

# STOCK BELLOWS EXPANSION JOINTS

# EFL & EW

There is a strong demand for stainless expansion joints in 2" through 16" (50 through 400mm) diameter with 2" (51mm) axial and 1/4" (6mm) transverse capability. Weld ends are most common, but there are also flanged requirements. All our flanged joints have one floating flange to facilitate installation and eliminate torsional stress. The other is raised face.

Like many companies, not only were our deliveries extended but whenever an inquiry came in, we would redesign and re-cost needlessly. We decided the thing to do was stock all sizes 2" through 16" (50 through 400mm), as shown in our dimension tables.

There seems to be some confusion as to what 2" (51mm) travel means, so let's go over it. Every expansion joint has its neutral length. From this neutral position, the joint can be used for a full 2" (51mm) compression or 2" (51mm) expansion, but never a combination of the two. They are perfectly suitable for 1" (25mm) compression and 1" (25mm) extension or as a further example, 1 1/2" (38mm) compression and 1/2" (13mm) extension. In other words, in its working life, total movement should never exceed combined 2" (51mm).

There is a common misconception that you can take a 2" (51mm) movement expansion joint, extend it 1" (25mm), and then use it for a compression of 3" (76mm). No matter where this information came from, it is wrong.

What determines the life of an expansion joint is the stress cycle, the total bending from one extreme to the other over its lifetime. Let's think of a flat strip of sheet metal. Place it in a vise and bend it to one side 2" (51mm) and then bring it back to the vertical. After a given number of cycles, this strip will crack at the bending point, based on the bending stress cycle for having moved the 2" (51mm) and back to neutral.

Now let's assume we would like to use that same strip for 3" (76mm) travel. So we bend it to one side 1" (25mm), go to neutral and then continue 2" (51mm), as in the previous example. With this simple picture in mind, I think we can all agree that the strip having moved through this 3" (76mm) travel will crack or break much earlier than if we had only moved it the simple 2" (51mm).

The same is true of expansion joints. Do not be deceived when someone tells you how easy it is to pre-extend the expansion joint and increase the allowable travel. Hopefully, that information is a misunderstanding, but sometimes it is just another way to get an order.

All of our designs are based on a working life of approximately 2,000 cycles. If the 2" (51mm) movement is exceeded, it will reduce the theoretical life. If movements are smaller, the joint will last longer.

Our tables include the "Spring Rate" for every joint. The spring rate is the number of pounds required to compress the joint 1" (25mm). Our multi-ply construction lowers the number. However, when designing anchors, the spring rate multiplied by the travel should be added to the pressure thrust.



