Victaulic Application Guidelines
Bolted Split-Sleeve Coupling System

Victaulic is the world leader in mechanical pipe joining systems. Established in 1925 Victaulic is known the world over for mechanical pipe joining systems that speed installation and reduce downtime.

The Victaulic bolted split-sleeve mechanical coupling concept was developed in the early 1980s to offer an improved alternative to sleeve type couplings, including better performance, flexibility for the accommodation of thermal pipe expansion and contraction, lateral movement, self restraining capabilities, and the time and cost saving benefits of construction methodology and installation productivity of the split sleeve couplings.

This publication will discuss basic bolted split-sleeve coupling design as well as provide guidelines for the proper application of this type of flexible, mechanical joint connection in piping systems. For dimensional data, performance criteria and material specifications of specific Victaulic bolted split-sleeve coupling styles please refer to the submittal publications that can be found on our website at www.victaulic.com.

NOTICE

- **This document does not take the place of proper system engineering and design. It is intended for use only as a supplement to provide proper application guidelines.**

Product Reference Guide:

For individual product submittals visit victaulic.com.

Style 229S Non-restrained flexible coupling for odor control system- Publication 60.16

Style 230 Non-restrained flexible coupling for carbon steel pipe- Publication 60.01

Style 230S Non-restrained flexible coupling for stainless steel pipe- Publication 60.02

Style 231 Non-restrained flexible expansion coupling for carbon steel pipe- Publication 60.03

Style 231S Non-restrained flexible expansion coupling for stainless steel pipe- Publication 60.04

Style 232 Restrained flexible coupling for carbon steel pipe- Publication 60.05

Style 232S Restrained flexible coupling for stainless steel pipe- Publication 60.06

Style 233 Restrained flexible coupling for dynamic joint deflection for carbon steel pipe- Publication 60.07

Style 233S Restrained flexible coupling for dynamic joint deflection for stainless steel pipe- Publication 60.08

Style 234 Restrained flexible single-gasket coupling for carbon steel pipe- Publication 60.09

Style 234S Restrained flexible single-gasket coupling for stainless steel pipe- Publication 60.10

Job/Owner

System No.	
Location	

Contractor

Submitted By	
Date	

Engineer

Spec Section	
Paragraph	
Approved	
Date	

Table of Contents:

Glossary of Terms/Abbreviations:

The following terms and abbreviations are used in this literature or are relative to the design and performance concepts of this product line:

Flexible joint – a pipe joint that allows relative movement between the two pipes being connected.

Rigid joint – a pipe joint that does not allow any relative movement between the two pipes being connected.

Restrained joint – pipe joint or connection that prevents pipe ends from pulling out of the joint and resists axial thrust.

Axial movement – motion or displacement in the direction of the pipe axis.

Lateral movement – the parallel displacement or offset between the axes of two pipes.

Longitudinal movement – same as axial movement.

Deflection – angular displacement between the axes of two pipes.

- Static (installed) deflection – pipe joint is deflected before coupling is installed.
- Dynamic (in-service) deflection – joint deflection occurs after coupling is installed.

Rotation – revolution about the axis of a pipe.

Yield strength – load per unit area that a material can withstand before permanent (plastic) deformation occurs.

Tensile strength – maximum load per unit area that a material is capable of withstanding before it fails; ultimate strength.

ANSI – American National Standards Institute

AWS – American Welding Society

AWWA – American Water Works Association

CPP – concrete pressure pipe

DFT – dry film thickness

EPDM – ethylene propylene diene monomer

FRP – fiber reinforced plastic

GRP – glass reinforced plastic

HDPE – high density polyethylene

NBR – nitrile butadiene rubber (also referred to as Buna-N)

NSF – National Sanitation Foundation

OD – outside diameter

PVC – polyvinyl chloride

RCCP – reinforce concrete cylinder pipe

SSPC – Society for Protective Coatings (formerly Steel Structures Painting Council)

Bolted-split sleeve coupling concept:

Coupling Components (Style 232 shown)

1. Body – Dual arch cross-section.

2. Shoulders (Type 2 and Type 3) – Provide additional stiffness, allow for larger o-ring gasket and provide vertical bearing surface for restraint rings.

3. Closure Plates – Low profile bolt pads for installation and tightening of coupling; gap between closure plates of installed coupling allows for field flexibility.

4. Sealing Plate – Provides axial seal across the coupling body and closure plate gap.

5. O-ring Gaskets – Provide circumferential seal.

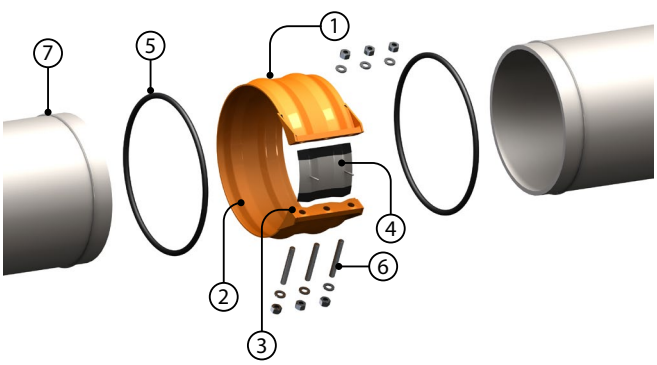
6. Fasteners

Studs – High Strength Threaded Rod

Nuts – Heavy Hex Nuts

Washers – SAE small pattern flat washers

7. Restraint Rings – Attached to pipe ends to create a restrained joint or fix the coupling to one pipe end for Style 231/231S expansion couplings.



