The AMERICAN Earthquake Joint System

The AMERICAN Earthquake Joint System combines the rugged, tough, and time-proven deflection performance of AMERICAN's Flex-Ring restrained joint pipe with the capacity to expand and contract.

The system is built around a ductile iron Earthquake System casting that features in its design an extended socket depth allowing the specially placed Flex-Ring weld ring an expansive range of motion.

The ductile iron Earthquake System casting and Flex-Ring connecting piece arrive at the jobsite pre-assembled by our professional staff at our manufacturing plant. The extended socket receives a special Flex-Ring spigot end with a specially located restraining ring. The pre-assembled Earthquake System spigot has a double stripe, one showing full insertion and the other mid-point insertion. The illustration above shows the joint installed in the fully extended position, such that both assembly stripes are fully visible.

Pre-assembly means the on-site contractor needs to assemble only the familiar and conventional Flex-Ring joint. In this application, the Flex-Ring spigot on the ductile iron Earthquake System casting is red in color and machined instead of welded. Conventionally, it's a Flex-Ring joint and is assembled in the field in the same manner.

The AMERICAN Earthquake System joint may be assembled in the fully contracted position, allowing for maximum expansion; it may be assembled in the mid-point position, allowing for both joint expansion and contraction; or it may be assembled in the fully extended position, allowing for maximum joint contraction.

The more common is the mid-point position, which allows for both expansion and contraction during a seismic event.

After assembly, the AMERICAN Earthquake Joint System can expand and contract longitudinally and deflect at both joints. With deflection from the conventional Flex-Ring joint and additional deflection from the extended socket Flex-Ring joint, the assembly provides 8 degrees deflection for 6", 8" and 12"; 7 degrees for 16"; and 6 degrees for 20" and 24"; 5 degrees for 30"; as well as 2.4 inches of either expansion or contraction. If assembled in the fully contracted or fully extended position, 4.8 inches of one-way longitudinal differential is available.

Standard Dimensions

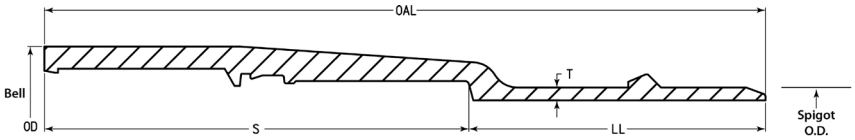


Table No. 9-9

Size (in.)	Working Pressure[1] (psi)	Earthquake Casting OAL (in.)	Earthquake Casting LL (in.)	Socket Depth (S) (in.)	Thickness (T) (in.)	Bell OD (in.)	Spigot OD (in.)
6	350	25.63	10.53	15.10	0.43	9.54	6.9
8	350	25.93	10.71	15.22	0.45	11.78	9.05
12	350	27.60	11.38	16.22	0.49	16.34	13.2
16	350	31.75	14.31	17.44	0.70	20.54	17.40
20	350	32.20	15.02	17.18	0.80	25.20	21.60
24	350	33.70	16.44	17.26	0.89	29.46	25.80
30	250	34.25	16.70	17.55	0.95	36.00	32.00

[1]Working pressure is the maximum pressure rating of the joint and is based on its capability to resist thrust due to internal pressure. If higher working pressure is required, contact AMERICAN.

Standard Dimensions (Continued)

Nominal full laying lengths for AMERICAN Earthquake Joint System assembled with AMERICAN Flex-Ring Joint Pipe*

Table No. 9-10

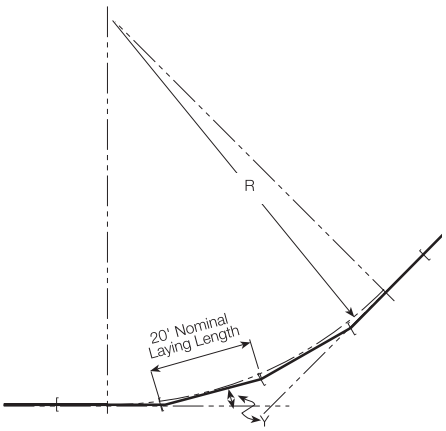
Size (in.)	Casting Fully Homed	Casting at Midpoint of Insertion	Casting Fully Extended	Casting Weight (lbs.)
6	20'-9.57"	21'-0.32"	21'-2.74"	104
8	20'-9.75"	21'-0.54"	21'-2.95"	140
12	20'-9.34"	21'-0.21"	21'-2.65"	263
16	20'-11.79"	21'-2.80"	21'-5.63"	419
20	21'-0.02"	21'-2.76"	21'-5.07"	610
24	21'-1.44"	21'-4.18"	21'-6.56"	779
30	21'-1.31"	21'-4.03"	21'-6.76"	1,088

* Subject to trim pipe allowances per AWWA C151. Where exact lengths are required, contact AMERICAN.

