5552	4502	0.47
7585S				0.030		52	10515	10309	8359	0.39
7585T	22	24.5	424	0.036	15	75	15075	17464	14160	0.32
7585W				0.040		93	18225	22033	17865	0.29
7585X				0.048		133	24300	41088	33316	0.23
7585Z				0.060		235	33775	82449	66853	0.17
7586N				0.018		19	2700	2364	2260	0.48
7586R				0.025		36	6975	6104	5838	0.47
7586S				0.030		52	10575	11196	10708	0.39
7586T	24	26.5	500	0.036	15	75	14850	19124	18289	0.32
7586W				0.040		93	17775	24113	23061	0.28
7586X				0.048		133	23296	44898	42938	0.24
7586Z				0.060		237	33975	89981	86053	0.17
7587N				0.018		19	2700	2523	2811	0.48
7587R				0.025		36	7200	6588	7338	0.47
7587S				0.030		51	10575	12204	13593	0.39
7587T	26	28.5	583	0.036	15	75	14400	20639	22989	0.32
7587W				0.040		93	17100	25077	27932	0.28
7587X				0.048		133	22275	48754	54304	0.24
7587Z				0.060		237	31950	97583	108693	0.17
7588N				0.018		18	3025	2708	3476	0.48
7588R				0.025		31	6239	6925	8887	0.47
7588S				0.030		45	8508	13099	16811	0.41
7588T	28	30.5	672	0.036	15	64	11344	21361	27414	0.32
7588W				0.040		102	13045	26917	34544	0.25
7588X				0.048		148	16448	52654	67574	0.20
7588Z				0.060		205	23633	105257	135081	0.18
7589N				0.018		16	3375	2728	4029	0.48
7589R				0.025		31	6750	6982	10310	0.47
7589S				0.030		45	9225	13026	19234	0.40
7589T	30	32.75	773	0.036	15	64	12375	20867	30812	0.33
7589W				0.040		81	14400	26294	38826	0.30
7589X				0.048		117	18675	51435	75949	0.24
7589Z				0.060		195	26100	99796	147358	0.18
7590N				0.018		16	3375	2902	4850	0.48
7590R				0.025		31	6750	7519	12563	0.47
7590S				0.030		45	9000	13994	23382	0.40
7590T	32	34.75	874	0.036	15	64	11925	22197	37088	0.33
7590W				0.040		81	13950	28185	47094	0.29
7590X				0.048		117	17775	53431	89275	0.24
7590Z				0.060		185	24975	106675	178237	0.18
7591N				0.018		16	3375	3034	5696	0.48
7591R				0.025		31	6525	7764	14574	0.47
7591S				0.030		45	8775	14832	27842	0.40
7591T	34	36.75	982	0.036	15	64	11700	23722	44530	0.33
7591W				0.040		81	13500	29874	56077	0.29
7591X				0.048		117	17100	56633	106306	0.24
7591Z				0.060		205	23850	113618	213272	0.18