Bolted Split-Sleeve Coupling Body Types and Styles:

Body Type

These couplings are categorized into body type designs that are based on pipe OD and design pressure. **These configurations are inherent to the coupling designs based on pipe diameter/operating pressure and are not a customer selectable option.** Bolted split-sleeve couplings can be identified by the following body types:

- Type 1 – simple dual-arch coupling housing design that typically applies to smaller diameter pipe sizes and/or lower pressure applications.
- Type 2 – single and dual-arch coupling housing design that utilizes a shoulder (rectangular bar section) welded to the body edge on both sides to add additional cross-sectional stiffness, allow for greater angular deflection and provide a vertical bearing surface for the restraint ring(s).
- Type 3 – flat body cross-section design (Style 230, 232 only) that typically applies to large diameter and/or higher pressure applications.

Style 230/230S Non-restrained Couplings

Bolted split-sleeve non-restrained coupling styles simply clamp around the pipe and provide a leak-proof joint while allowing for some flexibility at the joint. Style 229S, 230 and 230S couplings are an alternative to bolted, split sleeve type couplings per AWWA C219 in that both types of fabricated couplings are non-restrained, flexible joints. These split-sleeve couplings offer significant advantages over the other non-restrained joints.

Design Considerations:

- Provides a flexible, non-restrained connection that accommodates up to ½"/12.7mm of axial movement, as well as static joint deflection and limited dynamic joint deflection.
- Style 230/230S provides no axial restraint and therefore does not prevent pipe joint separation. The system design must provide restraint or the joint must be restrained using an external mechanism such as a harness.
- Can be supplied as an insulating joint
- Optional integral pipe stops are available to keep the coupling centered over the joint when minimal pipe movement occurs or when couplings are used on vertical or steep slope pipe installations. The 229S comes standard with pipe stops. Refer to the Pipe Stops section in this brochure for more details.

  Note: this coupling style is not recommended for aeration systems to accommodate thermal pipe movement. For this type of application, Style 231/231S couplings in conjunction with proper pipe supports/guides would be the more appropriate product selection.

Style 232/232S Restrained Couplings:

Bolted split-sleeve restrained couplings utilize a restraining mechanism in the form of round bar that is welded to each pipe end per AWS requirements at a specified location. Restraint ring placement & welding data sheets are supplied with each restraint ring shipment to assist contractors/fabricators with the proper attachment of the restraint rings to the pipe ends. The coupling housing straddles these restraint rings to resist the axial thrust load generated by internal pressure, preventing the pipe ends from pulling out of the coupled joint.

Design Considerations:

• This flexible connection is designed to provide joint restraint at full bulkhead thrust.

• Allows for joint deflection.

• Allows for axial movement.

Style 233/233S Restrained Couplings for Dynamic Joint Deflection:

Bolted Split-Sleeve restrained couplings for dynamic joint deflection are specifically designed to provide for a fully restrained joint while allowing for in-service (dynamic) angular joint deflection to occur.

Design Considerations:

- This flexible connection is designed to provide joint restraint at full bulkhead thrust and also accommodates joint deflection and/or axial movement.
- Allowable dynamic deflection is equivalent to allowable static deflection.
- Dynamic deflection and axial movement are non-concurrent.

Style 234/234S Single Gasket Restrained Couplings:

Single gasket restrained couplings are single arch, shouldered couplings that utilize an extruded “C” shape gasket to provide the radial seal at the joint. Since the gasket spans the pipe joint, the medium flowing through the pipe does not contact the inside of the coupling body.

Design Considerations:

- Flexible, single arch/gasket coupling designed to provide joint restraint at full bulkhead thrust.
- Often used for solids type service such as slurry, coal dust, etc. or for Style 240 expansion joint connections.
- Width of the coupling and restraint ring size are dependent on pipe size and pressure requirements and are not a selectable options.

Pipe Materials and Preparation:

Several pipe materials can be joined using bolted split-sleeve couplings depending on size, pressure and coupling style.

See the materials summary table below for a list of acceptable pipe materials.

Pipe Materials Summary Table:

Pipe Material	Coupling Style					
	229S	230	231	232	233	234
Carbon Steel	Y	Y	Y (1)	Y	Y	Y
Stainless Steel	Y	Y	Y	Y	Y	Y
Cast Iron	Y	Y	N	N	N	N
Ductile Iron	Y	Y	N	Y (2)	Y (2)	Y (2)
FRP	Y	Y	N	N	N	N

(1) Cladding required on expansion/slip end of pipe.
(2) Carbon steel restraint rings only.
NOTE: Surfaces must be smooth to an RMS value of 63 or better.

As a final note, for any non-standard applications, please contact your local Victaulic sales representative in order to assess the availability and/or feasibility of a bolted split-sleeve coupling to be used as a flexible joint connection.

Styles 229S, 230, 232 and 233 Pipe End Preparation

The "pipe end" is considered a distance equal to or greater than the total width of the coupling. The exterior surface of the pipe shall be smooth and free from weld reinforcement, weld bead, seams, scars, indentations, roll marks, and flat spots. Before installation, the pipe ends shall be clean and free from oil, dirt, debris, sharp edges or any foreign material that may interfere with sealing of the joint. Coated pipe ends shall be free from knits and surface defects. Pipe ends are subject to the tolerances listed in this brochure.

