



JOINT RESTRAINT PRODUCTS

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Star® Pipe Products
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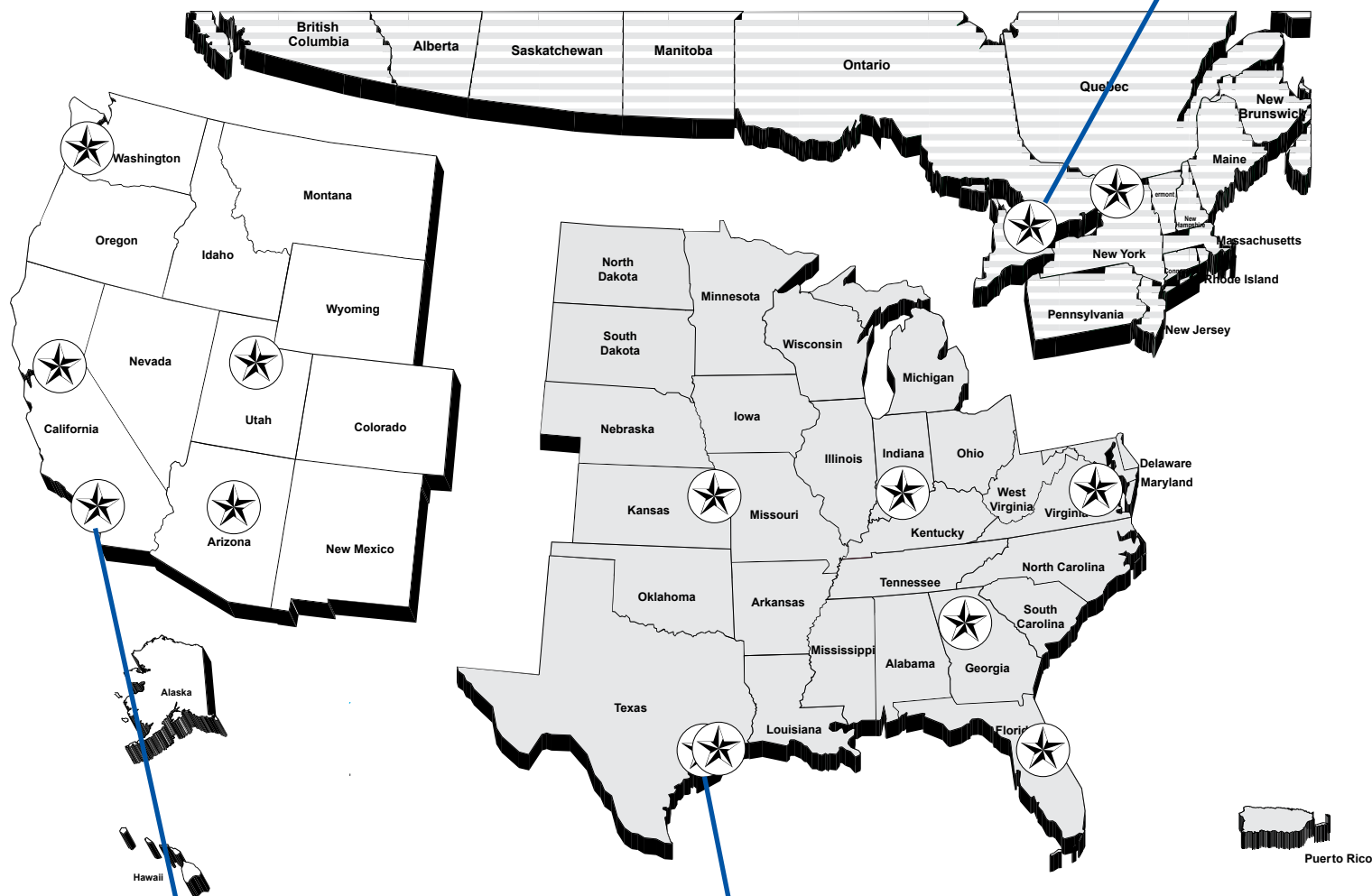
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	PVC STARGRIP® Series 4000, 4000G2, 4100P, 4400 Mechanical Joint Wedge Action Restraint for C900/C905 and IPS PVC pipe.	pg. 19 - 32 Nom. pipe size: 3"-36"
	PVC RING LOCK (PVCGRIP™) Series 3500 Mechanical Joint 360° ring type restraint system designed for C900/C905 and IPS PVC pipe.	pg. 33 - 36 Nom. pipe size: 4"-16"
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►► Please refer to Star Pipe Products' web site (www.starpipeproducts.com) for updated information.