Stock number	Inside diameter (inches)	Convolution O.D. (inches)	Effective area (square Inche)	Material thickness (inches)	Maximum convoluted length (inches)	Maximum pressure (PSI)	Stability* pressure (PSI)	Axial* spring rate (lbs/in.)	Lateral* spring rate (lbs/in.)	Axial*deflection +or- for 2,000 cycles (inches)
1	2	3	4	5	6	7	8	9	10	11
7592N				0.018		16	3600	3261	6833	0.48
7592R				0.025		32	6525	8203	17188	0.47
7592S				0.030		45	8550	14721	30846	0.40
7592T	36	38.75	1097	0.036	15	64	11250	25064	52518	0.33
7592W				0.040		81	13050	31806	66644	0.29
7592X				0.048		117	16425	60202	126144	0.24
7592Z				0.060		165	22725	120042	251529	0.18
7593N				0.018		16	3600	3436	7990	0.48
7593R				0.025		31	6300	8748	20345	0.48
7593S				0.030		45	8325	15662	36425	0.40
7593T	38	40.75	1217	0.036	15	64	10800	26405	61408	0.33
7593W				0.040		81	12600	33508	77926	0.29
7593X				0.048		117	15750	63423	147498	0.24
7593Z				0.060		207	21825	127081	295538	0.18
7594N				0.018		16	3600	3514	9025	0.48
7594R				0.025		31	6300	9192	23605	0.47
7594S				0.030		45	8100	16458	42262	0.40
7594T	40	42.75	1344	0.036	15	64	10575	27976	71839	0.33
7594W				0.040		81	12150	35210	90414	0.29
7594X				0.048		117	15075	67053	172182	0.24
7594Z				0.060		207	20925	133536	342899	0.17
7595N				0.018		16	3600	3684	10399	0.48
7595R				0.025		31	6075	9637	27197	0.47
7595S				0.030		45	7875	17254	48692	0.40
7595T	42	44.75	1477	0.036	15	64	10125	29329	82769	0.32
7595W				0.040		81	11700	36100	101879	0.29
7595X				0.048		117	14625	70294	198378	0.24
7595Z				0.060		207	20025	140670	396984	0.18
7596R				0.025		31	6075	9470	29248	0.48
7596S				0.030		45	7650	18049	55743	0.40
7596T	44	46.75	1616	0.036	15	64	9900	29778	91967	0.33
7596W				0.040		81	11250	37765	116632	0.29
7596X				0.048		117	14175	73536	227104	0.24
7596Z				0.060		207	19350	147156	454469	0.18
7597R				0.025		31	5850	9887	33288	0.47
7597S				0.030		45	7425	18845	63444	0.39
7597T	46	48.75	1762	0.036	15	64	9675	31348	105537	0.33
7597W				0.040		81	11025	39429	132744	0.29
7597X				0.048		117	13500	77246	260057	0.24
7597Z				0.060		207	18450	154387	519759	0.18
7598R				0.025		25	5625	10305	37685	0.47
7598S				0.030		36	7425	19834	72532	0.46
7598T	48	51	1914	0.036	15	52	9450	32671	119476	0.38
7598W				0.040		64	10800	41094	150276	0.33
7598X				0.048		94	13725	80507	294403	0.27
7598Z				0.060		166	18675	160905	588404	0.20
7599S				0.030		36	6239	16797	66827	0.46
7599T				0.036		52	7941	27716	110265	0.37
7599W	50	53	2083	0.040	14	64	9075	34861	138691	0.33
7599X				0.048		94	11344	68295	271706	0.27
7599Z				0.060		166	15503	136498	543042	0.20

Stock number	Inside diameter (inches)	Convolution O.D. (inches)	Effective area (square Inche)	Material thickness (inches)	Maximum convoluted length (inches)	Maximum pressure (PSI)	Stability* pressure (PSI)	Axial* spring rate (lbs/in.)	Lateral* spring rate (lbs/in.)	Axial*deflection +or- for 2,000 cycles (inches)
1	2	3	4	5	6	7	8	9	10	11
75100S				0.030		36	6050	16965	72838	0.46
75100T				0.036		52	7752	28792	123617	0.37
75100W	52	55	2248	0.040	14	64	8886	36214	155485	0.33
75100X				0.048		94	10966	70948	304607	0.27
75100Z				0.060		166	14936	141799	608798	0.20
75101S				0.030		36	6050	17599	81316	0.45
75101T				0.036		52	7562	29868	138005	0.37
75101W	54	57	2419	0.040	14	64	8508	37855	174907	0.33
75101X				0.048		94	10587	73600	340061	0.28
75101Z				0.060		166	14369	147100	679659	0.20
75102S				0.030		36	5672	18868	100197	0.45
75102T				0.036		52	7184	32021	170046	0.37
75102W	58	61	2781	0.040	14	64	8130	40583	215516	0.33
75102X				0.048		94	10020	79386	421570	0.27
75102Z				0.060		166	13612	158465	841509	0.20
75103S				0.030		36	5483	19502	110644	0.45
75103T				0.036		52	6995	33097	187776	0.37
75103W	60	63	2971	0.040	14	64	7941	41948	237987	0.33
75103X				0.048		94	9831	82054	465526	0.27
75103Z				0.060		166	13234	155120	880055	0.20
75104S				0.030		36	5105	21615	147728	0.45
75104T				0.036		52	6428	36626	250318	0.37
75104W	66	69	3578	0.040	14	64	7373	46391	317054	0.33
75104X				0.048		94	9075	90059	615502	0.27
75104Z				0.060		166	12100	171076	116920**	0.20
75106S				0.030		46	4916	23536	190728	0.43
75106T				0.036		52	6050	39881	323178	0.37
75106W	72	75	4243	0.040	14	66	6806	50514	409340	0.33
75106X				0.048		94	8319	98661	799493	0.34
75106Z				0.060		168	11155	187181	151681**	0.20
75107S				0.030		18	5105	24817	223593	0.47
75107T				0.036		27	6428	42052	378866	0.46
75107W	76	80	4717	0.040	14	33	7373	53263	479874	0.46
75107X				0.048		48	9264	98523	887636	0.45
75107Z				0.060		82	12856	197368	177817**	0.34
75108S				0.030		18	4916	12335	118420	0.47
75108T				0.036		27	6428	20934	200973	0.46
75108W	78	82	5027	0.040	11	33	7373	26532	254713	0.46
75108X				0.048		48	6050	51900	498242	0.45
75108Z				0.060		82	12478	99589	956058	0.34
75109S				0.030		18	2800	13260	147112	0.47
75109T				0.036		27	3500	22690	251726	0.46
75109W	84	88	5809	0.040	11	33	3900	28522	316428	0.46
75109X				0.048		48	4800	53633	595004	0.44
75109Z				0.060		82	6500	107575	119345**	0.33
75110S				0.030		18	2500	15259	219828	0.47
75110T				0.036		27	3100	25856	372486	0.46
75110W	96	100	7543	0.040	11	33	3500	32749	471794	0.46
75110X				0.048		48	4300	61488	885804	0.44
75110Z				0.060		82	5700	123177	177450**	0.41