Pipe Outside Diameter

Victaulic bolted split-sleeve couplings may be specified and are available for any pipe size between 3"/80mm and 144"/3600mm depending on the product style and pressure requirements. Larger sizes may be available upon request. Since bolted split-sleeve couplings fit over the outside of the pipe and are manufactured to the exact pipe OD, it is essential that the actual OD (not nominal pipe size) is specified at the time of enquiry/order to ensure proper product design and fit. The OD should be based on a circumferential measurement of the pipe end in consideration for a bolted split-sleeve coupling in order to eliminate the effect of ovality.

Pipe Roundness/Ovality

In order to properly install a bolted split-sleeve coupling and ensure optimal performance, the pipe ends at the joint shall be as round within the ovality tolerance requirements published for the appropriate style of coupling.

Pipe End Tolerances

Style 230, 232 and 233 Pipe End Tolerance Requirements

These tables represent required pipe end tolerances for installation of bolted split-sleeve couplings. Tolerances that do not meet the following criteria shall be discussed with Victaulic personnel before ordering or installing a bolted split-sleeve coupling.

Diameter Tolerance

(must also meet plus/minus tolerance)

Nominal Pipe Size-In./mm	Tolerance on Actual OD (OD based on actual pipe circumference)
Up to 14"/350 mm	-0.06" / +0.12"
16" to 36"/400 – 900mm	-0.08" / +0.18"
42" to 54"/1050 – 1350mm	-0.12" / +0.25"
60" to 144"/1500 – 3600 mm	-0.25" / +0.31"

Plus/Minus Tolerance

(allowable difference between pipe diameters at joint)

Nominal Pipe Size-In./mm	Allowable Pipe OD Difference (OD based on actual pipe circumference)
up to 16"/400mm	0.12"/3.05mm
18" to 24"/450 – 600mm	0.16"/4.06mm
30"/750mm and greater/850mm	0.20"/5.08mm

Ovality Tolerance

Nominal Pipe Size-In./mm	Tolerance on Roudness
up to 14”/350mm	within 1/8"/3.05mm
16" – 20"/400 – 500mm	within 1%
24" – 36"600 – 900mm	within ¾%
42" – 108"/1050 – 2700mm	within ½%
greater than 108"/2700mm	within 3/8%

Misalignment Tolerance

(lateral offset between pipe ends)

TYPE 1

Nominal Pipe Size-In./mm	Allowable Misalignment-In./mm
up to 14"/350mm	⅛"/3.05mm
16" – 48"/400 – 1200mm	3⁄16"/4.76mm

TYPE 2 AND TYPE 3

Nominal Pipe Size-In./mm	Allowable Misalignment-In./mm
up to 20"/500mm	3⁄16"/4.76mm
24" to 54"/600mm – 1350mm	¼"/6.35mm
greater than 60"/1500mm	⅜"/9.53mm

Style 234 Pipe End Tolerance Requirements

These tables represent required pipe end tolerances for installation of bolted split-sleeve couplings. Tolerances that do not meet the following criteria shall be discussed with Victaulic personnel before ordering or installing a bolted split-sleeve coupling.

Diameter Tolerance
(must also meet plus/minus tolerance)

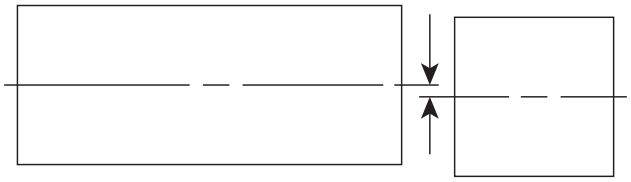
Nominal Pipe Size-In./mm	Tolerance on Actual OD (OD based on actual pipe circumference)
Up to 14"/350 mm	-0.06" / +0.12"
16" to 36"/400 – 900mm	-0.08" / +0.18"
42" to 54"/1050 – 1350mm	-0.12" / +0.25"
60" to 144"/1500 – 3600mm	-0.25" / +0.31"

Plus/Minus Tolerance
(allowable difference between pipe diameters at joint)

Nominal Pipe Size-In./mm	Allowable Pipe OD Difference (OD based on actual pipe circumference)
up to 16"/400mm	0.09"/2.29mm
18" to 24"/450 – 600mm	0.12"/3.05mm
30"/750mm and greater	0.15"/3.81mm

Roundness Tolerance (pipe ovality)

Nominal Pipe Size-In./mm	Tolerance on Roundness
up to 14"/350mm	within ⅛"/3.05mm
16" – 20"/400 – 500mm	within 1%
24" – 36"600 – 900mm	within ¾%
42" – 108"/1050 – 2700mm	within ½%
greater than 108"/2700mm	within ⅜%



Misalignment Tolerance
(lateral offset between pipe ends)

Nominal Pipe Size-In./mm	Tolerance on Roundness
up to 20"/500mm	3/32"/2.38mm
24" to 54"/600 – 1350mm	⅛"/3.18mm
greater than 60"/1500mm	3/16"/4.76mm

System Flexibility:

Flexible Coupling Design

A design element common to all Victaulic bolted split-sleeve couplings is that they provide "flexible" mechanical pipe connections. Flexible couplings should be properly supported to minimize or eliminate any loads such as shear or moment loads that could occur at the coupled joint. See pipe support located on pg. 14.

Flexible joints are commonly utilized to allow for ease of field connections, provide pipe accessibility and offer system protection by allowing for pipe movement to relieve or avoid stresses that could potentially damage piping systems and/or equipment. Depending on the product style, bolted split-sleeve couplings can allow for axial and angular movement and even allow for lateral pipe displacement in buried applications when used in pairs (refer to the Angular Deflection in piping systems section on page 9 and to Style 233/233S submittal data). In all cases, flexible system design must be considered and proper pipe supports must be utilized for above ground applications.