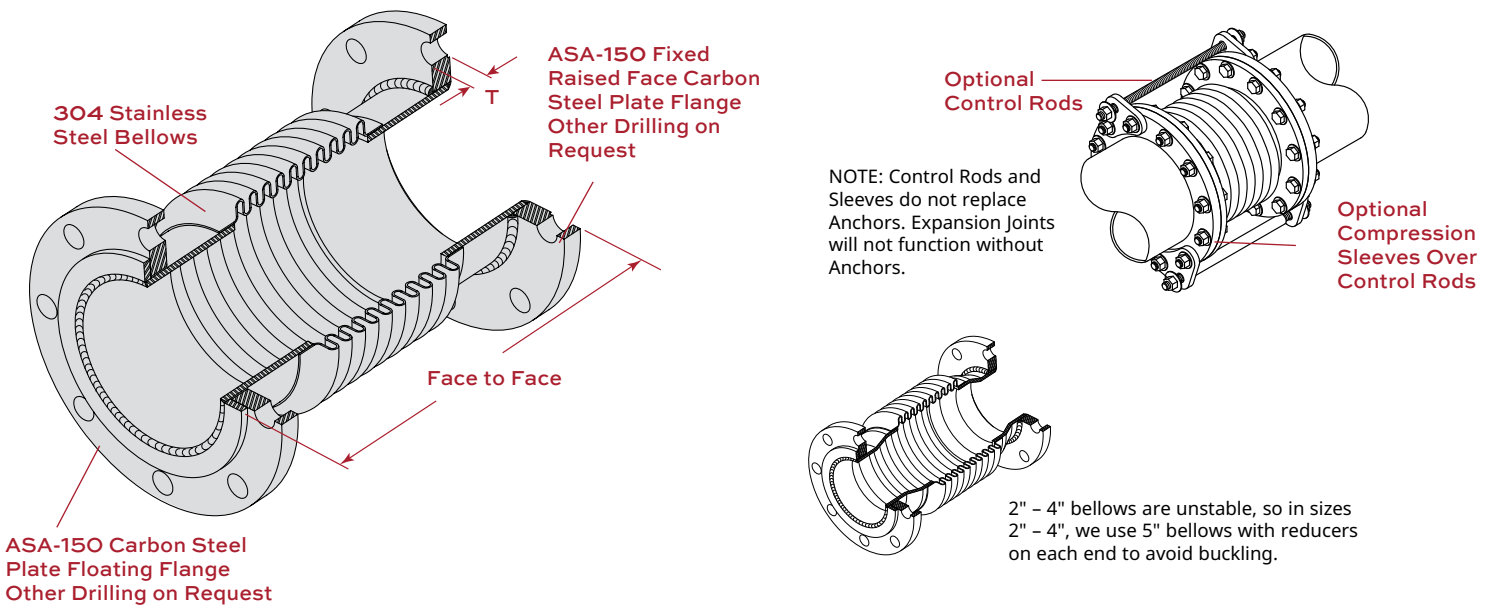
We stock 50 psi and 250 psi (3 and 17 kg/cm<sup>2</sup>) capabilities.

Expansion Joints are sometimes furnished with control rods to prevent overextension or pipe sleeves over the rods to prevent overcompression. Unless the joint is flexed laterally only or anchors are under-designed, they serve no purpose as expansion joints will not open or close unless forced to by properly located anchors. Guides prevent buckling. Note guide and anchor spacing on the bottom of pages 10-50 and 10-53.

We can furnish specially designed expansion joints to virtually any requirement, but we certainly hope that these shelf items and their quick delivery will help keep your jobs moving and minimize downtime.

Norm Mason

## EFL- Bellows Expansion Joint With Fixed & Floating Flanges



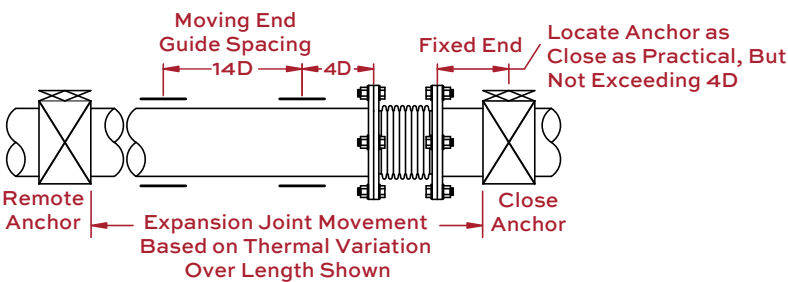
## EFL50 Max. Pressure 50 psi Full Vacuum