Table No. 9-11

Size (in.)	Working Pressure[1] (psi)	Earthquake Casting OAL (in.)	Allowable Deflection (degrees)	Offset Per Nominal Assembly LL (in.)	Radius of * Curvature (ft.)
6	350	25.63	8	35.12	150
8	350	25.93	8	35.15	150
12	350	27.60	8	35.10	150
16	350	31.75	7	31.05	174
20	350	32.20	6	26.63	203
24	350	33.70	6	26.78	204
30	250	34.25	5	22.31	245

* Based on midpoint position.



R = Radius of Curve (ft.)

Y = Deflection Angle (degrees)

$$\text{Radius of Curve} = \frac{\text{Nominal Laying Length}}{2 \times \text{Tangent } (Y \div 2)}$$

Suggested Specification

As required on the project plans and in these specifications, in high-risk areas subject to sudden and permanent ground deformations, a ductile iron system shall be provided that delivers joint deflection and longitudinal expansion and contraction. This system shall be the AMERICAN Earthquake Joint System or a system equal to or exceeding each of these performance criteria:

Table No. 9-12

Size (in.)	Pipe Joint Deflection	Casting Joint Deflection	Combined Assembly Deflection	Longitudinal Extension from Mid-Point	Ultimate Dead End Thrust Resistance	ISO 16134 Rating
6	5 degrees	3 degrees	8 degrees	± 1.00% (2.40 inches)	102,900 lbs	A,M1,S1
8	5 degrees	3 degrees	8 degrees	± 1.00% (2.40 inches)	137,200 lbs	A,M1,S1
12	5 degrees	3 degrees	8 degrees	± 1.00% (2.40 inches)	205,800 lbs	A,M1,S1
16	3.75 degrees	3.25 degrees	7 degrees	± 1.00% (2.40 inches)	274,400 lbs	A,M2,S1
20	3.5 degrees	2.5 degrees	6 degrees	± 1.00% (2.40 inches)	343,000 lbs	A,M2,S1
24	3 degrees	3 degrees	6 degrees	± 1.00% (2.40 inches)	411,600 lbs	A,M2,S1
30	2.5 degrees	2.5 degrees	5 degrees	± 1.00% (2.40 inches)	514,500 lbs	A,M2,S1

The ductile iron earthquake resistant pipe shall meet all applicable requirements of AWWA C150 (design), AWWA C151 (manufacture), AWWA C104 (lining), C111 (joints), AWWA C153 (fittings), AWWA C105 (polyethylene encasement), and AWWA C600 (installation). The ductile iron pipe shall be sized in inches.

The piping shall meet defined classifications detailed below as shown in ISO 16134 Earthquake Resistant Ductile Iron Pipe and Subsidence-Resistant Design. The seismic design shall be verified by an independent seismic lab such as Cornell University or an owner-approved alternative.

1. All ductile iron pipe and fittings joints shall meet or exceed 3dKN pull out strength or category A.

2. Designated Earthquake System piping shall meet or exceed a minimum deflection of 8 degrees for category M1 for sizes 6" - 12", between 4 degrees to 8 degrees for category M2 for 16", and between 3.5 degrees to 7 degrees for category M2 for sizes 20" and above, whether in the mid-point, fully inserted, or fully extended positions.

3. Designated ductile iron Earthquake System piping will have a minimum strain relief of plus or minus 1% or category S1.

As a designation, the minimum requirements would be A, M1, S1 per ISO 16134 for sizes 6" - 12" and A, M2, S1 for sizes 16" and above, unless otherwise shown on plans and specifications.

The network of ductile iron pipe connected to the Earthquake Joint System shall have the exterior of the pipe coated with a layer of arc-sprayed zinc. The mass of the zinc applied shall be a minimum of 200 g/m2 of pipe surface area, and the coating system shall conform in every respect to ISO 8179-1, "Ductile Iron Pipes - External Zinc-Based Coating - Part 1: Metallic Zinc with Finishing Layer," third edition 2017. The zinc shall have a top coat of approved materials. (Component pieces and field touch up may require the use of a zinc-rich coating 85% zinc per ISO-8179-part 2).

The Earthquake System piping will be installed in the fully open, fully closed, or mid-point position per design criteria. To facilitate determining field joint alignment, the expansion spigot in the assembly shall have a minimum of two assembly stripes – one indicating fully contracted and one indicating the mid-point of extension. Full extension can be achieved by pulling the completed joint out until the joint stops movement.

In addition, the connected network of ductile iron pipe shall be encased in 8 mil V-Bio polyethylene encasement meeting the requirements of AWWA C105 concerning both materials and installation.

The pipeline will be installed with a locator tape that identifies the buried line as an earthquake resistant pipeline. The tape will be a minimum 2 inches in width and red in color labeled "Earthquake Resistant Pipeline Below."

