

Accommodating Pipe Line Thermal Growth for StrengThin™ 100 Piping Systems for Thin Wall Stainless Steel Pipe

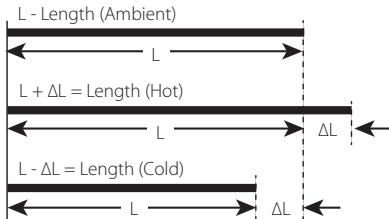


31.08

All materials, including pipe, machinery, structures and buildings, experience dimensional changes as a result of temperature fluctuations. This document covers considerations for accommodating thermal expansion and contraction of stainless steel piping using the Victaulic StrengThin™ 100 System for Thin Wall Stainless Steel Pipe.

1.0 BASIC THERMAL MOVEMENT

To accommodate thermal movement, the change in length must be calculated for a specified section of the piping system. A formula to calculate the expansion or contraction of a specified pipe length due to the change in temperature is shown below.



$$\Delta L = L \times \alpha \times \Delta T$$

Where:

- L = The length of the pipe system (mm)
- α = The thermal expansion coefficient [stainless steel = 17.2×10^{-6} mm/(mm.°C)]*
- ΔT = The change in temperature (°C)

*Expansion coefficients may vary when obtained from different sources.

Example:

- Material = Stainless steel
- Pipe length = 80 m
- Maximum operating temperature = 76°C
- Installation temperature = 18°C
- $\Delta L = 80 \times (17.2 \times 10^{-6}) \times (76 - 18) = 0.08 \text{ m} = 80 \text{ mm}$

2.0 ACCOMMODATING PIPE THERMAL MOVEMENT WITHIN THE STRENGTHIN™ 100 SYSTEM

The StrengThin™ 100 System includes the Style E497 Rigid Coupling that is not designed to provide linear movement, angular deflection or rotation. Victaulic offers several methods for accommodating thermal movement in piping systems:

1. Victaulic Style E155 Stainless Steel Expansion Joint
2. Victaulic Style 177N QuickVic™ Flexible Coupling deflection capabilities
3. Using the allowable bending moments of stainless steel pipe and Victaulic Style E497 Rigid Couplings
 - a. Changes in direction
 - b. Expansion loops

The data provided in this publication is intended for use as an aid to qualified designers when products are installed in accordance with the latest available Victaulic product data.

ALWAYS REFER TO ANY NOTIFICATIONS AT THE END OF THIS DOCUMENT REGARDING PRODUCT INSTALLATION, MAINTENANCE OR SUPPORT.

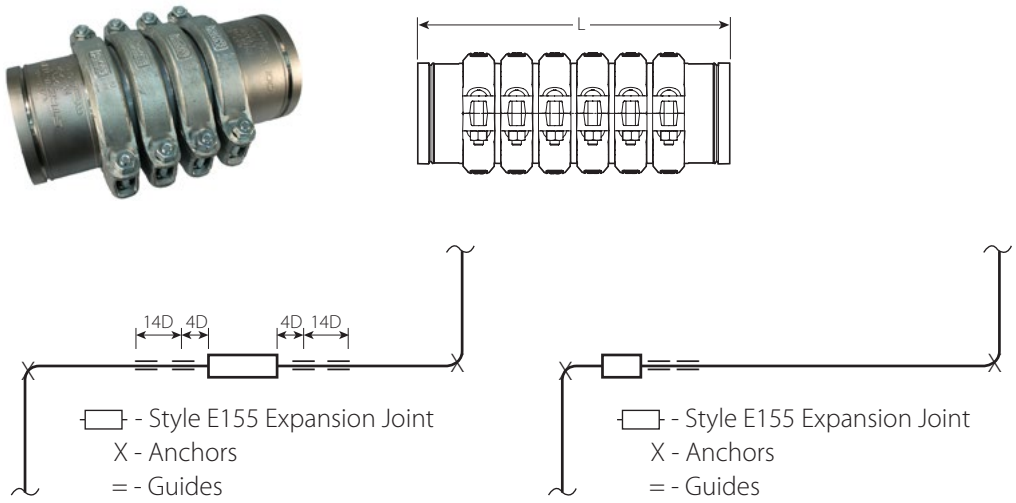
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1. Accommodating thermal movement using Victaulic Style E155 Stainless Steel Expansion Joint

