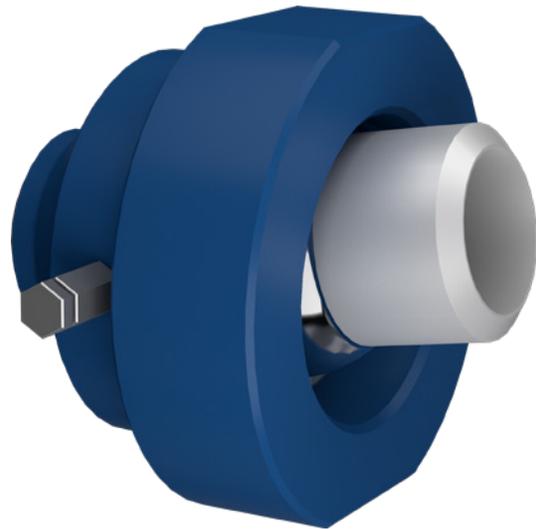


# Universal Ball Joints

## Flexible Pipe Connector

High-integrity connectors that add flexibility to piping spools in static and dynamic applications



### FEATURES

**360° continuous rotation and up to a 30° axial pivot**

**Engineered contact surfaces for superior wear and reduced friction**

**Simple, tool-free, in-line maintenance**



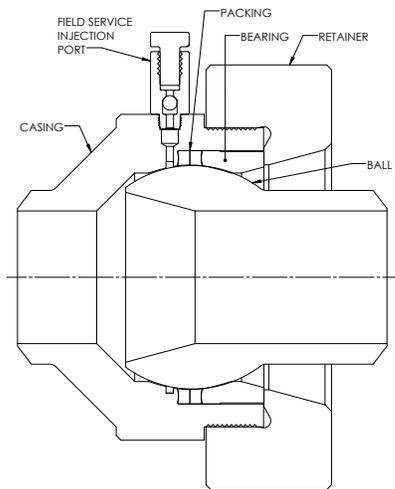
## Flexible Pipe Connector

Our universal ball joint\* is a high-integrity, flexible pipe connection suitable for both dynamic and static applications. A reliable high-temperature, high-pressure Graphfoil® seal is incorporated in the design and is easily serviced with the field injection port. All ball joints are shipped assembled, tested, and ready for installation.

\*Formerly the SMX International universal ball joint

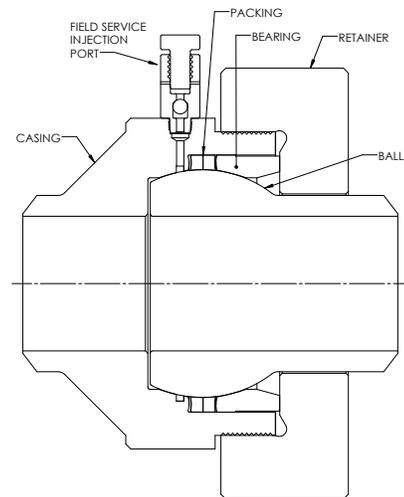
### Flexi-Ball Joint

The flexi-ball joint provides bidirectional movement through 360° continuous rotation and a 30° axial pivot. With this flexibility, the system can readily handle pipe expansion and overall pipe movements, substantially reducing stress.



### Uni-Ball Joint

The uni-ball joint provides bidirectional movement through 360° continuous rotation. The uni-ball joint is specifically designed for cases where restricted movement is required.



## Features

360° continuous rotation and a 30° axial pivot	A large total flex angle and infinite rotation provide a versatile flexible piping solution with continuous sealing during movement
Low-friction movement	Engineered contact surfaces and surface treatments ensure low break torque
In-line maintenance	Equipped with a seal injection port that enables simplified, tool-free repair of the seal. Easy, quick regeneration of seal results in lower maintenance cost
High cycle compatibility	Designed and tested to ensure seal longevity in high cycle applications
Reliable seal	Positive and reliable sealing achieved through combination of metallic and contoured graphite seals
High-temperature compatibility	Suitable for high-temperature applications
End connection flexibility	Available in butt-weld and/or flanged end configurations
Shipped ready for service	Factory hydrotested, pre-assembled, and pre-torqued. No onsite assembly or adjustment required
Compact design	Compact size and reduced weight. Suitable for close-proximity piping applications

# Applications

## Thermal Oil Extraction

Low friction movement and high pressure and temperature compatibility allow Universal ball joints to accommodate wellhead movement in enhanced oil recovery processes such as steam-assisted gravity drainage (SAGD), cyclic steam stimulation (CSS), solvent-aided process (SAP) and toe-to-heel air injection (THAI).