STAR® PIPE PRODUCTS

General Terms and Conditions

GENERAL	These terms and conditions shall control with respect to any purchase order or sale of Seller's products. No waiver, alteration or modification of these terms and conditions whether on Buyer's purchase order or otherwise shall be valid unless the waiver, alteration or modification is specifically accepted in writing and signed by an authorized representative of Seller.
DELIVERY	Seller will make every effort to complete delivery of products as indicated on Seller's acceptance of an order, but Seller assumes no responsibility or liability, and will accept no backcharge, for loss or damage due to delay or inability to deliver caused by acts of God, war, labor difficulties, accident, delays of carriers, by contractors or suppliers, inability to obtain materials, shortages of fuel and energy, or any other causes of any kind whatsoever beyond the control of Seller. Seller may terminate any contract of sale of its products without liability of any nature, by written notice to Buyer, in the event that the delay in delivery or performance resulting from any of the aforesaid causes shall continue for a period of sixty (60) days. Under no circumstances shall Seller be liable for any special or consequential damages or for loss, damage, or expense (whether or not based on negligence) directly or indirectly arising from delays or failure to give notice of delay.
WARRANTY	Seller warrants for one year from the date of shipment Seller's manufactured products to the extent that Seller will replace those having defects in material or workmanship when used for the purpose and in the manner which Seller recommends. If Seller's examination shall disclose to its satisfaction that the product is defective, and an adjustment is required, the amount of such adjustment shall not exceed the net sales price of the defective products only and no allowance will be made for labor or expense of repairing or replacing defective product or workmanship or damage resulting from the same. No adjustment shall be implemented unless product in question is returned to seller in its originally installed condition, still connected to other components of the joint. Buyer must contact Seller as quickly as possible so Seller can assess product in its installed condition. No claims will be honored unless claim is made within forty five (45) days of the defect being found. Where engineering design or fabrication work is supplied, Buyer's acceptance of Seller's design or of delivery of work shall relieve Seller of all further obligation, other than expressed in Seller's product warranty. THIS IS SELLER'S SOLE WARRANTY. SELLER MAKES NO OTHER WARRANTY OF ANY KIND, EXPRESSED OR IMPLIED AND ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE WHICH EXCEED SELLER'S AFORESTATED OBLIGATION ARE HEREBY DISCLAIMED BY SELLER AND EXCLUDED FROM THIS WARRANTY. Seller neither assumes, nor authorizes any person to assume for it, any other obligation in connection with the sale of its engineering designs or product. This warranty shall not apply to any products or parts of products which (a) have been repaired or altered outside of Seller's factory, in any manner; (b) have been subjected to misuse, negligence or accidents; (c) have been used in a manner contrary to Seller's instructions or recommendations. Seller shall not be responsible for design errors due to inaccurate or incomplete information supplied by Buyer or its representatives. This warranty is non-transferable.
LIABILITY	Seller will not be liable for any loss, damage, cost of repairs, incidental or consequential damages of any kind, whether based upon warranty (except for the obligation accepted by Seller under "Warranty" above), contract or negligence, arising in connection with the design, manufacture, sale, use or repair of the products or of the engineering designs supplied to Buyer.
DISCLAIMER	Per AWWA/ANSI C110 A21.10, the flanged joint is generally specified for above ground service. Underground use of the flanged joint is generally not desirable due to the rigidity of the joint.
RETURNS	Seller cannot accept return of any products unless its written permission has been first obtained, in which case same will be credited subject to the following: (a) All material returned must, on its arrival at Seller's plant, be found to be in first-class condition; if not, cost of putting in saleable condition will be deducted from credit memoranda; (b) A handling charge deduction of twenty-five percent (25%) will be made from all credit memoranda issued for material returned; (c) Transportation charges, if not prepaid will be deducted from credit memoranda.
SHIPMENTS	All products sent out will be carefully examined, counted and packed. The cost of any special packing or special handling caused by Buyer's requirements or requests shall be added to the amount of the order. No claim for shortages will be allowed unless made in writing within ten (10) days of receipt of a shipment. Claims for products damaged or lost in transit should be made on the carrier, as Seller's responsibility ceases, and title passes, on delivery to the carrier.
PRODUCTS	Orders covering special or non-standard products are not subject to cancellation except on such terms as Seller may specify on application.
PRICES	Prices and designs are subject to change without notice. All prices are F.O.B. Point of Shipment, unless otherwise stated.
TAXES	The amount of any sales, excise or other taxes, if any, applicable to the products covered by this order, shall be added to the purchase price and shall be paid by Buyer unless Buyer provides Seller with an exemption certificate acceptable to the taxing authorities.



Stargrip® series 3000

Mechanical Joint Wedge Action Restraint
for Ductile Iron Pipe

Stargrip® series 3000 for Ductile Iron Pipe

INFORMATION

The Stargrip® Mechanical Joint Restraint System is a unique product with a proven design that provides an exceptional restraining system for mechanical joint fittings (AWWA C153 or C110), valves, fire hydrants and all classes of ductile iron pipe.

More Adaptable for Field Use

FEATURES & ADVANTAGES

- Gland is made from high strength Ductile Iron per ASTM A536, Grade 65-45-12 and is compatible with all Mechanical Joints conforming to ANSI/AWWA C111/A21.11.
- The Wedge Assembly is designed with a Break-Off Torque Control Nut that will only break off in one direction, ensuring proper installation.
- The Stargrip® offers a full 5° deflection through 12" size, 3° on 14"-24", 2° on 30"-36" and 1° on 42"-48".
- Minimum safety factor of 2:1
- Stargrip® sizes 3"-36" are listed with Underwriters Laboratories Inc. and sizes 3"-12" are approved by Factory Mutual Research.
- The Wedges are heat treated to a minimum of 370 BHN.
- The Wedge Assembly is designed to fit specific pipe sizes and is field repairable.
- No special tools are required for installation of the Stargrip®.
- Stargrip® eliminates tie rods and thrust blocks.
- Standard gland color is Graphite Black (RAL 9011).
- Stargrip® may also be used on steel pipe* up to 12" (***transition gasket required on 12" and under**). For 14" and larger steel applications, contact Star Pipe.

SAMPLE SPECIFICATIONS

Restrainer mechanism shall be integrated into the design of the follower gland. As the mechanism is activated, multiple wedging action shall be imparted against the pipe increasing its resistance as internal pressure increases. After burial of the restraining mechanism, joint flexibility shall be maintained.

The actuating bolt shall be threaded into the restraining wedge and have a 1-1/4" hex operating nut. The operating nut shall be threaded onto the actuating bolt, not swaged or riveted. The restraining twist off nut bolt system shall have a torque-limiting feature designed to break off at preset torque levels, thus insuring proper action of restraining device. Glands shall be manufactured of high strength ductile iron in accordance with ASTM A536 Grade 65-45-12 requirements. The wedge shall be manufactured of high strength ductile iron and be heat treated to a minimum hardness of 370 BHN. Applicable dimensions shall conform to ANSI/AWWA C111/A21.11 and shall be incorporated into the mechanical joint restraint so that the device facilitates use with standard mechanical joint bells.