Ordering Instructions

Specify: Stock Number + Convoluted Length + Neck Trim Length.

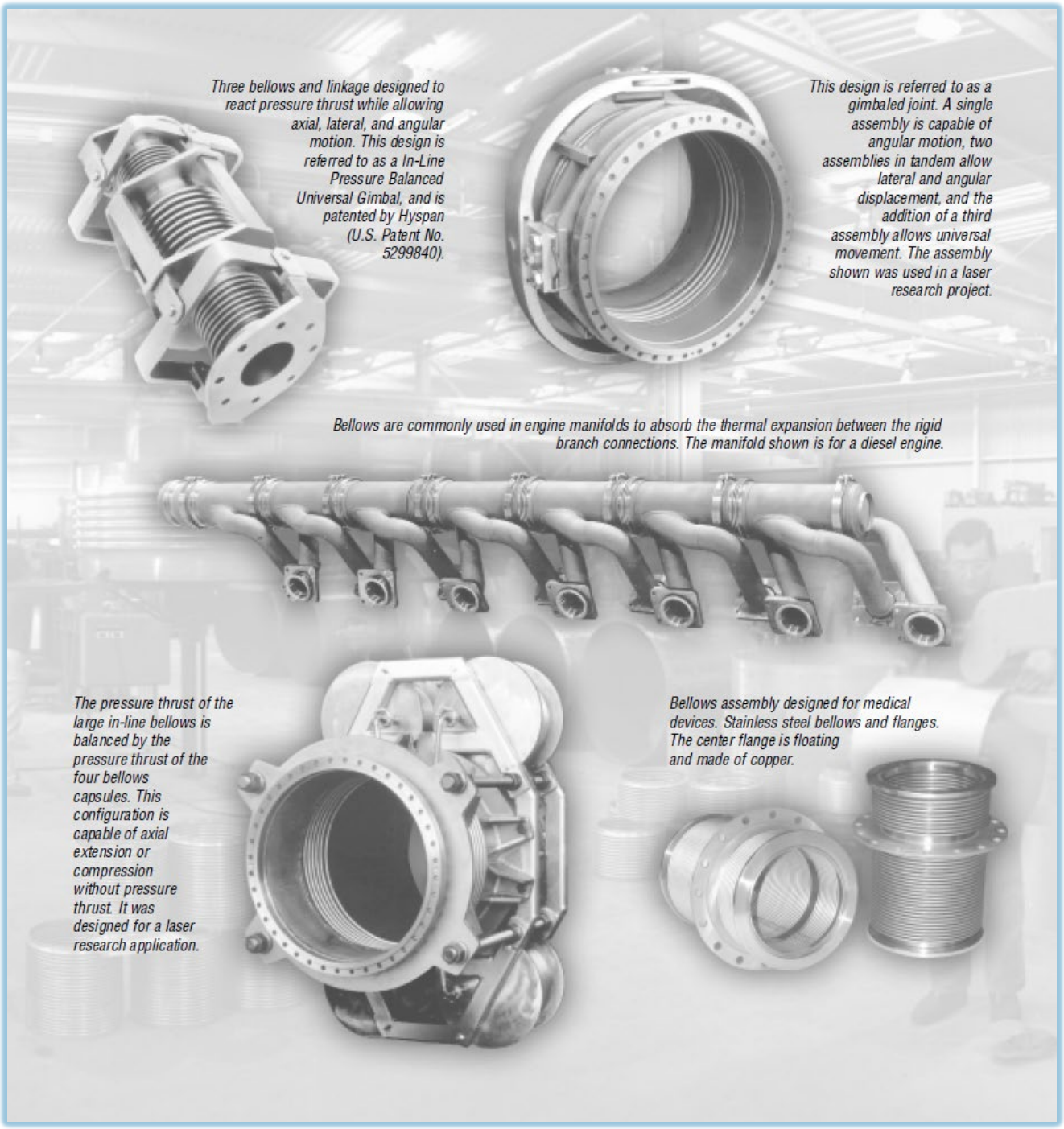
Example: 1.50" ID, 0.008" thick Type 321, 4.0" convoluted length, 0.50" neck trim → Part No. **7522G-4.0-0.50**.