## Thermal Expansion in Piping Systems

Piping systems carrying a hot transferred medium, such as steam, may undergo substantial elongation as they are taken from a cold state to the operating temperature. A Universal ball joint can accommodate the expansion and contraction of piping systems while reducing pipe stresses.

## Solar Energy Piping Systems

Universal ball joints are suitable for use in solar thermal energy systems where flexibility is required in pipe spools for solar tracking movement and thermal expansion.

## Pipe Movement

In cases where hose is not suitable due to size, pressure or temperature limitations a pipe spool incorporation of Universal ball joints is the solution. The universal ball joint is suitable in low or high cycle applications.

## Angular Misalignment

Universal ball joints can compensate for improper alignment between joining legs of piping systems. The ball joint provides an effective seal whether the two lines are parallel and offset or come together at an acute angle over a short piping distance.

## Storage Tank Settlement

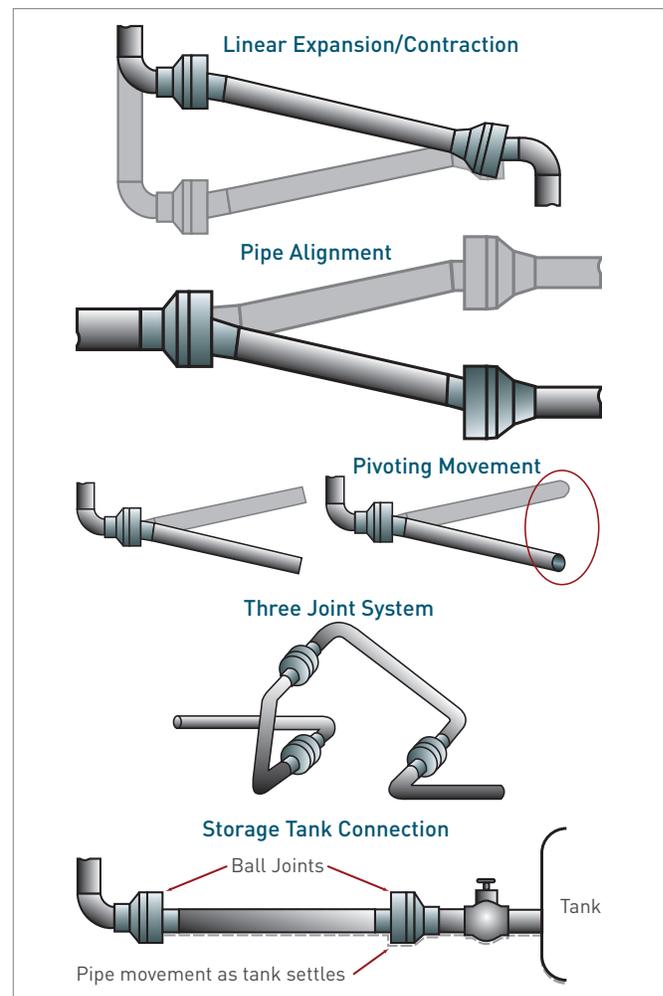
The universal ball joint can also mitigate the effects of tank settling and tilting. As a storage tank settles with loading or over time, the flexi-ball joint compensates by eliminating potentially damaging pipe stresses to the header piping and tank nozzles.

## Subsea

The universal ball joint provides a unique solution for subsea applications and can be used to accommodate static misalignment and pipe movement, and to reduce stress at flow line connectors.