TYPE EFL50 DIMENSIONS & PRESSURE RATINGS  
2" (51mm) AXIAL MOVEMENT, 1/4" (6mm) LATERAL DEFLECTION

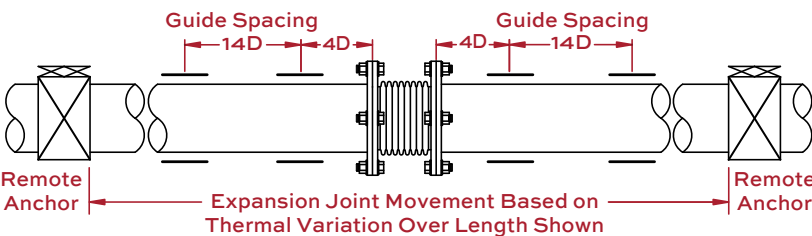
Type	Pipe Size		Face to Face		Axial Spring Rate		Lateral Spring Rate		Max. Thrust @ 50 psi (3 kg/cm <sup>2</sup> )		Rated Pressure @70°F (21°C)		Ship Weight	
	(in)	(mm)	(in)	(mm)	(lb/in)	(kg/cm)	(lb/in)	(kg/cm)	(lb)	(kg)	(psi)	(kg/cm <sup>2</sup> )	(lb)	(kg)
EFL50-	4	100	21	533	640	115	850	152	1400	635	50	3	33	15
	5	125	141/4	362	640	115	850	152	1400	635	50	3	35	16
	6	150	151/4	387	890	159	1400	250	1900	862	50	3	43	20
	8	200	151/2	394	1130	202	3700	661	3200	1451	50	3	78	35
	10	250	153/4	400	1250	223	6400	1143	4800	2177	50	3	100	45
	12	300	173/4	451	1360	243	7790	1391	6600	2997	50	3	140	64
	14	350	181/2	470	1410	252	9450	1688	8800	3992	50	3	181	82
16	400	19	483	1810	323	18160	3243	11300	5126	50	3	226	103	

### GUIDE SPACING - REFERENCING PIPE DIAMETER "D"

GUIDES & ANCHORS FOR JOINT LOCATED NEAR ANCHOR



GUIDES & ANCHORS FOR JOINT LOCATED BETWEEN REMOTE ANCHORS



NOTE: Consult Bulletin ASG-33, page 10-58 for location of intermediate guides when needed to prevent buckling.

### RATED PRESSURES @ ELEVATED TEMPERATURES

Temperature		Rated Pressure	
(°F)	(°C)	(psi)	(kg/cm <sup>2</sup> )
200	93	46	3.2
300	149	43	3.0
400	204	39	2.7
500	260	38	2.7
800	427	37	2.6
1000	538	30	2.1
1500	816	13	0.9

### FLANGE BOLT & NUT REQUIREMENTS

EFL50 Size	Quantity per End	Size & Length
4	16	5/8 x 31/4
5 & 6	16	3/4 x 31/2
8	16	3/4 x 4
10 & 12	24	7/8 x 41/4
14	24	1 x 41/2
16	32	1 x 41/2

### CARBON STEEL PLATE FLANGE THICKNESS

Pipe Size		Flange Thickness T	
(in)	(mm)	(in)	(mm)
4	100	5/8	16
5 thru 6	125 thru 150	3/4	19
8 thru 16	200 thru 406	1	25

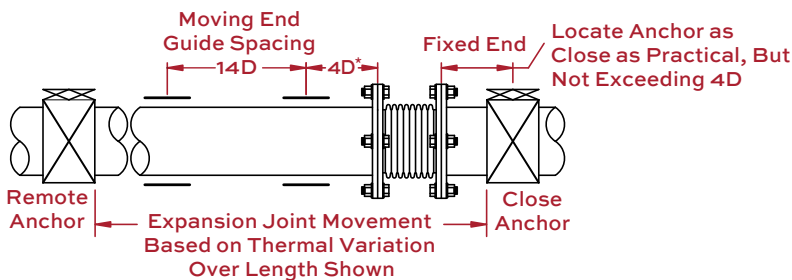
## EFL250 Max. Pressure 250 psi Full Vacuum