Standard neck trim length (if omitted from part number): 0.75" for 1"–6" ID; 1.0" for over 6" ID.

Optional neck trim styles (A, B, C, D), bands, and multi-ply construction must be specified separately.

Custom Assemblies

Hyspan engineers custom bellows assemblies across the full Series 7500 size range, including: gimbal assemblies for angular motion, in-line pressure balanced gimbal assemblies (Hyspan U.S. Patent No. 5299840), engine exhaust manifold bellows, medical device bellows, cryogenic disconnect assemblies, and large-diameter wind tunnel bellows.



Three bellows and linkage designed to react pressure thrust while allowing axial, lateral, and angular motion. This design is referred to as a In-Line Pressure Balanced Universal Gimbal, and is patented by Hyspan (U.S. Patent No. 5299840).

This design is referred to as a gimbaled joint. A single assembly is capable of angular motion, two assemblies in tandem allow lateral and angular displacement, and the addition of a third assembly allows universal movement. The assembly shown was used in a laser research project.

Bellows are commonly used in engine manifolds to absorb the thermal expansion between the rigid branch connections. The manifold shown is for a diesel engine.

The pressure thrust of the large in-line bellows is balanced by the pressure thrust of the four bellows capsules. This configuration is capable of axial extension or compression without pressure thrust. It was designed for a laser research application.

Bellows assembly designed for medical devices. Stainless steel bellows and flanges. The center flange is floating and made of copper.