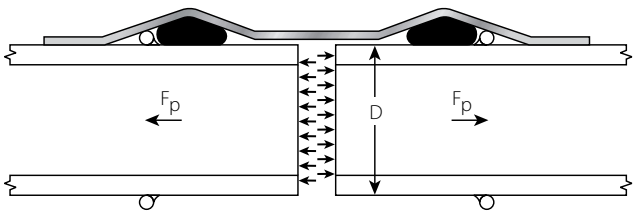
Flexiblle Couplings

The following factors must be considered when designing or installing flexible piping systems.

Pressure Thrust

When a flexible mechanical coupling is sustaining forces trying to separate the pipe ends, the restraint ring is pulled hard against the inside face of the coupling shoulder. This is what prevents the pipes from separating.

The allowable force which a joint can sustain varies for different types of couplings, pipe wall thickness and types of pipes. The product data under the column "Maximum Permissible End Load" shows the maximum allowable end force due to internal pressure and external loading that the couplings will sustain.



When this end force is due to a closed end or change in direction, the pressure thrust transmitted by the joint can be computed from the formula:

$$Fp = \frac{\pi}{4} D^2 p$$

Where:

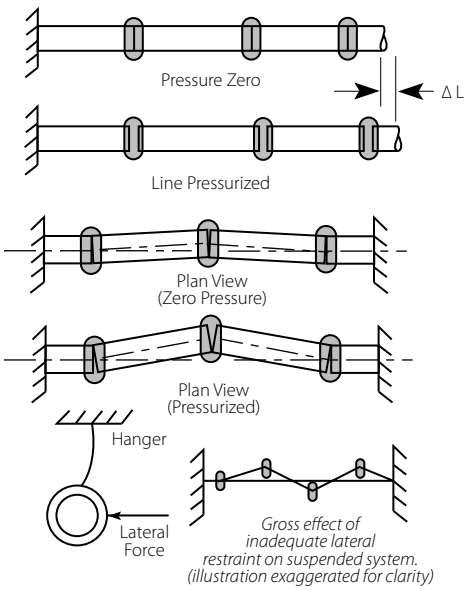
Fp = Pressure thrust or end load (lbs.)

D = Outside diameter of pipe (inches)

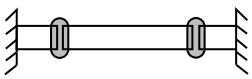
p = Internal pressure (psi)

Pipe will be moved to the full extent of the available pipe end gaps when allowed to float. Ensure resulting movement of systems is not harmful to joints at changes in directions or branch connections or to parts of structure or other equipment. Note also that thermal expansion of pipes will add to total movement in these cases.

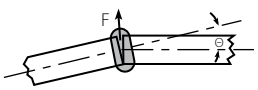
Design Data:



For anchored systems, where pressure thrusts do not act to hold the joints in tension, or in systems where the joints have been intentionally deflected (e.g., curves), provide lateral restraint to prevent movement of the pipes due to pressure thrusts acting at deflections. Lightweight hangers are not adequate in preventing sideways movement of pipes. It should be anticipated that small deflections will occur in all straight lines and side thrusts will be exerted on the joints.



Angular deflection at butted or fully spaced joints is not possible unless the ends of the pipes are free to move as required. Unrestrained deflected joints will straighten up under the action of axial pressure thrusts or other forces acting to pull pipes apart. If joints are to be maintained deflected, then lines must be anchored to restrain pressure thrusts and end pull forces, otherwise sufficient lateral force must be exerted to keep joint deflected.



Lateral forces (F) will always act on deflected joints due to internal —pressure. A fully deflected joint will no longer be capable of providing the full linear movement normally available at the joint.

Axial Flexibility

Axial movement refers to movement in the direction of the pipe axis, as in pipe expansion and contraction, due to changes in temperature of the pipe. See Figure 1.

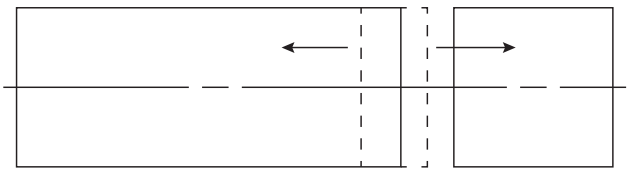
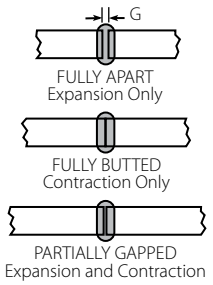
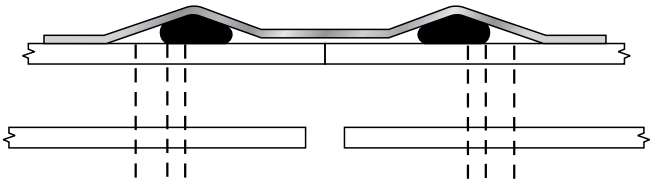


Figure 1. AXIAL MOVEMENT

- Style 229S/230/230S non-restrained couplings will allow up to ½"/12.7mm of axial movement.
- Style 231/231S expansion couplings are specifically designed to accommodate thermal expansion and contraction in a piping system and can accommodate up to 4"/101.6 of axial movement depending on pipe size and body width of the coupling.
- Style 232/232S/234/234S restrained couplings will allow up to 3/8"/9.7mm of linear pipe movement within the coupled joint. Refer to product submittal publications for specific details.
- Although Style 233/233S dynamic restrained couplings are designed specifically to accommodate in-service deflection, the couplings will also allow for up to 1"/25.4mm of axial movement. Axial movement and deflection values are non-concurrent.