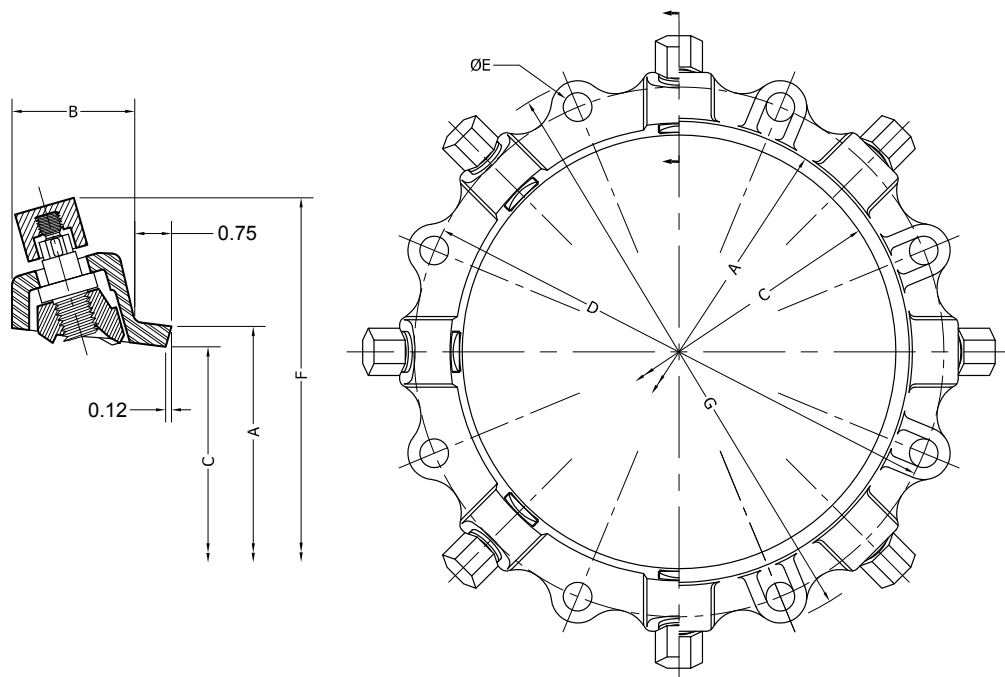
The mechanical joint restraint mechanism shall have a maximum water working pressure of 350 PSI for sizes 3"-16" and 250 PSI for sizes 18" and above. All sizes shall have a minimum safety factor of 2:1 (i.e. twice the maximum pressure rating of the restraint). The mechanical joint restraint mechanism shall be Underwriters Laboratories listed on size 3" through 36" and Factory Mutual Research Approved on size 3"-12". The restraint mechanism shall be Star® Pipe Products Stargrip® series 3000 or an approved equal.



Stargrip® series 3000

Mechanical Joint Wedge Action Restraint
for Ductile Iron Pipe

TECHNICAL INFORMATION



STARGRIP® 3000 SPECIFICATIONS*

NOM. SIZE	MAX PRESSURE RATING (PSI)	A	B	C	D	E	F	F W/NUTS TWISTED OFF	G	NO. OF WEDGES	NO. OF T-BOLTS	APPROX WT. (LBS)
3	350	4.84	2.40	4.06	6.19	3/4	9.85	8.78	8.13	2	4	7
4	350	5.92	2.40	4.90	7.50	7/8	11.06	9.62	9.12	2	4	9
6	350	8.02	2.40	7.00	9.50	7/8	13.06	11.72	11.12	3	6	13
8	350	10.17	2.51	9.15	11.75	7/8	15.25	13.84	13.37	4	6	17
10	350	12.22	2.51	11.20	14.00	7/8	17.25	15.88	15.62	6	8	23
12	350	14.32	2.51	13.30	16.25	7/8	19.50	17.98	17.88	8	8	31
14	350	16.40	2.91	15.44	18.75	7/8	21.25	20.12	20.90	10	10	54
16	350	18.50	2.91	17.54	21.00	7/8	23.34	22.22	23.00	12	12	60
18	250	20.60	2.91	19.64	23.25	7/8	26.40	24.90	25.25	12	12	69
20	250	22.70	2.67	21.74	25.50	7/8	28.56	27.00	27.50	14	14	72
24	250	26.90	3.50	25.94	30.00	7/8	33.86	32.34	31.54	16	16	170
30	250	33.29	3.49	32.17	36.88	1-1/8	40.12	38.62	39.12	20	20	197
36	250	39.59	3.49	38.47	43.75	1-1/8	46.42	44.92	46.00	24	24	242
42	250	45.79	5.15	44.75	50.62	1-3/8	54.86	53.32	53.12	28	28	425
48	250	52.09	5.15	51.05	57.50	1-3/8	61.16	59.62	60.00	32	32	500

*All dimensions in inches except where indicated.

Notes:

- Stargrips® must be adequately wrapped or protected if they are covered by concrete to ensure that concrete does not enter the wedge pocket.
- For applications exceeding the maximum pressure ratings listed, please contact Star Pipe Products for recommendations (see Tandem Stargrip® on page 10).
- For applications with vertical offsets, please contact Star Pipe Products for technical assistance.
- For applications on existing pipe, the pipe needs to be structurally sound and the surface needs to be relatively free of any corrosive by-products in order for the wedges to function properly. Please contact Star Pipe Products for technical assistance.
- Sizes 42" & 48" require extra long 1 1/4" x 8 1/2" T-bolts.



Oversized Stargrip® series 3000OS

Mechanical Joint Wedge Action Restraint
for A, B, C & D Pit Cast Pipe



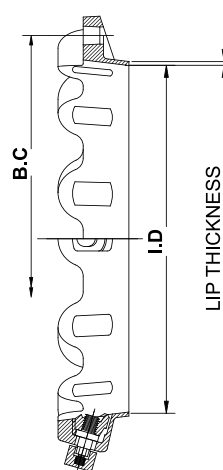
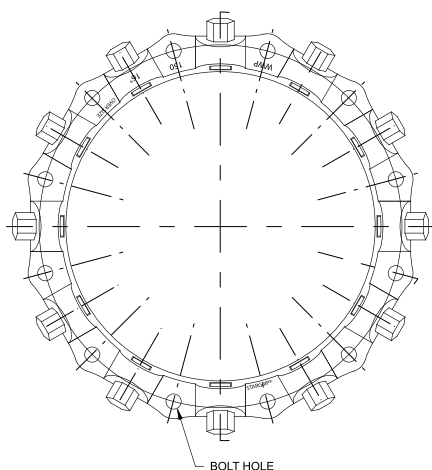
Stargrip® series 3000OS

INFORMATION

The oversized Stargrip® series 3000OS has the same features as the series 3000 except the bore (ID) has been increased to accommodate Class A, B, C, & D pit cast pipe.