Series 8500 — Expansion Compensators

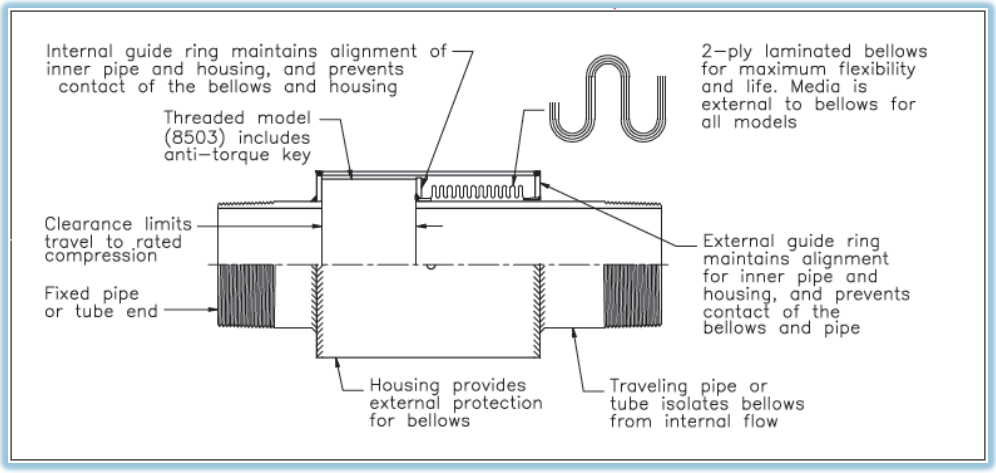
Nominal Sizes	¾" – 4" NPS (steel pipe); ¾" – 4" copper tube
Design Pressure	200 PSIG (see copper tube pressure limits by size and temperature)
Test Pressure	300 PSIG
Temperature Range	–400°F to 500°F (steel); –320°F to 500°F (copper, size-dependent)
Axial Travel	2" or 3" compression; 0.5" extension (standard)
Bellows Construction	Fully enclosed, externally pressurized, multi-ply stainless steel (Type 321 or 304)
Steel End Types	8503 (threaded), 8504 (weld end), 8505 (fixed flange), 8506 (grooved)
Copper End Types	8509 (male tube, press-fitting friendly), 8510 (female tube)
Certifications	NSF/ANSI 372 Lead Free (copper models); Canadian Registration No. 0D9278.59870YTNADD3
Warranty	Three-year limited replacement warranty

Product Description

Series 8500 Expansion Compensators provide a maintenance-free, compact, economical solution for absorbing thermal expansion and contraction in heat transfer system piping — HVAC, domestic hot water, district energy, solar panels, radiators, and commercial mechanical rooms. The compact in-line design minimizes pressure drop and heat loss; the fully enclosed externally pressurized bellows requires no maintenance and is protected from both internal flow and the external environment.

Internal and external guide rings maintain bellows alignment throughout the stroke. All-welded or high-temperature brazed construction eliminates gaskets and maintenance points. Hyspan's stainless-to-stainless bellows weld technology maximizes service life and minimizes corrosion at the weld interface.

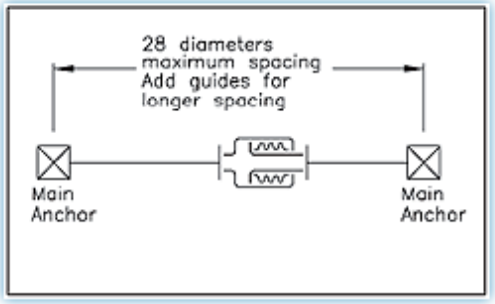
Design Features



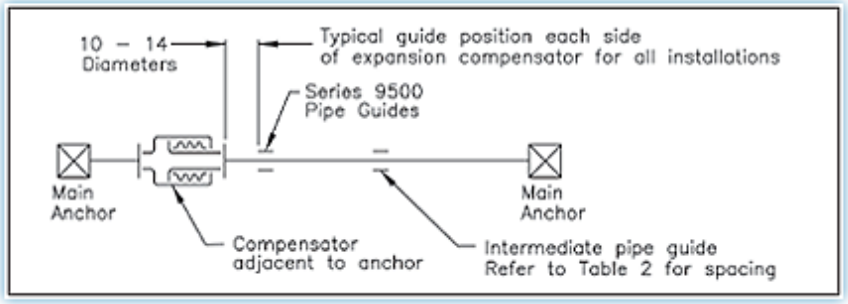
Applications

Series 8500 compensators are designed for installations where the principal movement is axial. Standard joints are factory set for 2" or 3" compression with 0.5" extension. Where the primary movement is extension (pipe contraction), the compensator can be pre-set at the factory — contact Hyspan at time of order.