TYPE EFL250 DIMENSIONS & PRESSURE RATINGS  
 2" (51mm) AXIAL MOVEMENT, 1/4" (6mm) LATERAL DEFLECTION

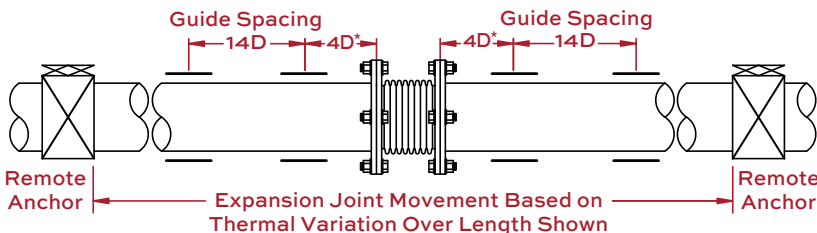
Type	Pipe Size		Face to Face		Axial Spring Rate		Lateral Spring Rate		Max. Thrust @ 50 psi (3 kg/cm <sup>2</sup> )		Rated Pressure @70°F (21°C)		Ship Weight	
	(in)	(mm)	(in)	(mm)	(lb/in)	(kg/cm)	(lb/in)	(kg/cm)	(lb)	(kg)	(psi)	(kg/cm <sup>2</sup> )	(lb)	(kg)
EFL250-	2	50	21	533	1500	268	2040	364	7070	3207	250	17	30	14
	2 1/2	65	21	533	1500	268	2040	364	7070	3207	250	17	34	16
	3	80	21	533	1500	268	2040	364	7070	3207	250	17	36	17
	4	100	21	533	1500	268	2040	364	7070	3207	250	17	37	17
	5	125	141/4	362	1500	268	2040	364	7070	3207	250	17	38	18
	6	150	161/2	419	1960	350	2450	438	9620	4364	250	17	49	23
	8	200	171/4	438	2040	364	3980	711	15910	7217	250	17	84	39
	10	250	18	457	2500	446	7790	1391	23760	10777	250	17	116	53
	12	300	19	483	3530	630	14300	2554	33190	15055	250	17	155	71
	14	350	20	508	3700	660	17600	3143	44180	20040	250	17	203	92
	16	400	20 1/2	521	4660	832	30650	5473	56750	25741	250	17	249	113

### GUIDE SPACING - REFERENCING PIPE DIAMETER "D"

GUIDES & ANCHORS FOR JOINT LOCATED NEAR ANCHOR



GUIDES & ANCHORS FOR JOINT LOCATED BETWEEN REMOTE ANCHORS



\*Plus an additional 5" (127mm) for Sizes 2 & 2 1/2

NOTE: Consult Bulletin ASG-33, page 10-58 for location of intermediate guides when needed to prevent buckling.

### RATED PRESSURES @ ELEVATED TEMPERATURES

Temperature		Rated Pressure	
(°F)	(°C)	(psi)	(kg/cm <sup>2</sup> )
200	93	227	15.9
250	121	220	15.4
300	149	212	14.9
400	204	195	13.7
500	260	192	13.4
600	316	190	13.3
700	371	185	13.0
800	427	Not Recommended	