The AMERICAN Earthquake Joint System

Assembly Instructions – 6-inch, 8-inch and 12-inch

General Note: The assembly of the AMERICAN Earthquake Joint System relies on the efficient and proven assembly features of the AMERICAN Flex-Ring joint. This system can be field assembled with various pushing or pulling devices and rigging to provide the nominal Fastite gasket assembly force of 100-300 lbs. times the outside diameter in inches.

The enhanced strain and deflection capabilities of the Earthquake system should be maximized by careful field positioning of a central ductile iron Earthquake casting bell joint. The design of this joint features an extended socket depth, allowing the extended Flex-Ring weld ring on the Earthquake spigot end an expansive range of motion.

1. Ensure the required material to assemble and extend the joint is available. This includes the Flex-Ring locking ring, Fastite gasket, AMERICAN Fastite lubricant, one lever hoist, two choker cables, one hydraulic ram and one split restraining gland. Prior to joint insertion, remove the full-length strap (Figure 1) as well as the packing material holding the split Flex-Ring onto the casting spigot (Figure 2), unless Flex-Rings have been shipped separately.

Figure 1

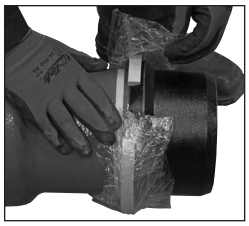


Figure 2

2. Thoroughly clean the pipe socket locking groove, the Fastite gasket recess and casting plain end in accordance with standard 4- to 12-inch Flex-Ring and Fastite joint assembly instructions.

3. In accordance with standard Fastite joint assembly instructions, insert the Fastite gasket ensuring gasket is flush without protrusions. Lubricate the inside surface of the gasket and the red plain end of the casting up to the ring abutment, paying close attention to the beveled nose end of the casting. Ensure the lubricated portion of the casting does not come in contact with the ground to ensure dirt and debris do not contaminate the surface during assembly.

4. With the pipe in essentially straight alignment, assemble the casting spigot end into the Flex-Ring pipe socket until the spigot stripe disappears into the bell. The orientation of the spigot stripe relative to the bell face is an indication of pipe alignment. For the most control and least disturbance of the intended position of the opposite Earthquake Joint and any previously installed joint, assembly of the joint with a lever hoist and two choker slings is recommended.

Figure 3

Assemble by installing one choker anchored around/behind the previously installed pipe bell and one anchored around the long bell cylinder of the Earthquake casting with the lever hoist between. Use the lever hoist to apply assembly force needed to position the joint fully homed (Figure 3).

5. Tap the split flex-ring into the bell's Flex-Ring socket beginning with one end of the split flex-ring and progressing around the joint (Figure 4). This operation is made easier by holding one end of the split flex-ring inside the bell as the remainder of the ring is tapped into the socket. Correct seating is generally indicated by a snapping noise as the split flex-ring springs into position. Visually confirm the ring is fully in position (the split flex-ring is painted yellow to aid in this inspection). (Note: When a visual inspection to determine the

Figure 4

split flex-ring position is not practical, such as with underwater installations, a feeler gauge may be used to verify the correct positioning of the Flex-Ring in the socket locking groove. It may be necessary to move the entering pipe slightly to improve alignment if the ring does not readily spring into the socket locking groove.)

6. When the fully contracted position is not desired, extension can be performed with the use of a split restraining gland and one hydraulic ram to extend the Earthquake casting to the desired position. Install the split restraining gland on the Earthquake spigot with the leading edge facing away from the bell face. Distance should be sufficient to place a hydraulic ram (Figure 5). Once assembled in straight alignment per manufacturer'instructions, place the hydraulic ram between the split restrained gland and Earthquake casting bell face (Figure 6). Ensure consistent force is applied by the hydraulic ram until the desired placement is reached as indicated by assembly stripes.

7. Once the desired Earthquake stripe location has been reached, remove the hydraulic ram and split restraining gland. After removal of restraining gland ensure the pipe coating has not been damaged during extension. If coating damage has occurred during extension, repair coating per the AMERICAN coating repair procedure. The completed joint pictured in Figure 7 is in the intermediate position* as previously described, with the first assembly stripe of the opposite Earthquake joint fully inserted and flush with the bell face and the second stripe is fully exposed.