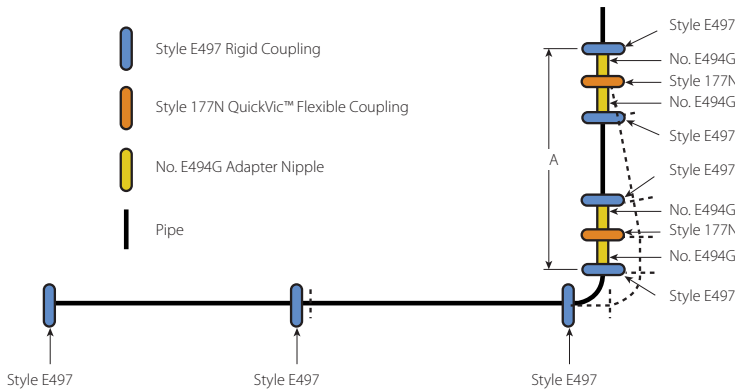
The Style E155 Expansion Joint is a combination of grooved flexible couplings and short pipe nipples, joined in series to provide increased movement. The stainless steel nipples are precisely grooved to provide full linear allowance at each joint. The Style E155 Expansion Joint is supplied with StrenghThin™ 100 grooved ends.



For movement capability and details on proper use of the E155 Expansion Joint, refer to [publication 31.07](#): Victaulic Style E155 Expansion Joint.

2. Accommodating thermal movement using Style 177N QuickVic™ Flexible Couplings

Thermal movement (ΔL) in a piping system can be accommodated by using the angular deflection capabilities of the Victaulic Style 177N QuickVic™ Flexible Couplings. The Style 177N couplings are connected to the rigid StrenghThin™ 100 grooved system by Victaulic No. E494G StrenghThin™ 100 Adapter Nipples in strategic locations. To accommodate ΔL , "A", the length between the two Style 177N flexible couplings, should be appropriately sized.



Example of Style 177N QuickVic™ Flexible Coupling Deflection Capabilities

For information on the Victaulic Style 177N QuickVic™ Flexible Coupling and its movement capabilities, refer to [publication 06.24](#): Victaulic QuickVic™ Flexible Coupling Style 177N.

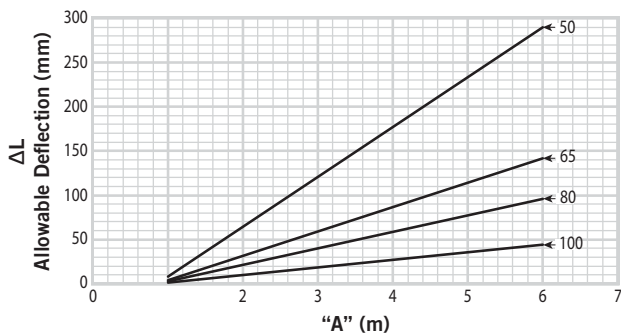
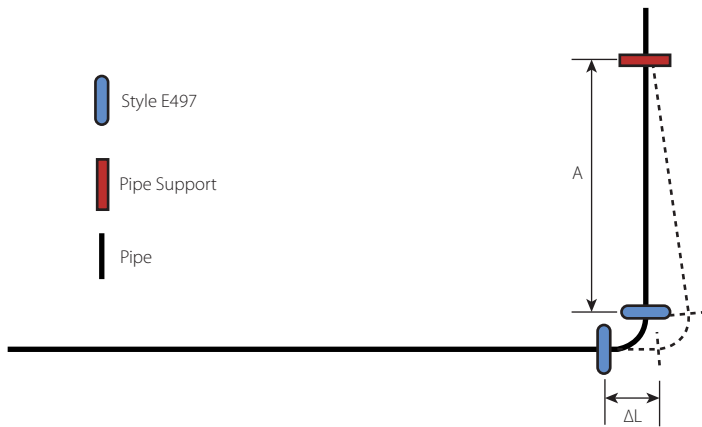
For information on the use of flexible couplings for movement accommodation, refer to [publication 26.02](#): Victaulic Calculating and Accommodating Pipe Line Thermal Growth.