## Marine Loading Piping Systems

Available in a wide range of diameters and pressure classes, the universal ball joint can be used in marine loading applications where other technologies are not suitable. Using multiple flexi-ball joints in a series can create a flexible pipe spool with reliable sealing for dynamic and static applications.



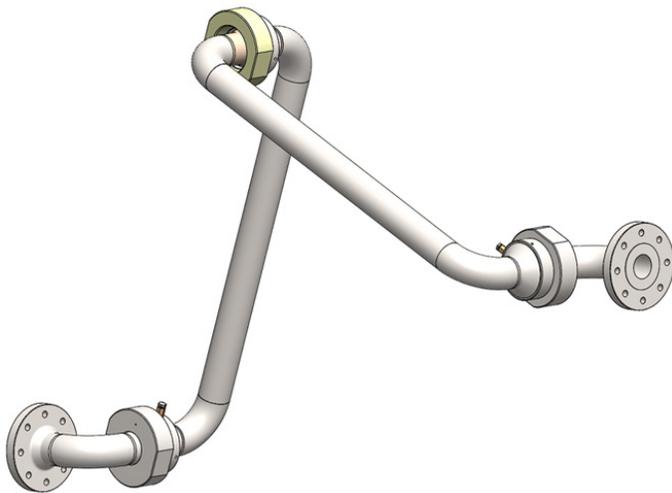
# Other Products

## Expansion Arms

Custom-fabricated expansion arms to suit any requirement

### Features:

- » Geometry optimized to suit pipe movements and space constraints, and to reduce piping stresses
- » Fabricated in accordance with material and NDE requirements
- » Shipped tested and ready for installation on site

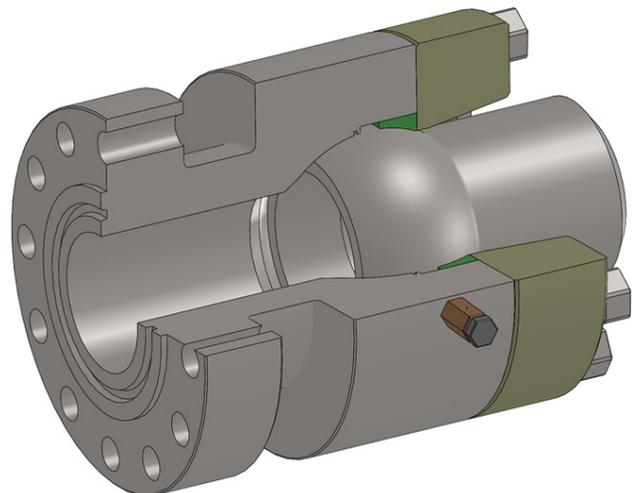


## Alignment Connectors

Flanged universal ball joints to alleviate onsite alignment concerns

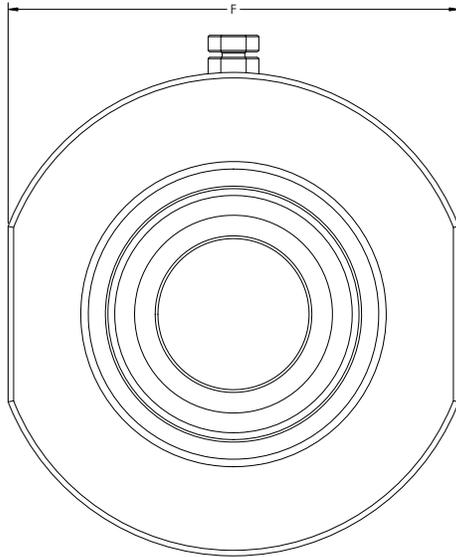
### Features:

- » Available in single or double ball joint configurations to accommodate any amount of misalignment
- » No limitations on end connection size or type
- » Available in flange x flange or flange x butt-weld configurations