Linear movement available at flexible pipe joints is published under performance data for each Victaulic coupling style. These values are MAXIMUMS.



Linear Movement for Non-Restrained Couplings (Style 229S, 230/230S)

Above ground installations using non-restrained couplings on unanchored pipe may be subject to having the pipe shift during operation such that some or all of the pipe gaps accumulate at one joint (see Figure 8). In such a case, it is important that the accumulated gap X does not exceed the published maximum allowable pipe end separation at any single coupling.

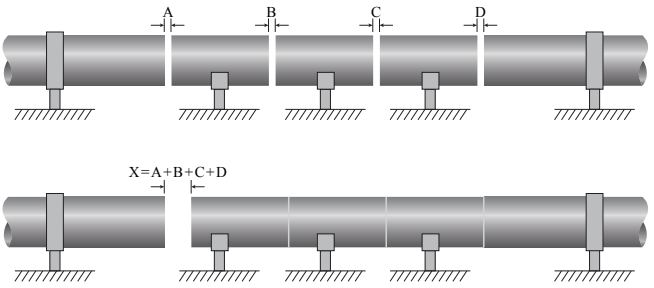


Figure 8.

Angular Flexibility

Angular deflection is the angular misalignment of two pipe axes. See Figure 2.

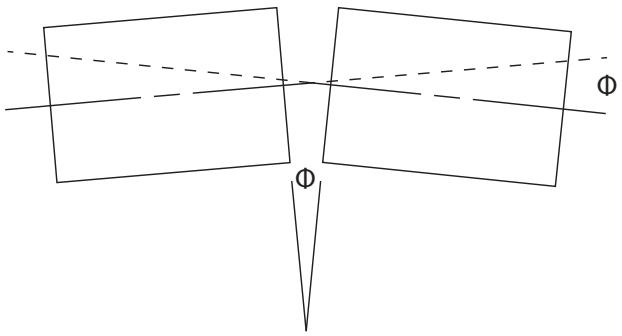
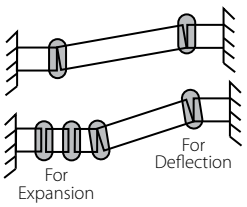


Figure 2. ANGULAR MOVEMENT

- BSS couplings are designed to accommodate for angular deflection. See individual product submittals for specific information.

Joints Deflected
No Expansion,Contraction available

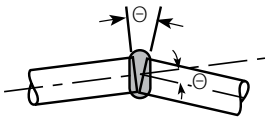


Angular deflection at butted or fully spaced joints is not possible unless the ends of the pipes are free to move as required. Unrestrained deflected joints will straighten up under the action of axial pressure thrusts or other forces acting to pull pipes apart. If joints are to be maintained deflected, then lines must be anchored to restrain pressure thrusts and end pull forces, otherwise sufficient lateral force must be exerted to keep joint deflected.

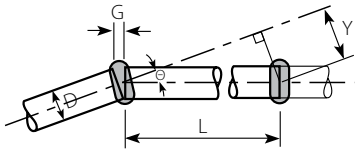
Angular Deflections

Angular deflection available at flexible pipe joints is published under Performance Data for each Victaulic coupling style. These values are MAXIMUMS.

O = Maximum angular deflection between center lines as shown under Performance Data.



NOTE: Joints which are fully deflected can no longer provide linear movement. Partially deflected joints will provide some portion of linear movement. NOTE: Pressure thrusts will tend to straighten deflected pipe.



$$Y = L \sin \Theta$$

$$\Theta = \sin^{-1} \frac{G}{D}$$

$$Y = \frac{G \times L}{D}$$

Where:

Y = Misalignment (Inches)

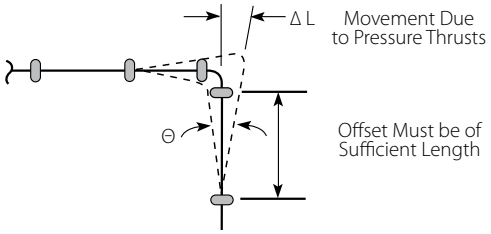
G = Maximum Allowable Pipe End Movement (Inches) as shown under Performance Data (Published value to be reduced by Design Tolerance.)

O = Maximum Deflection (Degrees) from Center Line as shown under Performance Data (Published value to be reduced by Design Tolerance.)

D = Pipe Outside Diameter (Inches)

L = Pipe Length (Inches)

Offsets and Branch Connections



Ensure that branch connections and offsets are sufficiently long so that the maximum angular deflection of coupling (shown in Performance Data for each coupling style) is never exceeded and can accommodate anticipated total movement of pipes.

Otherwise, anchor system to direct movement away from these. Also ensure that adjacent pipes can move freely to provide anticipated movements.

Lateral Flexibility

Lateral offset is the displacement of pipe or pipes in one plane while maintaining parallel axes such as in differential settlement. When accommodating lateral pipe movement, a minimum of 2 flexible couplings must be utilized. The required distance between the flexible couplings is determined by the couplings deflection capability, and governs the amount of available lateral displacement accommodation. See individual product submittals for specific information. See Figure 3.

- For additional details see AWWA M-11 Design Manual.