Oversized Accomodates Class A,B,C & D Pit Cast Pipe

TECHNICAL INFORMATION



STARGRIP® 3000OS SPECIFICATIONS*

NOM. SIZE	MAX PRESSURE RATING (PSI)	B.C. DIAMETER	BOLT HOLES	NOMINAL GLAND I.D.	LIP THICKNESS	APPROX WT. (LBS)
4	250	7.50	4 x 7/8	5.10	0.32	9
6	250	9.50	6 x 7/8	7.20	0.32	13
8	250	11.75	6 x 7/8	9.40	0.29	18
10	250	14.00	8 x 7/8	11.50	0.27	23
12	250	16.25	8 x 7/8	13.60	0.27	31
14	150	18.75	10 x 7/8	15.79	0.23	54
16	150	21.00	12 x 7/8	17.94	0.21	60

*All dimensions in inches except where indicated.

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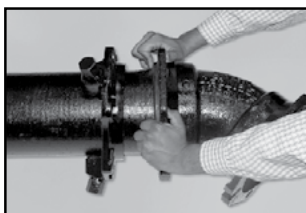
Stargrip® series 3000 & 3000OS

Mechanical Joint Wedge Action Restraint
for Ductile Iron Pipe

INSTALLATION INSTRUCTIONS - SIZES 3" - 48"

**STEP 1**

To ensure the rubber gasket will seal more effectively, clean and remove all loose materials and rust from the mating surfaces. Lubricate the gasket and plain end by brushing either soapy water or pipe lubricant. Slide the Stargrip® on the plain end with lip extension towards the plain end, followed by the MJ gasket. Do not remove rubber washers prior to installation. Washers have been provided for proper wedge placement during shipment and installation.

**STEP 2**

After insertion of the pipe into the bell of the fitting, firmly press the gasket into the gasket recess. During this process the joint should be kept straight.

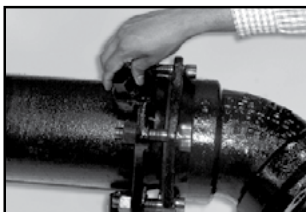
**STEP 3**

Slide the Stargrip® toward the MJ bell with the gland lip against the gasket. Insert T-bolts and hand tighten nuts.

IMPORTANT: Make deflection after joint is assembled but before tightening T-bolts.

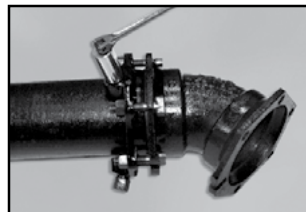
**STEP 4**

When tightening bolts, it is essential that the gland be brought up toward the bell flange evenly, maintaining approximately the same distance between the gland and the face of the flange at all points around the socket. All T-bolts should be tightened until they are in within the torque range per ANSI/AWWA C600 (See Table A). T-Bolts should be tightened alternately on the opposite sides (Star Pattern).

**STEP 5**

Tighten the torque limiting twist off nuts in a clockwise direction until all wedges are in firm contact with the pipe surface.

Continue tightening in an alternative manner going on the opposite sides [Star Pattern], until all of nuts have been twisted off. Never turn a single nut over 180 degrees without alternating to another nut.

**STEP 6**

If removal is necessary, utilize the 5/8" hex head provided. [If reassembly is required, assemble the joint in the same manner as above and tighten the wedge bolt to 90 ft-lbs on sizes 3"-20", 120 ft-lbs on sizes 24"-36" & 130 ft-lbs on sizes 42"-48"].

(TABLE A) T-HEAD BOLT & NUT DETAILS

PIPE SIZE (IN)	BOLT SIZE (IN)	RANGE ¹ OF TORQUE (FT-LBS)
3	5/8	45-60
4-24	3/4	75-90
30-36	1	100-120
42-48	1 1/4	120-150

¹These torque ranges are requirements of AWWA C600

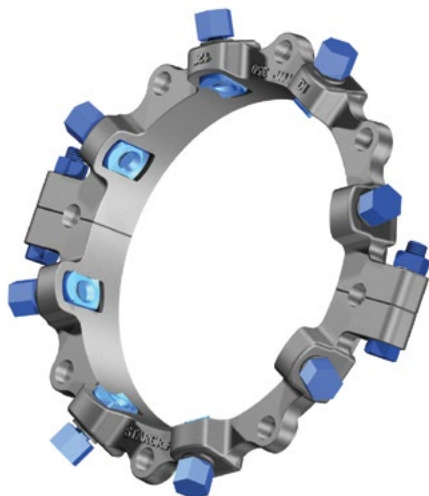
Notes:

- If effective sealing is not attained at the maximum torque indicated, then the joint should be disassembled, thoroughly cleaned, and reassembled. **Overstressing the bolts to compensate for poor installation practice is not acceptable.**
- Not to be used on plain end fittings or PVC or HDPE pipe.
- Stargrip® may also be used on steel pipe* up to 12" (*transition gasket required on 12" and under). For 14" and larger steel applications, contact Star Pipe.
- Stargrips® must be adequately wrapped or protected if they are covered by concrete to ensure that concrete does not enter the wedge pocket.
- For applications exceeding the maximum pressure ratings listed, please contact Star Pipe Products for recommendations (see Tandem Stargrip® on page 10).
- For applications with vertical offsets, please contact Star Pipe Products for technical assistance.
- For applications on existing pipe, the pipe needs to be structurally sound and the surface needs to be relatively free of any corrosive by-products in order for the wedges to function properly. Please contact Star Pipe Products for technical assistance.
- Pressure ratings shall not exceed the maximum pressure rating of the ductile iron pipe it is installed on.