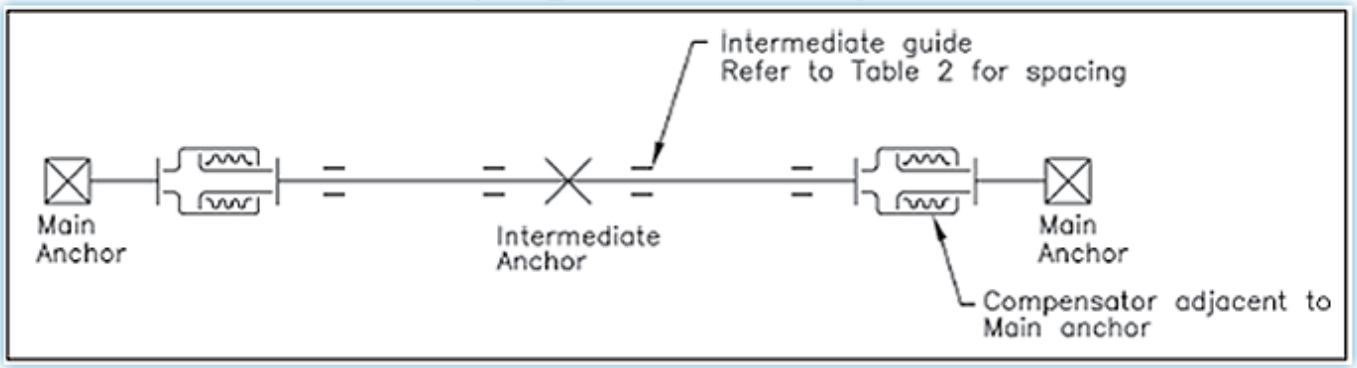
Short run requiring no guides



Run requiring only one compensator



Run requiring more than one compensator



Thermal Expansion & Guide Spacing

Table 1 - Thermal Expansion

Saturated Steam Pressure		Temperature Deg F	Temperature 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.

Series 8500 — Design Data Tables

Materials of Construction

Steel pipe models (8503–8506): Bellows — laminated ASTM A240 Type 321 or 304 SS. Pipe — Schedule 40 ASTM A53 Grade B. Flanges — ASME A105 raised face per ASME B16.5, 150 LB. Housing, guides, stops — carbon steel sheet and tube. Note: 8503 includes anti-torque stop.

Copper tube models (8509/8510): Bellows — laminated ASTM A240 Type 321 or 304 SS. Tube — ASTM B88 copper. Housing and guides — ASTM A240 Type 304 or 321 SS. Designed for sweat connection per ASME B16.2. Note: silver brazed joints — do not exceed 1,000°F during installation.

Steel Pipe Applications

8503
MALE PIPE THREAD

8504
WELD END

8505
FIXED FLANGE

8506
GROOVED END

Copper Pipe Applications

NSF/ANSI 372 - LEAD FREE

8509
MALE TUBE END

8510
FEMALE TUBE END

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 are the forces produced by pressure only.
Refer to the axial spring rates in Tables 5 & 6 for the force resulting from the bellows stiffness.

Table 5 — Steel Pipe Ends Design Data (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 Design Data (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. Pre-sets for extension can be ordered upon request.

Copper Tube Pressure Limits

For copper tube models 8509 and 8510, the 200 PSIG design pressure applies at the following maximum temperatures by size:

- ¾" and 1" — 400°F
- 1¼"–2" — 350°F
- 2½"–3" — 300°F
- 4" — 175°F (300°F for max 180 PSIG / 200°F for max 192 PSIG).

Available with ASTM A240-316/316L, A240-321, or ASTM B443-625 Gr.1 bellows material as alternatives to standard construction.

Travel Required

Thermal expansion or contraction (inches) = Length of run between anchors (feet) × Linear change from Table 1 ÷ 100.

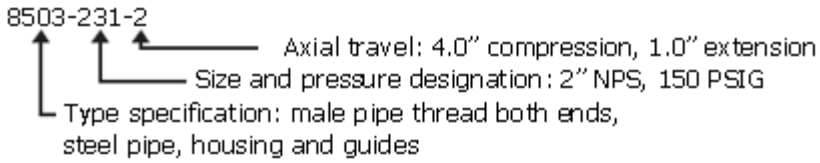
For installation temperatures above 70°F, subtract the expansion for the installation temperature from the service temperature; add for installations below 70°F.