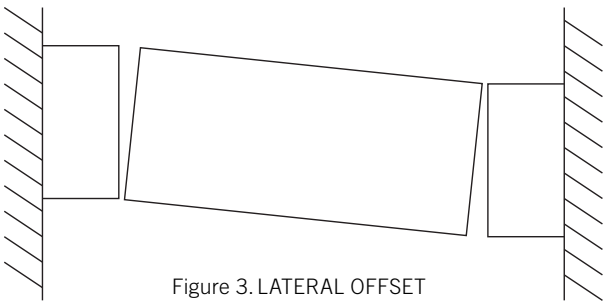
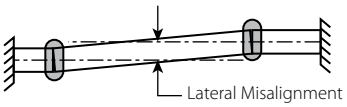


Figure 3. LATERAL OFFSET

Misalignment

Pipe misalignment can be accommodated with a Victaulic flexible piping system. Note that at least two flexible couplings must be used for the combined lateral displacement and angular deflection (Y).



At least two flexible couplings are required to provide for lateral misalignment of pipes. Angular deflection of each joint must not exceed Maximum Deflection From Centerline published for each Victaulic coupling style.

Dynamic Deflection – Differential Settlement

In a buried piping system application it is typical that the engineer or designer must accommodate differential settlement between the pipeline and a structure or between two structures connected by a pipeline. A combination of two or more flexible couplings separated by a calculated length of pipe can be used to allow for this movement. The lateral displacement is transferred through angular deflection at each joint and the length of the pipe spool required between the two couplings is calculated using the maximum allowable angular deflection of the coupling.

WARNING

- **A single flexible coupling shall never be used to accommodate differential settlement.**

The following illustration shows the concept of utilizing two couplings to achieve proper joint deflection when ground settlement occurs. One coupling should be installed as close to the structure as possible, connecting a pipe spool of calculated length via a second coupling to the remainder of the piping system, thus allowing the spool to articulate between the couplings as settlement occurs. This diagram is not drawn to scale and the deflection angle has been exaggerated for clarity. See Figure 6.

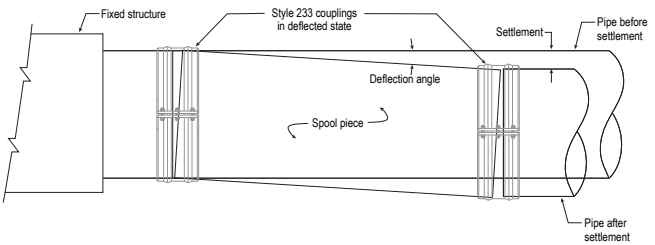


Figure 6.

The spool length L can be calculated using the following equation:

$$L = \frac{S}{\sin \Phi}$$

Where:

S = Anticipated settlement.
L = length of individual stick of pipe; in inches.
Φ = allowable static angular deflection of a joint; by degrees

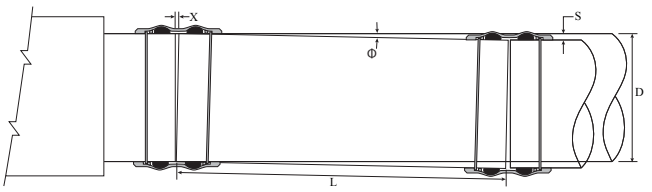


Figure 7.

Rotation

Victaulic bolted split-sleeve couplings will not prevent rotation of the pipe about its own axis. This mode of movement is not recommended as an option for flexibility at the joint. See Figure 4

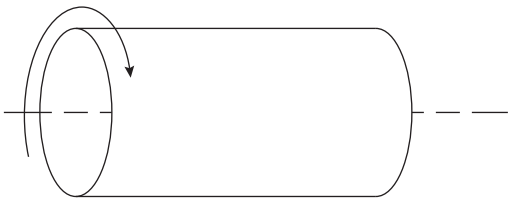


Figure 4. AXIAL ROTATION

Performance Summary Table:

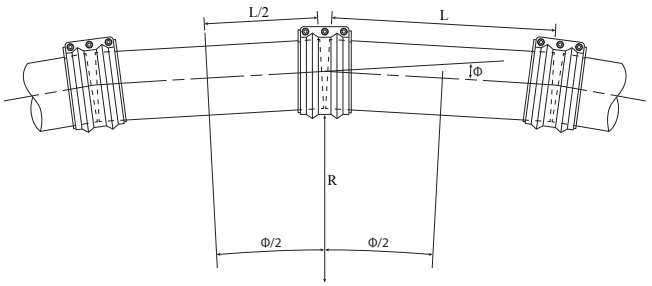
Coupling Style	Axial Movement	Static Deflection	Dynamic Deflection
Style 229S/230/230S	up to ½"/12.7mm	Y	half of static
Style 232/232S	up to ⅜"/9.6mm	Y	half of static
Style 233/233S	up to 1"/25.4mm	Y	Y
Style 234/234S	up to 3⁄16"/4.8mm	limited	limited

Design Section

Angular Deflection in Piping Systems

Static Deflection - Laying out a Long Radius Curve

Flexible couplings can be used to install a pipeline in long radius curves to circumvent the use of costly elbows or mitered bends (and the associated thrust blocks required to control the resulting forces at the changes in direction) by allowing a small static deflection at each joint. Using this design methodology, pipelines can be installed to accommodate changes in topography and avoid obstacles. See Figure 5.



The piping radius R can be calculated using the following equation:

$$R = \frac{L}{2\sin\left(\frac{\Phi}{2}\right)}$$

Figure 5.