Split Stargrip® series 3000S

Split Mechanical Joint Wedge Action Restraint
for New or Existing Ductile Iron Pipe



Stargrip® series 3000S for Ductile Iron Pipe.

INFORMATION

The Split Stargrip® is used for restraining new or existing ductile iron mechanical joint fittings, valves, fire hydrants and all classes of ductile iron pipe. Split Stargrip® pressure rating per table on next page.

The unique split design makes installation fast and simple.

Easy Installation

FEATURES & ADVANTAGES

- Split design Stargrip® Series 3000S for easy installation on new or existing Ductile Iron Mechanical Joint systems.
- Gland is made from high strength Ductile Iron per ASTM A536, Grade 65-45-12 and is compatible with all Mechanical Joints conforming to ANSI/AWWA C111/A21.11.
- The Wedge Assembly is designed with a Break-Off Torque Control Nut that will only break off in one direction, ensuring proper installation.
- Offers a full 5° deflection through 12" size, 3° on 14"-24", 2° on 30"-36" and 1° on 42"-48".
- Minimum safety factor of 2:1
- The Wedges are heat treated to a minimum of 370 BHN.
- The Wedge Assembly is designed to fit specific pipe sizes and is field repairable.
- Clamping bolts per SAE J429 Grade 5 steel
- Eliminates tie rods and thrust blocks
- Standard gland color is Graphite Black (RAL 9011).
- Split Stargrip® may also be used on steel pipe* up to 12" (***transition gasket required on 12" and under**). For 14" and larger steel applications, contact Star Pipe.

SAMPLE SPECIFICATIONS

Restraint mechanism shall be of split design for use on new or existing mechanical joints. As the mechanism is activated, multiple wedging action shall be imparted against the pipe increasing its resistance as internal pressure increases. After burial of the restraining mechanism, joint flexibility shall be maintained.

The actuating bolt shall be threaded into the restraining wedge and have a 1-1/4" hex operating nut. The operating nut shall be threaded onto the actuating bolt, not swaged or riveted. The restraining twist off nut bolt system shall have a torque-limiting feature designed to break off at preset torque levels, thus insuring proper action of restraining device. Glands shall be manufactured of high strength ductile iron in accordance with ASTM A536 Grade 65-45-12 requirements. The wedge shall be manufactured of high strength ductile iron and be heat treated to a minimum hardness of 370 BHN.

Applicable dimensions shall conform to ANSI/AWWA C111/A21.11 and shall be incorporated into the mechanical joint restraint so that the device facilitates use with standard mechanical joint bells.

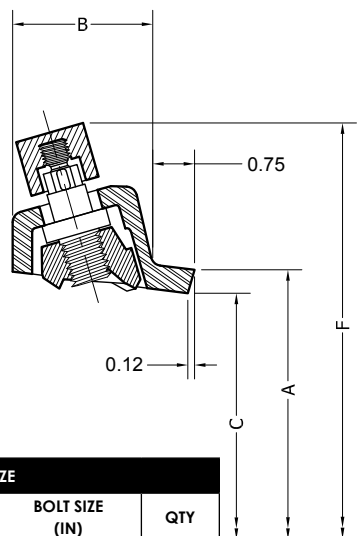
The mechanical joint restraint mechanism shall have a maximum water working pressure of 350 PSI for sizes 3"-8", 300 PSI for sizes 10"-16", 200 PSI for sizes 18"-36" and 175 PSI for sizes 42"-48". All sizes shall have a minimum safety factor of 2:1 (i.e. twice the maximum pressure rating of the restraint). The restraint mechanism shall be Star® Pipe Products Split Stargrip® series 3000S or an approved equal.



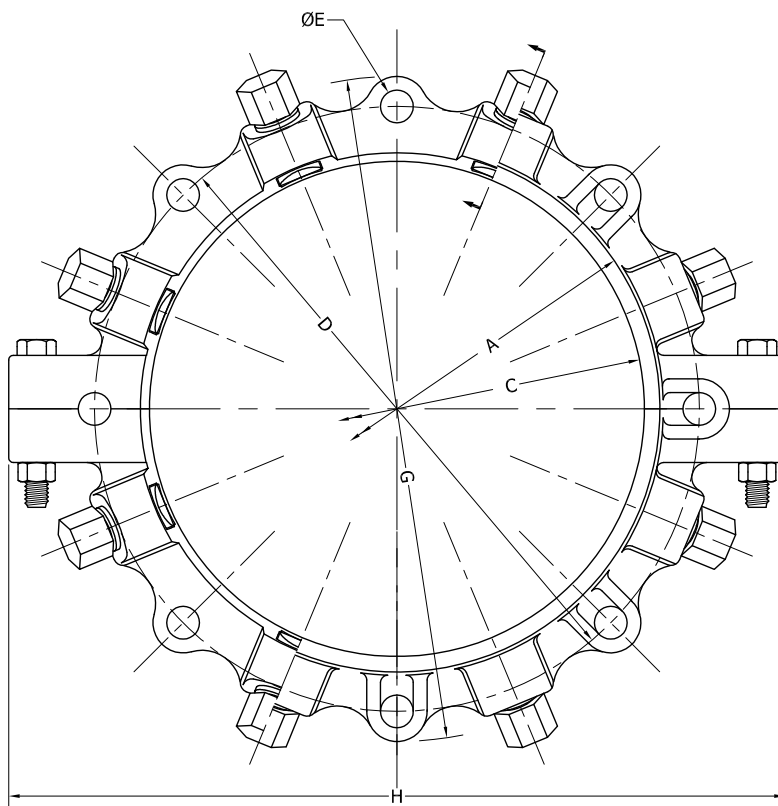
Split Stargrip® series 3000s

Split Mechanical Joint Wedge Action Restraint
for New or Existing Ductile Iron Pipe