***Note: The expansion/contraction position can be varied as desired by the positioning of the two assembly stripes of the bell joint of the Earthquake casting. When a position other than midpoint is desired, the stripe position can be adjusted by moving/telescoping the spigot of the Earthquake joint in or out the amount desired.**

Figure 5

Figure 6

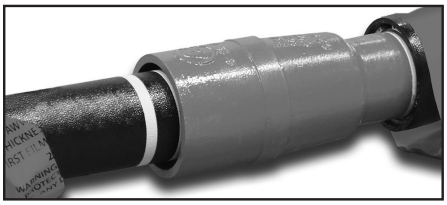


Figure 7

The AMERICAN Earthquake Joint System

Assembly Instructions – 16-inch, 20-inch, 24-inch and 30-inch

General Note: The assembly of the AMERICAN Earthquake Joint System relies on the efficient and proven assembly features of the AMERICAN Flex-Ring joint. This system can be field assembled with various pushing or pulling devices and rigging to provide the nominal Flex-Ring joint assembly force of 200-500 lbs. times the outside diameter in inches.

The enhanced strain and deflection capabilities of the Earthquake system should be maximized by careful field positioning of the iron Earthquake casting bell joint. The design of this joint features an extended socket depth, allowing the Flex-Ring weld ring on the Earthquake spigot end an expansive range of motion.

1. Ensure the required material to assemble and extend the joint is available. This includes (the rubber backed Flex-Ring, Fastite gasket, AMERICAN Fastite Lubricant, two lever hoists, four choker cables, two hydraulic rams and one split restraining gland). Remove the full-length strap. (Figure 1).

Figure 1

Figure 2

2. Thoroughly clean the pipe socket locking groove, the Fastite gasket recess area, and the casting plain end in accordance with standard 14-inch through 54-inch Flex-Ring and Fastite joint assembly instructions.

3. In accordance with 14- to 54-inch Flex-Ring joint assembly instructions, place the rubber-backed Flex-Ring in the socket restraining groove in gasket-like fashion. Ensure the yellow restraining segments are oriented toward the entering spigot and evenly spaced.

4. In accordance with standard Fastite joint assembly instructions, insert the Fastite gasket ensuring gasket is flush without protrusions. Lubricate the inside surface of the Fastite gasket (Figure 2) and the spigot end of the casting up to the ring abutment, paying close attention to the beveled nose end of the casting. There is no need to lubricate the Flex-Ring rubber-backing ring or segments. Ensure the lubricated portion of the casting does not come in contact with the ground to ensure dirt and debris do not contaminate the surface during assembly.

5. With the pipe in essentially straight alignment, assemble the casting plain end into the Flex-Ring pipe socket until the spigot stripe disappears into the bell. The orientation of the ring abutment and spigot stripe relative to the bell face is an indication of pipe alignment. Correct assembly is generally indicated by an audible snap of the Flex-Ring segments into

Figure 3

the correct position; however, if any segment should not come down firmly on the casting, deflect the entering assembly slightly in that direction, allowing the segment to seat itself correctly. Verify the correct positioning of the yellow Flex-Ring segments by visual inspection or feeler gauge if conditions are limiting. The ring abutment is in the proper assembled position when it is fully beyond the yellow Flex-Ring segments and all segments are fully against the casting. For the most control and least disturbance of the intended position of the opposite Earthquake joint and any previously installed Earthquake castings, assembly of this joint using two lever hoists and four reasonably short choker slings is recommended. Assembly using two choker slings anchored around/behind the previously installed pipe bell and two anchored around the long bell cylinder of the Earthquake casting

with the two lever hoists between is best for applying the assembly force needed (Figure 3). Ensure even distribution of assembly force by tightening both lever hoists at the same rate.

6. When the fully contracted position is not desired, it is necessary to use a split restraining gland and two hydraulic rams to extend the Earthquake casting to the desired position. Install the split restraining gland on the Earthquake spigot with the leading edge facing

Figure 4

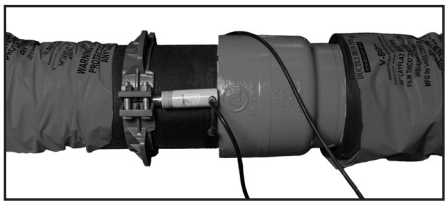


Figure 5

away from the bell face at a distance sufficient to place hydraulic rams (Figure 4). Once assembled in straight alignment per manufacturer's instructions, place the hydraulic rams between the split restraining gland and Earthquake casting bell face. Ensure even and consistent force is applied by the hydraulic rams until the desired placement is reached as indicated by assembly stripes (Figure 5).

7. Once the desired EQ position has been reached, remove the hydraulic rams and split restraining gland. After removal of the restraining gland ensure the pipe coating has not been damaged during extension. If coating damage has occurred during extension, repair coating per the AMERICAN coating repair procedure. The completed joint pictured in Figure 6 is in the intermediate midpoint position* as previously described, with the first assembly stripe of the opposite Earthquake joint fully inserted and flush with the bell face, and the second stripe is fully exposed.

Figure 6

***Note: The expansion/contraction position can be varied as desired by the positioning of the two assembly stripes of the bell joint of the Earthquake casting. When a position other than midpoint is desired, the stripe position can be adjusted by moving/telescoping the spigot of the Earthquake joint in or out the amount desired.**