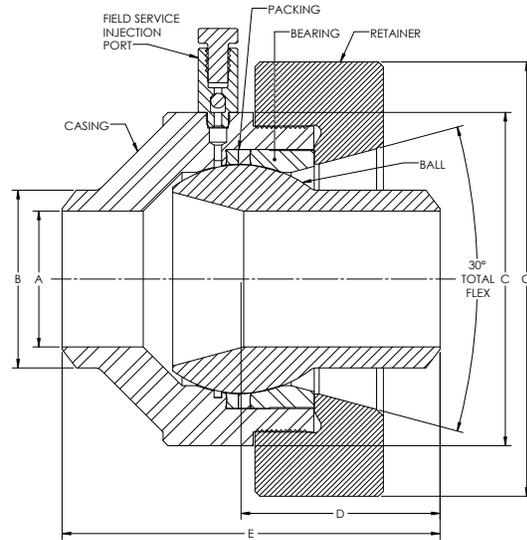


# Dimensions

Right side view of section view



Threaded Flexi-Ball Joint – 8 in Class 900 & Smaller



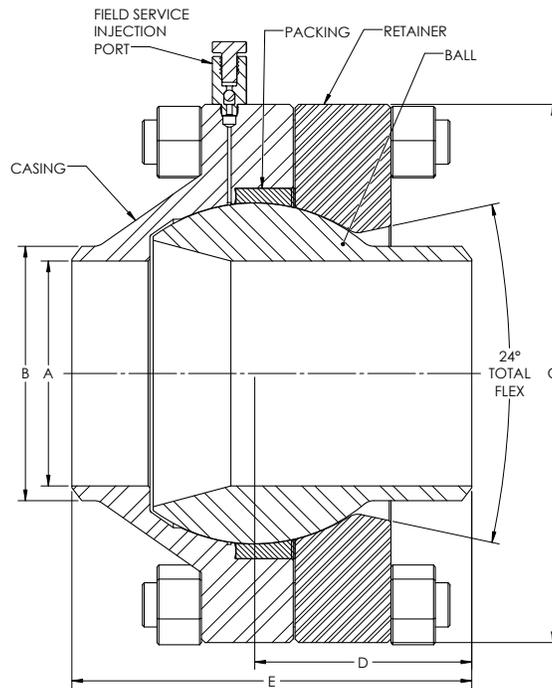
Nominal Pipe Size	Pressure Class**	Flexi-Ball and Uni-Ball Dimensions (in)							Weight (lb)
		A*	B	C	D	E	F	G	
1 ½ in	150 to 1500	***	1.900	5.90	3.63	6.81	6.00	7.00	30
2 in	150 to 1500	***	2.375	5.90	3.63	6.81	6.00	7.00	28
2 ½ in	150 to 1500	***	2.875	7.20	5.00	9.56	8.25	9.00	75
3 in	150 to 1500	***	3.500	7.20	5.00	9.56	8.25	9.00	70
4 in	150 to 1500	***	4.500	8.44	5.00	9.56	10.25	11.00	105
5 in	150 to 1500	***	5.563	10.90	5.72	10.88	12.00	12.75	150
6 in	150 to 1500	***	6.625	10.90	5.72	10.88	12.00	12.75	150
8 in	150 to 900	***	8.625	14.50	6.50	12.00	15.98	16.50	245

\* Custom schedules, weights, and wall thicknesses available upon request.

\*\* Pipe wall thickness may reduce the pressure rating in some cases.

\*\*\* As specified.

### Flanged Flexi-Ball Joint – 8 in Class 1500 & Larger



Nominal Pipe size	Pressure Class**	Flexi-Ball and Uni-Ball Dimensions (in)					Weight (lb)
		A*	B	C	D	E	
8 in	1500	***	8.625	18.75	10.86	17.00	800
10 in	150 to 300	***	10.75	19.50	8.30	16.50	455
	600	***	10.75	20.25	8.30	17.00	680
12 in	150 to 300	***	12.75	23.75	9.63	20.25	775
	600	***	12.75	24.00	9.63	20.25	956
14 in	150 to 300	***	14.00	26.00	9.00	20.50	1,065
	600	***	14.00	26.00	9.00	20.50	1,282
16 in	150 to 300	***	16.00	29.25	10.00	23.00	1,609
	600	***	16.00	29.25	10.00	23.00	1,947
18 in	150 to 300	***	18.00	33.00	11.00	25.00	1,901
	600	***	18.00	33.00	11.00	25.00	2,811
20 in	150 to 300	***	20.00	35.75	12.00	27.00	2,674
	600	***	20.00	35.75	12.00	27.00	3,538
24 in	150 to 300	***	24.00	41.25	14.00	31.00	4,766
	600	***	24.00	41.25	14.00	31.00	6,198

\* Custom schedules, weights, and wall thicknesses available upon request.