TECHNICAL INFORMATION



CLAMPING BOLT SIZE		
SERIES 3000S (IN)	BOLT SIZE (IN)	QTY
3-6	5/8 x 3 1/2	2
8-10	3/4 x 3 1/2	2
12	3/4 x 4	2
14-24	7/8 x 3 3/4	2
30	1 x 3 3/4	2
36	7/8 x 3 3/4	4
42-48	1 1/8 x 4 1/2	4



SPLIT STARGRIP® 3000S SPECIFICATIONS*

NOM. SIZE	MAX PRESSURE RATING (PSI)	A	B	C	D	E	F	F W/NUTS TWISTED OFF	G	H	WEDGES (QTY)	T-BOLTS (QTY)	APPROX WT. (LBS)
3	350	4.66	2.40	4.06	6.19	3/4	9.85	8.45	7.69	8.77	2	4	9
4	350	5.92	2.44	4.90	7.50	7/8	11.06	9.28	9.12	9.80	2	4	11
6	350	8.02	2.44	7.00	9.50	7/8	13.06	11.38	11.12	13.86	3	6	15
8	350	10.17	2.44	9.15	11.75	7/8	15.25	13.53	13.37	15.16	4	6	20
10	300	12.22	2.44	11.20	14.00	7/8	17.25	15.58	15.62	17.98	6	8	26
12	300	14.32	2.44	13.30	16.25	7/8	19.50	12.68	17.88	20.86	8	8	35
14	300	16.40	2.83	15.44	18.75	7/8	21.25	19.82	20.75	25.08	10	10	54
16	300	18.50	2.83	17.54	21.00	7/8	23.34	21.92	23.00	27.12	12	12	60
18	200	20.60	2.91	19.64	23.25	7/8	26.40	24.84	25.25	29.64	12	12	76
20	200	22.70	2.67	21.74	25.50	7/8	28.56	27.00	27.50	31.66	14	14	77
24	200	26.90	3.50	25.94	30.00	7/8	33.86	32.30	31.54	36.14	16	16	131
30	200	33.29	3.49	32.17	36.88	1 1/8	40.12	38.56	39.12	44.18	20	20	201
36	200	39.59	3.49	38.47	43.75	1 1/8	46.42	44.86	46.00	51.29	24	24	240
42	175	45.79	5.15	44.75	50.62	1 3/8	54.86	53.32	53.12	58.82	28	28	581
48	175	52.09	5.15	51.05	57.50	1 3/8	61.16	59.62	60.00	65.12	32	32	664

*All dimensions in inches except where indicated.

Notes:

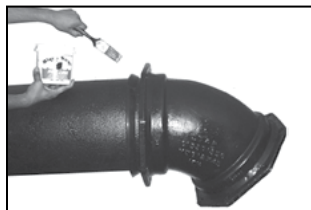
- Sizes 42" & 48" require extra long 1 1/4" x 8 1/2" T-bolts.
- For applications with vertical offsets, please contact Star Pipe Products for technical assistance.
- Pressure ratings shall not exceed the maximum pressure rating of the ductile iron pipe it is installed on.



Split Stargrip® series 3000s

Split Mechanical Joint Wedge Action Restraint
for New or Existing Ductile Iron Pipe

INSTALLATION INSTRUCTIONS - SIZES 3" - 48"



STEP 1

Existing joint must be disassembled and thoroughly cleaned. If necessary, replace the existing gasket with a field cut gasket. Brush both the gasket and the plain end with soapy water or approved pipe lubricant, which meets ANSI/AWWA C111/A21.11. Firmly insert the split gasket into the bell cavity.



STEP 2

Remove the clamping bolts from the split Stargrip®. Loosely assemble the halves on the pipe, making sure that the lip extension is towards the mechanical joint bell. Then reinstall the clamping bolts. Do not remove rubber washers prior to installation. Washers have been provided for proper wedge placement during shipment and installation.



STEP 3

Slide the loosely assembled Stargrip® towards the MJ bell and insert T-Bolts and hand-tighten the nuts.



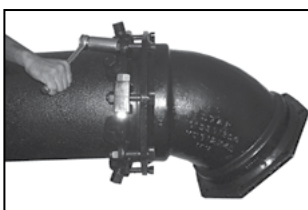
STEP 4

Tighten Clamping bolts on the Split Stargrip® to the following:

3" - 12": 100-125 FT-LBS.

14" - 36": 250-275 FT-LBS.

42" - 48": 300-325 FT-LBS.



STEP 5

Tighten the T-bolts to normal range of bolt torque. It is necessary that the gland be brought up toward the bell flange evenly, maintaining approximately the same distance between the gland and the face of the flange at all points around the socket. T-Bolts should be tightened alternately on the opposite sides (Star Pattern) (see table A).



STEP 6

Hand tighten the torque limiting twist off nuts in a clockwise direction until all wedges are in firm contact with the pipe surface.

Continue tightening in an alternative manner going on opposite sides [Star Pattern], until all of the nuts have been twisted off. Never turn a single nut over 180 degrees without alternating to another nut.

If removal is necessary, utilize the 5/8" hex head provided. [If reassembly is required, assemble the joint in the same manner as above and tighten the wedge bolts to 90 ft-lbs on sizes 3"-20", 120 ft-lbs on sizes 24"-36" & 130 ft-lbs on sizes 42"-48"].

(TABLE A) T-HEAD BOLT & NUT DETAILS

PIPE SIZE (IN)	BOLT SIZE (IN)	RANGE ¹ OF TORQUE (FT-LBS)
3	5/8	45-60
4-24	3/4	75-90
30-36	1	100-120
42-48	1 1/4	120-150

¹These torque ranges are requirements of AWWA C600

Notes:

- Not to be used on plain end fittings or PVC or HDPE pipe.
- May also be used on steel pipe* up to 12" (*transition gasket required on 12" and under). For 14" and larger steel applications, contact Star Pipe.
- Stargrips® must be adequately wrapped or protected if they are covered by concrete to ensure that concrete does not enter the wedge pocket.
- For applications exceeding the maximum pressure ratings listed, please contact Star Pipe Products for recommendations (see Tandem Stargrip® on page 10).
- For applications with vertical offsets, please contact Star Pipe Products for technical assistance.
- For applications on existing pipe, the pipe needs to be structurally sound and the surface needs to be relatively free of any corrosive by-products in order for the wedges to function properly. Please contact Star Pipe Products for technical assistance.