For information on the Victaulic No. E494G StrenghThin™ 100 Adapter Nipple, refer to [publication 31.04](#): Victaulic StrenghThin™ 100 Fittings for Stainless Steel.

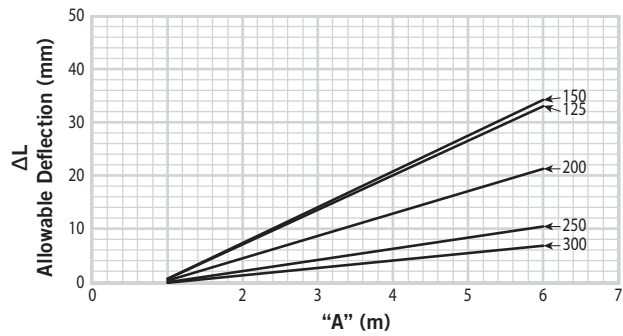
For confirmation of pressure ratings of the Style 177N QuickVic™ Flexible Coupling on stainless steel pipe and the No. E494G StrenghThin™ 100 Adapter Nipple, refer to [publication 17.09](#): Victaulic Pressure Ratings and End Loads for Victaulic Ductile Iron Grooved Couplings on Stainless Steel Pipe.

3. Accommodating thermal movement using Style E497 Rigid Couplings

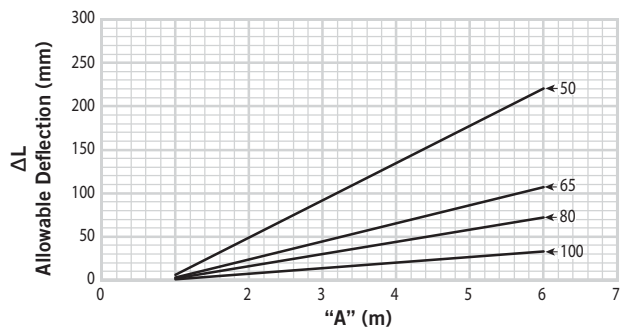
a. Changes in direction: Victaulic rigid couplings, grooved elbows, and grooved pipe ends can be assembled in L-type offset configurations to accommodate the resulting thermal growth through bending of the pipe. The minimum required unsupported pipe length adjacent to the elbow depends on the allowable bending moment of the grooved pipe, the grooved elbow, and the rigid couplings.



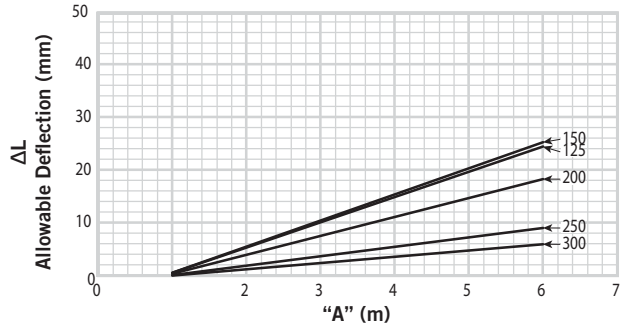
StrenghThin™ 100 Movement - "Thin"
2 – 6"/DN50 – DN150: Wall Thickness ≤ 2.3 mm



StrenghThin™ 100 Movement - "Thin"
8 – 12"/DN200 – DN300: Wall Thickness ≤ 3.1 mm



StrenghThin™ 100 Movement - "Thick"
2 – 6"/DN50 – DN150: Wall Thickness > 2.3 mm



StrenghThin™ 100 Movement - "Thick"
8 – 12"/DN200 – DN300: Wall Thickness > 3.1 mm

NOTE

- For systems with angles different than what is shown above, please contact Victaulic.

b. Expansion loops utilizing Victaulic rigid couplings and fittings: Expansion loops or “U” bends are frequently used to accommodate the expansion and/or contraction due to thermal changes. The necessary dimensions of a stainless steel pipe expansion loop in a StrengThin™ 100 System can be found in following chart (see Figure 1 for loop height “A”):