Where:

R = piping radius; in inches.
L = length of individual stick of pipe; in inches.
Φ = allowable static angular deflection of a joint; by degrees

SUPPORTS SHALL BE ONE PIPE DIAMETER FROM EACH SIDE OF THE PIPE JOINT.

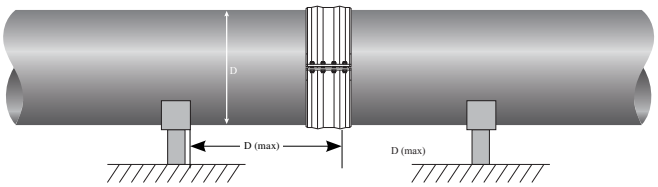


Figure 13.

Style 232 couplings/water service

Support Spacing 229S, 230, 232, 233 and 234 For Air Systems:

Use the following table as a guideline for support spacing on straight runs of pipe conveying air, and where concentrated loads are not a concern.

Maximum support spacing for air piping

Nominal Pipe Size- In./mm	Recommended Maximum Distance Between Ft./m
3 – 4/80 – 100mm	10 3.1
5 – 20/125 – 500mm	12 3.7
24 – 48/600 – 1200mm	15 4.6
54 – 96/1350 – 2400mm	18 5.5
108 – 144/2700 – 3600mm	20 6.1

Note: no length of pipe should be left unsupported between any two couplings.

Buried Applications

Proper bedding shall be utilized. The pipe at the coupled joints shall be properly supported using stulls, saddles or other devices to help maintain the shape of the pipe during installation, filling and testing. It is recommended that the pipe and system satisfy requirements or follow guidelines set forth by industry standards such as the ASCE MOP 119 Manual for Buried Flexible Steel Pipe or AWWA Manual M11 to ensure system and design integrity.

Maximum Activation Force

The activation forces required to engage linear movement of Victaulic flexible couplings is equivalent to the forces required to overcome approximately 15 psi/103kPa of internal pressure.

Non-restrained couplings such as Style 229S/230/230S or Style 231/231S will not provide any pipe restraint.

NOTE: These values are not intended for use as substitutions for proper pipe support or anchoring. Systems requiring restraint must utilize restrained coupings or the appropriate harness.

Thermal Movement

All materials, including pipe, machinery, structures and buildings experience dimensional changes as a result of changes in temperatures. This section provides the calculated thermal expansion/contraction values for carbon steel and stainless steel. The amount of thermal expansion/contraction varies by material.

Temperature °F °C	Thermal Expansion of Pipe inches per 100 ft. mm per 100 meters	
	Carbon Steel	Stainless Steel
-40 -40	-0.288 -24.0	-0.461 -38.4
-20 -28	-0.145 -12.1	-0.230 -19.0
0 -17	0 0	0 0
20 -6	0.148 12.5	0.230 19.0
32 0	0.230 19.0	0.369 30.8
40 4	0.300 24.9	0.461 38.4
60 15	0.448 37.4	0.691 57.7
80 26	0.580 48.2	0.922 76.8
100 37	0.753 62.7	1.152 96.1
120 48	0.910 75.8	1.382 115.2
140 60	1.064 88.6	1.613 134.5
160 71	1.200 100.1	1.843 153.6
180 82	1.360 113.2	2.074 172.9
200 93	1.520 126.6	2.304 191.9
212 100	1.610 134.2	2.442 203.4
220 104	1.680 140.1	2.534 211.3
230 110	1.760 146.7	2.650 220.8
260 126	2.020 168.3	3.000 250.0
280 137	2.180 181.8	3.226 268.8
300 148	2.350 195.9	3.456 288.0
320 160	2.530 211.0	3.686 307.2
340 171	2.700 225.1	3.917 326.4
350 176	2.790 232.6	4.032 336.0

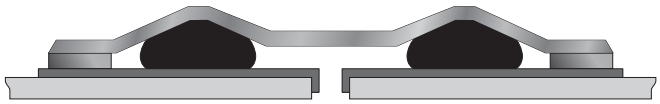
Values are approximate and can vary based on material grades.

Options/Solutions using Bolted Split-Sleeve Couplings

There are multiple options available using some form or variation of standard Victaulic bolted split-sleeve coupling in order to provide a unique engineered product application solution. The following is a list of such specialty products. Contact Victaulic for details on proper application of specialty products.

Insulating Couplings

In some instances an engineer may specify the need to isolate one section of pipe from another. In cases such as this, a Style 230/230S non-restrained coupling may be used with a rubber insulating boot over the end of each piece of connecting pipe. A variation without the use of rubber boots may also be feasible. This option utilizes a Style 230/230S Type 2 coupling with Teflon® shoulders instead of alloy shoulders to prevent any metal coupling components from contacting the pipe.



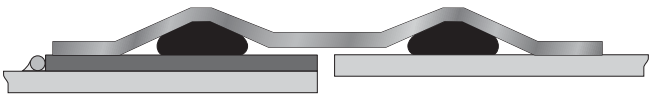
Style 230 Type 2 coupling with insulation boots

Figure 16.

Transition Couplings

In the event pipe diameters at a single joint are a different size or the pipe end tolerance at a joint exceeds the required max/min pipe tolerance for bolted split-sleeve couplings, small steps in pipe diameter may be able to be accommodated through the use of a transition coupling. These couplings fall into two groups, transitions made via a rubber sleeve installed over the smaller pipe end and Type 2 couplings which have unequal shoulders.