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STAR[®] PIPE PRODUCTS



Tandem Stargrip® series 3000T

For High Pressure DI Pipe to MJ Fitting Applications



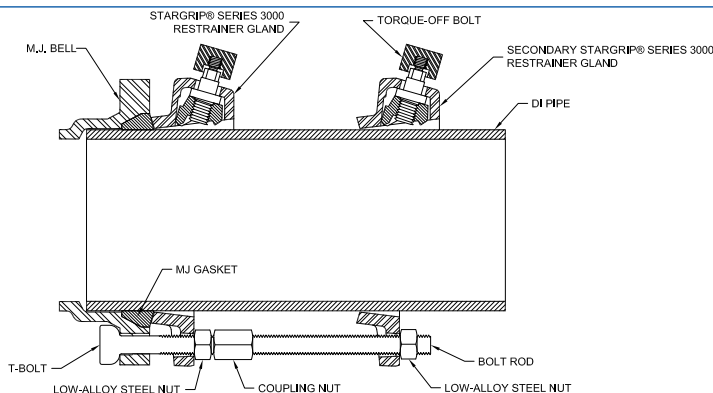
Stargrip® series 3000T for Ductile Iron Pipe.

INFORMATION

The Tandem Stargrip® Mechanical Joint Restraint System was designed for high pressure Ductile Iron Pipe to MJ Fitting applications (AWWA C153 or C110). Tandem Stargrip® pressure rating per table below is based on use with PC350 or TC50 (or above) ductile iron pipe.

For High Pressure Ductile Iron Pipe to MJ Fitting Applications

TECHNICAL INFORMATION



DATA FOR HIGH PRESSURE STARGRIP® ASSEMBLY

NOM. SIZE	DI PIPE OD	PRESSURE RATING (PSI)	BOLT ROD SIZE	T-BOLT SIZE	T-BOLT TORQUE (FT-LBS)	COUPLING NUT- GRADE 5 STEEL	WT
3	3.96	700	5/8 x 6	5/8 x 4	45-60	5/8 x 2 1/8	18
4	4.80	700	3/4 x 12	3/4 x 4 1/2	75-90	3/4 x 2 1/4	28
6	6.90	700	3/4 x 12	3/4 x 4 1/2	75-90	3/4 x 2 1/4	41
8	9.05	700	3/4 x 12	3/4 x 4 1/2	75-90	3/4 x 2 1/4	49
10	11.10	600	3/4 x 12	3/4 x 4 1/2	75-90	3/4 x 2 1/4	69
12	13.20	600	3/4 x 12	3/4 x 5	75-90	3/4 x 2 1/4	88
14	15.30	500	3/4 x 12	3/4 x 5	90-110	3/4 x 2 1/4	141
16	17.40	500	3/4 x 12	3/4 x 5	90-110	3/4 x 2 1/4	159
18	19.50	350	3/4 x 12	3/4 x 5	120-140	3/4 x 2 1/4	177
20	21.60	350	3/4 x 12	3/4 x 5 1/2	120-140	3/4 x 2 1/4	191
24	25.80	350	3/4 x 12	3/4 x 5 1/2	120-140	3/4 x 2 1/4	294
30	32.00	300	1 x 12	1 x 6 1/2	120-140	1 x 2 3/4	520
36	38.30	300	1 x 12	1 x 7 1/2	120-140	1 x 2 3/4	616
42	44.50	300	1 1/4 x 12	1 1/4 x 8 1/2	120-150	1 1/4 x 3	1118
48	50.80	300	1 1/4 x 12	1 1/4 x 8 1/2	120-150	1 1/4 x 3	1357

*All dimensions in inches except where indicated.

Notes:

- For applications with vertical offsets, please contact Star Pipe Products for technical assistance.

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Tandem Stargrip® series 3000T

For High Pressure DI Pipe to MJ Fitting Applications

INSTALLATION INSTRUCTIONS

Tandem Stargrip® Installation Instructions

1. To ensure the rubber gasket will seal more effectively, clean and remove all loose materials and rust from the mating surfaces. Lubricate the gasket and plain end by brushing either soapy water or pipe lubricant. Slide both Stargrip® Glands on the plain end, followed by the MJ gasket. Ensure that the lip of Stargrip® Glands are facing towards the MJ Gasket & MJ bell. Do not remove rubber washers prior to installation. Washers have been provided for proper wedge placement during shipment and installation.
2. After insertion of the pipe into the bell of the fitting, firmly press the gasket into the gasket recess. During this process the joint should be kept straight.
3. Slide the first Stargrip® toward the MJ bell with the gland lip against the gasket. Insert T-bolts and hand tighten nuts.
IMPORTANT: Make deflection after joint is assembled but before tightening T-bolts.
4. When tightening bolts, it is essential that the gland be brought up toward the bell flange evenly, maintaining approximately the same distance between the gland and the face of the flange at all points around the socket. All T-bolts should be tightened until there is less than 1/4" gap present between the bottom of the gland wedge pocket & the MJ flange. T-Bolts should be tightened alternately on the opposite sides (Criss-Cross Pattern) to the torque per table above.
5. Tighten the torque limiting twist off nuts in a clockwise direction until all wedges are in firm contact with the pipe surface.
6. Continue tightening in an alternative manner going on the opposite sides [Criss-Cross Pattern], until all of nuts have been twisted off. Never turn a single nut over 180 degrees without alternating to another nut. If removal is necessary, utilize the 5/8" hex head provided. [If reassembly is required, assemble the joint in the same manner as above and tighten the wedge bolt to 90 ft-lbs on sizes 3"-20", 120 FT-LBS on sizes 24"-36" and 130 FT-LBS on sizes 42"-48"].
7. Slide the secondary Stargrip® towards the first Stargrip®. Thread the coupling nut onto the exposed threads of the first assembled Stargrip® T-bolts.
8. Ensure that the bolt is threaded into the coupling nut at least half its length.
9. Then pass Bolt Rods through the bolt holes of the secondary Stargrip® & thread them into the coupling nuts & ensure that they enter approximately halfway into the coupling nuts. Make sure that the T-bolts & the bolt rods are butted against each other in the coupling nuts.
10. Tighten nuts onto the Bolt Rods behind the Secondary Stargrip® as shown in the sketch above & ensure that threads are shown past nut by at least the full length of the nut.
11. Pull the secondary Stargrip® away from the first Stargrip® to remove any slack in the joint. Tighten the torque limiting twist off nuts on the secondary Stargrip® in a clockwise direction until all wedges are in firm contact with the pipe surface.
12. Continue tightening in an alternative manner going on the opposite sides [Criss-Cross Pattern], until all of nuts have been twisted off.
13. Never turn a single nut over 180 degrees without alternating to another nut. If removal is necessary, utilize the 5/8" hex head provided.
14. Ensure that the Nuts behind the secondary Stargrip® are snug. Half turn by wrench only.
15. If reassembly is required, assemble the joint in the same manner as above and tighten the wedge bolt to 90 FT-LBS on sizes 3"-20", 120 FT-LBS on sizes 24"-36" and 130 FT-LBS on sizes 42"-48".