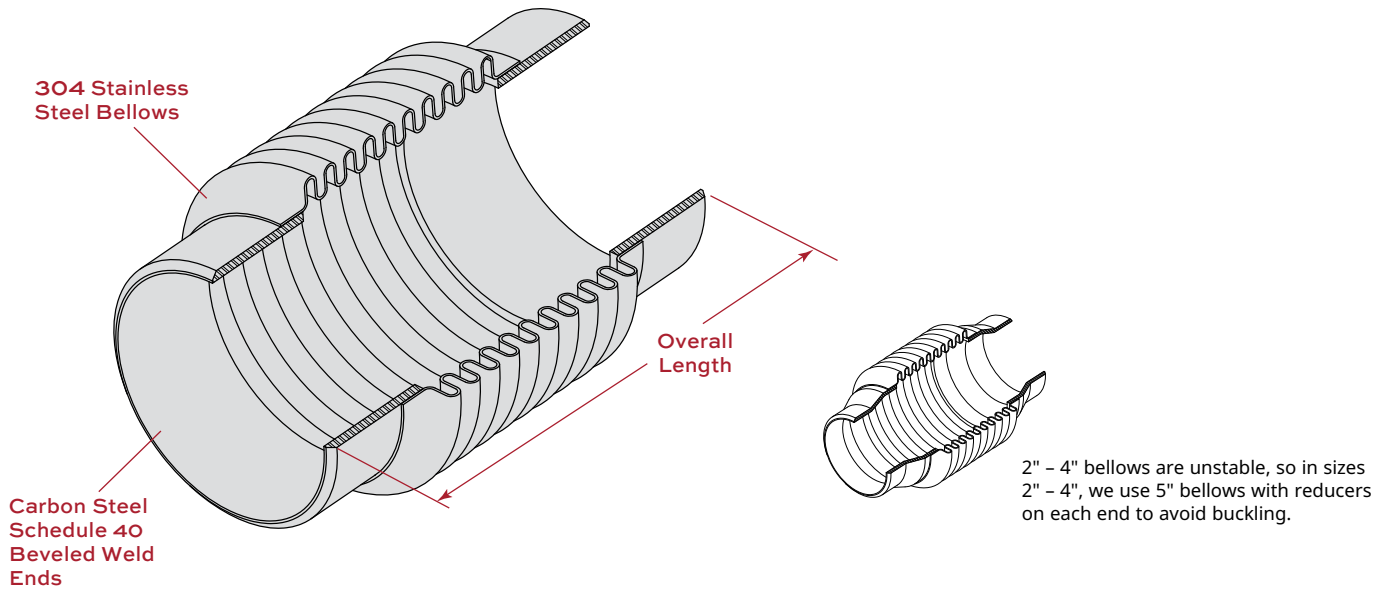
### FLANGE BOLT & NUT REQUIREMENTS

EFL250 Size	Quantity per End	Size & Length
2 & 2 1/2	8	5/8 x 3
3	8	5/8 x 3 1/4
4	16	5/8 x 3 1/4
5 & 6	16	3/4 x 3 1/2
8	16	3/4 x 4
10 & 12	24	7/8 x 4 1/4
14	24	1 x 4 1/2
16	32	1 x 4 1/2

### CARBON STEEL PLATE FLANGE THICKNESS

Pipe Size	Flange Thickness T	
	(in)	(mm)
2 thru 4	5/8	16
5 thru 6	3/4	19
8 thru 16	1	25

## EW- Bellows Expansion Joint with Weld Ends



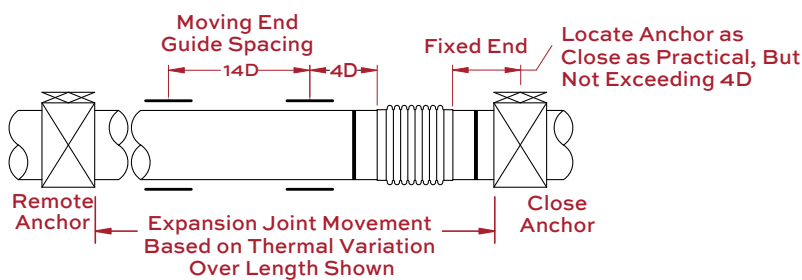
### EW50 Max. Pressure 50 psi Full Vacuum

TYPE EW50 DIMENSIONS & PRESSURE RATINGS  
2" (51mm) AXIAL MOVEMENT, 1/4" (6mm) LATERAL DEFLECTION

Type	Pipe Size		Face to Face		Axial Spring Rate		Lateral Spring Rate		Max. Thrust @ 50 psj (3 kg/cm <sup>2</sup> )		Rated Pressure @70°F (21°C)		Ship Weight	
	(in)	(mm)	(in)	(mm)	(lb/in)	(kg/cm)	(lb/in)	(kg/cm)	(lb)	(kg)	(psi)	(kg/cm <sup>2</sup> )	(lb)	(kg)
EW50-	4	100	173/4	451	640	115	850	152	1400	635	50	3	14	6
	5	125	141/4	362	640	115	850	152	1400	635	50	3	15	7
	6	150	151/4	387	890	159	1400	250	1900	862	50	3	16	7
	8	200	151/2	394	1130	202	3700	661	3200	1451	50	3	27	13
	10	250	153/4	400	1250	223	6400	1143	4800	2177	50	3	35	16
	12	300	173/4	451	1360	243	7790	1391	6600	2994	50	3	46	21
	14	350	181/2	470	1410	252	9450	1688	8800	3992	50	3	62	38
	16	400	19	483	1810	323	18160	3243	11300	5126	50	3	82	37