- **Main Anchor Force** (lbf) = Pressure Force (Table 3 or 4) + [Spring Rate (Table 5 col. 2 or Table 6 col. 3) × Axial Travel (inches)]
- **Intermediate Anchor Force** (lbf) = Spring Rate × Axial Travel

Ordering Instructions

Example:

• Threaded steel pipe ends
• 200 PSIG @ 500°F maximum
• 2.0" axial travel maximum
• 2" NPS



*Alloy 625 bellows also available — specify in writing.

Installation Notes

- Do not remove shipping restraints prior to installation — they ensure correct length and alignment. Remove before pressure testing.
- Compensators are designed for axial movement only — guides, supports, and anchors are required per application diagrams.
- Flow can be from either direction.
- For copper tube models (8509/8510): silver brazed joints — do not exceed 1,000°F during installation (brazing or soldering adjacent connections).
- Post-installation: confirm compensator is undamaged, correctly located, anchors and guides per design, shipping restraints removed.

Engineering Support & Contact

Custom Engineered Solutions

Hyspan's engineering team supports specification review, reverse engineering of legacy components, replacement of discontinued product lines, and development of application-specific expansion joints and motion-control systems for new installations, retrofits, and replacement programs.

Size Range	¼" to 32 ft diameter
Pressure Range	Full vacuum to 5,000+ PSIG
Temperature Range	Cryogenic to 1,250°F
Materials	Inconel 625, Hastelloy X, Monel, Titanium, Beryllium Copper, and others
Analysis Tools	SolidWorks, ANSYS FEA, Inventor — stress, fatigue, cycle life, thermal, vibration
Standards	EJMA, ASME B31.1, B31.3, BPVC Sec. VIII Div. 1, NAVSEA, MIL-STD-2035, PED, ITAR

Legacy Product Line Support

Hyspan maintains the engineering drawings, specifications, and production rights for acquired product lines including American BOA, Anaconda/Anamet, Barco, and Flexider USA. Original data and tooling are preserved to ensure long-term replacement continuity and system upgrade capability.

Contact Hyspan

Headquarters	1685 Brandywine Avenue, Chula Vista, CA 91911
Phone	+1 619.421.1355
Email	websales@hyspan.com
Website	www.hyspan.com
LinkedIn	linkedin.com/company/hyspan-precision-products-inc-/

Ordering Guidance

To place an order or request a quotation, contact Hyspan with the following information:

- Product series and model/type designation
- Nominal pipe or tube size (NPS or OD)
- Design pressure and temperature
- Axial travel required (compression and extension)
- Lateral offset (if applicable)
- End connection type and flange class
- Special materials, coatings, or certifications required
- Applicable code or standard (ASME, EJMA, NAVSEA, etc.)
- Quantity and requested delivery

Warranty

Limited Warranty — All Series

The following summarizes warranty coverage for standard catalog Hyspan bellows products. Full warranty terms are available at hyspan.com or upon request.

Series 1500	Five-year limited replacement warranty
Series 2500	Hyspan Limited Warranty applies — see hyspan.com for full terms
Series 3500	Five-year limited replacement warranty (standard catalog and Alloy 625 bellows construction)
Series 5500	24 months from delivery / 12 months from first use (whichever is shorter)
Series 7500	24 months from delivery / 12 months from first use / specified service life (whichever is shortest)
Series 8500	Three-year limited replacement warranty

General Warranty Conditions (All Series)

Warranty coverage is conditional on the following:

- Design pressure and temperature are not exceeded — including surge and upset conditions.
- Installation conforms to Hyspan installation instructions and approved practice for anchoring, supporting, guiding, and generally accepted good piping practice.
- Substances in contact with all internal and external surfaces are compatible with the materials of construction. Steam, condensate, and water containing more than 100 ppm chlorides are specifically excluded when stainless bellows are used; Alloy 625 bellows construction qualifies for these services.
- The exterior of the expansion joint is not exposed to corrosive substances (ground water minerals, road salt, etc.).

Warranty is limited to replacement of the same model expansion joint and payment for transportation by the least expensive method. Labor, material, and other costs related to failure or replacement are not included. Warranty is limited to installations in the United States, Puerto Rico, and Canada (series-dependent — see full terms).

To make a warranty claim, advise the Hyspan factory of the nature of the failure and the serial number or part number of the expansion joint. Hyspan will provide return goods authorization and shipping directions.

Hyspan

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