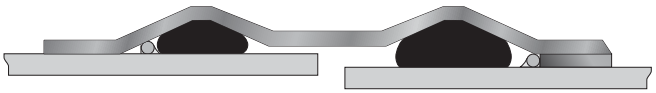
The use of a rubber sleeve under a coupling can only be used with nonrestrained couplings in low pressure applications and small differences in pipe diameter (less than 1"/25.4mm). A retaining ring may also have to be attached (welded) to the pipe directly behind the transition sleeve to ensure that internal pressure does not force the sleeve out from under the coupling. See Figure 17



Style 230 Type 1 coupling with transition sleeve and retaining ring

Figure 17.

The use of a coupling with unequal shoulders is better suited to restrained couplings and expansion joints, but is also limited to relatively small differences in actual pipe OD. See Figure 18.



Style 232 hybrid (Type 1 on one side, Type 2 on the other)

Figure 18.

A third option to accommodate diameter transition at a pipe joint that can be applied to steel or stainless steel pipe applications only is to require the fabricator/contractor to build up the smaller diameter pipe end to match the larger diameter pipe end using a wrapper plate welded in place. For larger transitions, the use of a transitioning spool (concentric, eccentric or stepped) in conjunction with two couplings is recommended.

Dished Head Assemblies

Victaulic offers a dished head assembly prepared with a restraint ring to be used with Style 232/232S, 233/233S, 234/234S for field testing or to terminate a pipeline and allow for future expansion. See Figure 19.

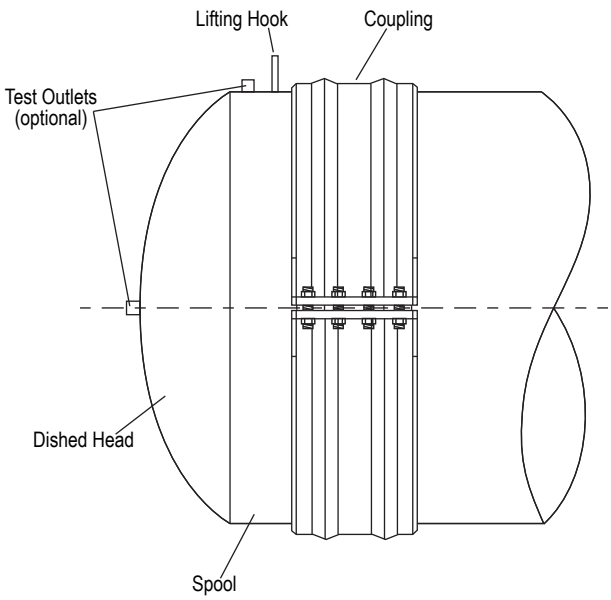
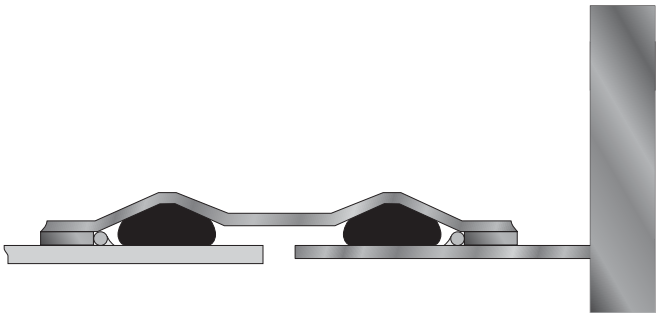


Figure 19.

Couplings with Flanged Adapter

Flanged adapters allow the use of a coupling near a flange. A flanged adapter, when used in conjunction with a bolted split-sleeve coupling, allows the joint to function as a type of dismantling joint, providing easy access to pipe and equipment for maintenance. The benefits of utilizing a Victaulic bolted split-sleeve style coupling are realized with the limited quantity of hardware that must be loosened to disassemble the coupling and the limited space required by a bolted split-sleeve Style 232/232S coupling as compared to a typical bolted, sleeve-type coupling with AWWA M11 harness lugs for pipe restraint. See Figure 20

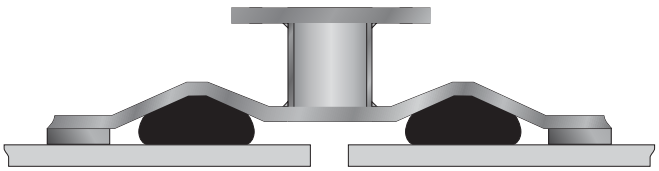


Style 232 Type 2 coupling with flanged spool

Figure 20.

Outlet Couplings

Bolted split-sleeve couplings can be supplied with an outlet in the body of the coupling to accommodate the addition of testing apparatus or branch lines at the coupled joint. The outlet can be supplied with various end connections that include flanged, grooved, prepared with restraint rings and plain or beveled end for welding to allow for attachment to equipment or to a new branch of piping. This option typically requires a wider than standard coupling body to accommodate the size of the outlet. See Figure 21



Style 230 Type 2 with flanged outlet

Figure 21.

Installation
Reference should always be made to the I-100 Victaulic Field Installation Handbook for the product you are installing. Handbooks are included with each shipment of Victaulic products for complete installation and assembly data, and are available in PDF format on our website at www.victaulic.com.

Warranty
Refer to the Warranty section of the current Price List or contact Victaulic for details.

Note
This product shall be manufactured by Victaulic or to Victaulic specifications. All products to be installed in accordance with current Victaulic installation/assembly instructions. Victaulic reserves the right to change product specifications, designs and standard equipment without notice and without incurring obligations.

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