### GUIDE SPACING - REFERENCING PIPE DIAMETER "D"

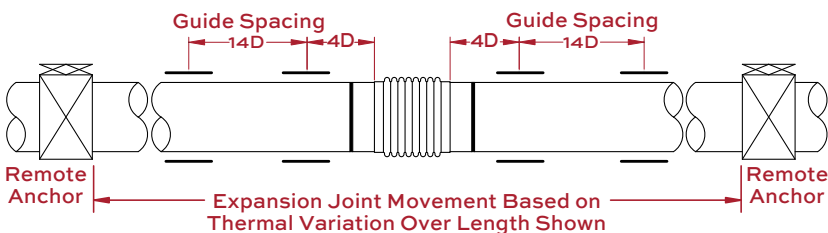
#### GUIDES & ANCHORS FOR JOINT LOCATED NEAR ANCHOR



#### RATED PRESSURES @ ELEVATED TEMPERATURES

Temperature		Rated Pressure	
(°F)	(°C)	(psi)	(kg/cm <sup>2</sup> )
200	93	46	3.2
300	149	43	3.0
400	204	39	2.7
500	260	38	2.7
800	427	37	2.6
1000	538	30	2.1
1500	816	13	0.9

#### GUIDES & ANCHORS FOR JOINT LOCATED BETWEEN REMOTE ANCHORS



NOTE: Consult Bulletin ASG-33, page 10-58 for location of intermediate guides when needed to prevent buckling.

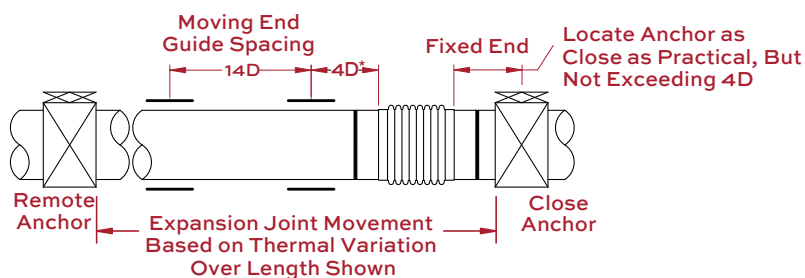
## EW250 Max. Pressure 250 psi Full Vacuum

TYPE EW250 DIMENSIONS & PRESSURE RATINGS  
 2" (51mm) AXIAL MOVEMENT, 1/4" (6mm) LATERAL DEFLECTION

Type	Pipe Size		Face to Face		Axial Spring Rate		Lateral Spring Rate		Max. Thrust @ 50 psi (3 kg/cm <sup>2</sup> )		Rated Pressure @70°F (21°C)		Ship Weight	
	(in)	(mm)	(in)	(mm)	(lb/in)	(kg/cm)	(lb/in)	(kg/cm)	(lb)	(kg)	(psi)	(kg/cm <sup>2</sup> )	(lb)	(kg)
EW250-	2	50	21	533	1500	268	2040	364	7070	3207	250	18	22	10
	2 1/2	65	21	533	1500	268	2040	364	7070	3207	250	18	23	10
	3	80	21	533	1500	268	2040	364	7070	3207	250	18	24	11
	4	100	18	457	1500	268	2040	364	7070	3207	250	18	25	11
	5	125	14 1/4	362	1500	268	2040	364	7070	3207	250	18	26	12
	6	150	16 1/2	419	1960	350	2450	438	9620	4364	250	18	28	13
	8	200	17 1/4	438	2040	364	3980	710	15910	7217	250	18	32	15
	10	250	18	457	2500	446	7790	1391	23760	10777	250	18	51	23
	12	300	19	483	3530	630	14300	2554	33190	15055	250	18	60	27
	14	350	20	508	3700	661	17600	3143	44180	20040	250	18	79	36
16	400	20 1/2	521	4660	832	30650	5473	56750	25741	250	18	107	49	