\*\* Pipe wall thickness may reduce the pressure rating in some cases.

\*\*\* As specified.

# Installation and Maintenance Instructions

## Post-receiving inspection, preservation, and storage

All ball joints must be inspected upon receiving for damages that may have occurred during transportation or handling. Recipients must verify that there is a nameplate and anti-rotation screw attached to the ball joint. Any damages noted should be documented; serious damages should be reported immediately to Grayloc® Products. Ball joints should be stored indoors prior to installation to maximize preservation of the paint and the rust inhibitor coating. In the as-delivered (un-welded) condition, the ball should not be able to be moved by hand. If you are able to easily move the ball by hand, contact Grayloc® Products.

## Operation, installation, and orientation

All standard ball joints are designed for bidirectional flow unless otherwise specified. Verify that ball joint materials, including pressure/temperature limits shown on the nameplate, are suitable for the intended application. The following guidelines are to be taken into account when preparing weld procedures to weld ball joints.

Heat conditions during preheat welding heat input and localized post-weld heat treatment (PWHT) must be carefully controlled to ensure that distortion is minimized. Do not use PWHT on the entire assembly.

The standard ball joint is delivered preassembled and complete with butt-welding ends. Conventional welding procedures may be followed in fabricating the ball joints. The ball joint is to be welded to the appropriate piping, as received. Do not disassemble the ball joint or loosen the retainer.

Ingress of fabrication debris into the sealing area will compromise the seal's integrity and can occur from within or outside the ball joint. Use clean ceramic wool to ensure that weld spatter and grinding debris do not enter the sealing area. Debris in the adjoining pipe and fittings must be

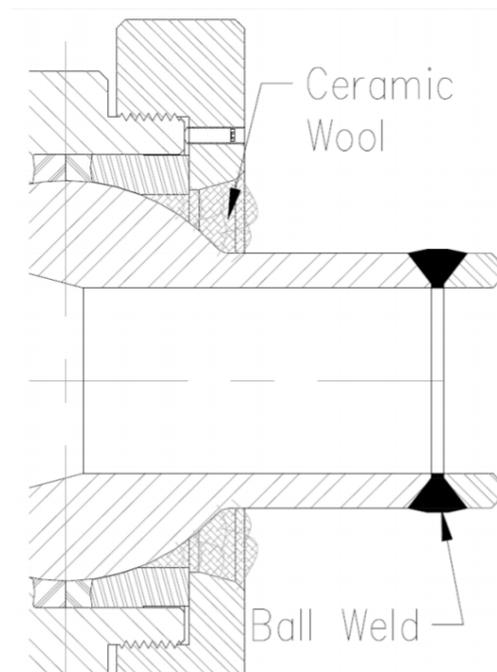
removed prior to and after fabrication to eliminate the chance of migration into the sealing area.

Upon completion of the welding and grinding fabrication processes, carefully remove the ceramic wool, ensuring that no steel particulates fall between the ball and the retainer or bearing. Do not reuse the ceramic wool.

Visually inspect the exposed ball, bearing, and retainer surfaces, and remove any foreign particulates prior to completion.

## General maintenance

Ball joints should be inspected after installation for proper welding and to verify that the angular position is not binding against the retainer inside diameter. Ball joints should also be inspected after the first pressure cycling to verify angular position and that the ball joints are not loose. Beyond the first cycling, the ball joints should be inspected regularly during operation and should be subjected to scheduled maintenance. Please contact Grayloc® Products for specific written instructions prior to use of the field injection port.



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