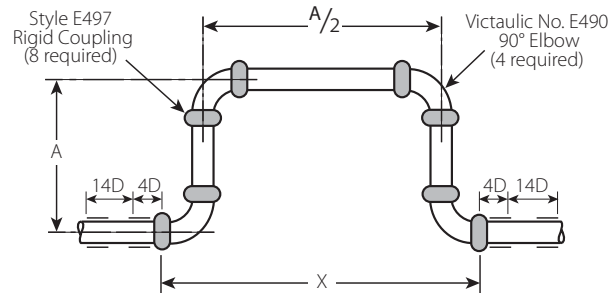


Figure 1
Expansion Loop

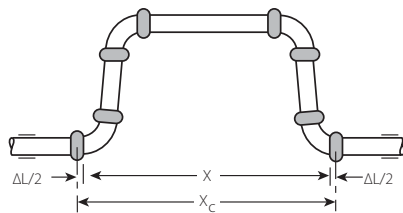


Figure 2
Thermal Contraction
Pipeline Shrinks - Loop Expands

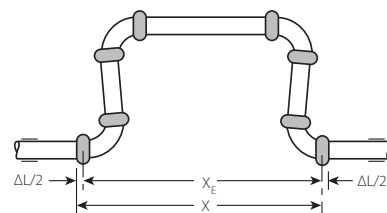


Figure 3
Thermal Expansion
Pipeline Grows into Loop - Loop Contracts

$$\Delta L = X_c - X \text{ or } X - X_E$$

Where:

- ΔL = Change in length of pipe run from expansion/contraction
- X = Width of expansion loop at ambient temperature
- X_c = Width of expansion loop under contraction at lowest temperature
- X_E = Width of expansion loop under expansion at highest temperature

ΔL Expansion/ Contraction	Minimum Height "A" of the Expansion Loop for Pipe Sizes Shown								
	DN50 60.3	DN65 76.1	DN80 88.9	DN100 114.3	DN125 139.7	DN150 168.3	DN200 219.1	DN250 273.0	DN300 323.9
	m ft	m ft	m ft	m ft	m ft	m ft	m ft	m ft	m ft
10 0.4	1.3 4.3	1.5 4.9	1.8 5.9	1.3 4.3	1.4 4.6	1.7 5.6	1.4 4.6	1.6 5.2	2.1 6.9
20 0.8	1.5 4.9	2.0 6.6	2.3 7.5	1.6 5.2	1.7 5.6	2.0 6.6	2.0 6.6	2.4 7.8	2.9 9.6
30 1.2	1.8 5.9	2.4 7.9	2.8 9.2	1.9 6.2	2.2 7.2	2.3 7.5	2.7 8.7	3.2 10.3	3.7 12.2
40 1.6	2.1 6.9	2.9 9.5	-	2.3 7.5	2.7 8.9	2.8 9.2	3.3 10.8	3.9 12.9	-
50 2.0	2.4 7.9	-	-	3.6 8.5	-	2.9 9.5	3.9 12.8	-	-
60 2.4	2.7 8.9	-	-	2.9 9.5	-	-	-	-	-

NOTES

- Expansion loop shall be located between two pipe anchors and shall have pipe guides installed and located as shown above.
- The data provided is intended for use as an aid to qualified designers when products are installed in accordance with the latest available Victaulic product data.

3.0 REFERENCE MATERIALS

[06.24: Victaulic QuickVic™ Flexible Coupling Style 177N](#)

[17.09: Victaulic Pressure Ratings and End Loads for Victaulic Ductile Iron Grooved Couplings on Stainless Steel Pipe](#)

[26.02: Victaulic Calculating and Accommodating Pipe Line Thermal Growth](#)

[31.02: Victaulic StrengThin™ 100 System Style E497 Rigid Coupling](#)

[31.04: Victaulic StrengThin™ 100 Fittings for Stainless Steel](#)

[31.07: Victaulic Style E155 Expansion Joint](#)

User Responsibility for Product Selection and Suitability

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