### GUIDE SPACING - REFERENCING PIPE DIAMETER "D"

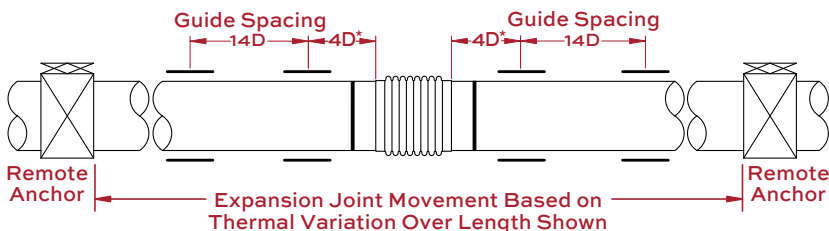
GUIDES & ANCHORS FOR JOINT LOCATED NEAR ANCHOR



RATED PRESSURES @ ELEVATED TEMPERATURES

Temperature (°F)	Temperature (°C)	Rated Pressure (psi) (kg/cm <sup>2</sup> )	
		200	93
250	121	220	15.4
300	149	212	14.9
400	204	195	13.7
500	260	192	13.4
600	316	190	13.3
700	371	185	13.0
800	427	Not Recommended	

GUIDES & ANCHORS FOR JOINT LOCATED BETWEEN REMOTE ANCHORS



\*Plus an additional 5" (127mm) for Sizes 2 & 2 1/2

NOTE: Consult Bulletin ASG-33, page 10-58 for location of intermediate guides when needed to prevent buckling.

## Anchorage Calculations

Total Force on Anchors is the sum of the Pressure Thrust plus the force needed to flex the expansion joint. We have published the pressure thrusts at the maximum ratings of 50 and 250 psi and the spring rate (force needed to compress the joint 1" (25mm)).

However, to determine the specific anchoring, reduce the pressure thrust by the system pressure divided by 50 or 250 psi, depending on which series you are using.

### ANCHOR RESISTANCE CALCULATION

#### Pressure Thrust

$$\frac{\text{System Pressure}}{\text{Max. Allowable Pressure}} \times \text{Max. Published Thrust} = \text{Pressure Anchor Force}$$

#### Spring Force

$$\frac{\text{Expansion Joint Travel}}{\text{Max. Allowable Travel}} \times \frac{\text{Spring Rate}}{\text{Minimum Total Anchorage Requirement}} = \text{Resistive Spring Force}$$

### TYPICAL ANCHOR CALCULATIONS

#### EFL-50 (US)

6" Diameter - 50 psi - 2" Movement

Pressure Thrust-		1,900 lb
Spring Force-	890 lb/in x 2 in =	<u>1,780 lb</u>
Minimum Anchorage Requirement		3,680 lb

#### EFL-250 (US)

6" Diameter - 200 psi - 11/2" Movement

Pressure Thrust-	200psi/250psi x 9620 lb =	7,696 lb
Spring Force-	1960 lb/in x 1.5 in =	<u>2,940 lb</u>
Minimum Anchorage Requirement		10,636 lb

NOTE: There is support and sometimes guide friction too. An addition of 10 - 20% to total is more conservative.

#### EFL-50 (METRIC)

150mm Diameter - 3 kg/cm<sup>2</sup> - 50mm (5cm) Movement

Pressure Thrust-		862 kg
Spring Force-	159 kg/cm x 5 cm =	<u>795 kg</u>
Minimum Anchorage Requirement		1657 kg

#### EFL-250 (METRIC)

150mm Diameter - 14 kg/cm<sup>2</sup> - 40mm (4cm) Movement

Pressure Thrust-	14 kg/cm <sup>2</sup> /17 kg/cm <sup>2</sup> x 4364 kg =	3594 kg
Spring Force-	350 kg/cm x 4 cm =	<u>1400 kg</u>
Minimum Anchorage Requirement		4994 kg