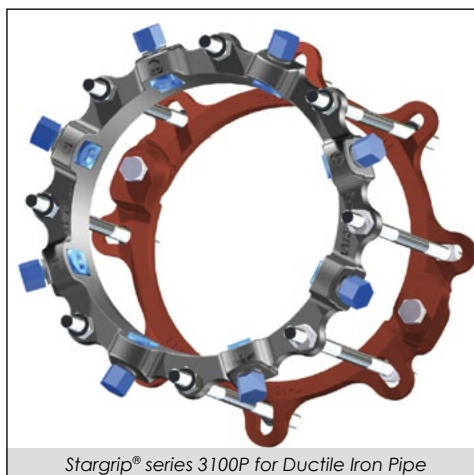
Notes:

- Designed for Restraining Mechanical Joint Fittings with DI Pipe per ANSI/AWWA C151
- For applications with vertical offsets, please contact Star Pipe Products for technical assistance.
- Pressure Rating has 2:1 safety factor
- Maintains full deflection on Mechanical Joints - same as standard Stargrip® (See page 3)
- T-Bolts/Rods/Hex Nuts: High Strength Low Alloy Steel Per ANSI/AWWA C111/A21.11
- Sizes 42" & 48" require extra long 1 1/4" x 8 1/2" T-bolts.
- Due to additional length of the T-bolt, some appurtenances (valves, etc.) may not accommodate T-bolt insertion through the backside of MJ bell.



Stargrip® series 3100P

Wedge Action Restraint
for Ductile Iron Pipe Bells - New Installations



Stargrip® series 3100P for Ductile Iron Pipe

FEATURES & ADVANTAGES

- Stargrip® and split back-up rings are manufactured from Ductile Iron per ASTM A536, Grade 65-45-12.
- Includes Stargrip® and Split Back-Up Ring (for sizes 3"-36") or two Stargrips® for sizes 42"-48" and high strength low alloy steel double ended rods and nuts which meet the requirements of ANSI/AWWA C111/A21.11
- Minimum Safety Factor 2:1
- For use on all classes of Ductile Iron Pipe -- Stargrip® restraint pressure rating per table below
- For new pipe-to-pipe installations only
- Pipe OD must be gauged overall to assure restraint will fit properly.
- Please refer to chart for maximum bell outside diameter for rod clearance.
- Standard gland color is Graphite Black (RAL 9011).

TECHNICAL INFORMATION

SPLIT STARGRIP® 3100P SPECIFICATIONS*

NOM. SIZE	MAX PRESSURE RATING (PSI)	RODS (QTY)	ROD DIA x LENGTH	MAX. BELL OD	APPROX WT. (LBS)
3	350	4	5/8 x 17	5.57	19
4	350	4	3/4 x 17	6.75	23
6	350	6	3/4 x 17	9.27	35
8	350	6	3/4 x 17	11.63	42
10	350	8	3/4 x 24	13.37	60
12	350	8	3/4 x 24	16.60	76
14	350	8	3/4 x 24	19.17	121
16	350	10	3/4 x 24	21.41	142
18	250	10	3/4 x 24	23.64	165
20	250	12	3/4 x 24	26.05	192
24	250	14	3/4 x 24	30.78	276
30	250	18	1 x 24	37.39	499
36	250	22	1 x 24	44.42	495
**42	250	28	1 1/4 x 30	49.37	996
**48	250	32	1 1/4 x 30	56.25	1175

*All dimensions in inches except where indicated.

** For sizes 42" and 48" two Stargrips® are provided; one on the spigot and one behind the bell.

Notes:

- For applications with vertical offsets, please contact Star Pipe Products for technical assistance.
- Pressure ratings shall not exceed the maximum pressure rating of the ductile iron pipe it is installed on.

SAMPLE SPECIFICATIONS

Restrainer mechanism shall be integrated into the design of the gland. As the mechanism is activated, multiple wedging action shall be imparted against the pipe increasing its resistance as internal pressure increases. After burial of the restraining mechanism, joint flexibility shall be maintained.

The actuating bolt shall be threaded into the restraining wedge and have a 1-1/4" hex operating nut. The operating nut shall be threaded onto the actuating bolt, not swaged or riveted. The restraining twist off nut bolt system shall have a torque-limiting feature designed to break off at preset torque levels, thus insuring proper action of restraining device. Glands shall be manufactured of high strength ductile iron in accordance with ASTM A536 Grade 65-45-12 requirements. The wedge shall be manufactured of high strength ductile iron and be heat treated to a minimum hardness of 370 BHN.

The mechanical joint restraint mechanism shall have a maximum water working pressure of 350 PSI for sizes 3"-16" and 250 PSI for sizes 18" and above. All sizes shall have a minimum safety factor of 2:1 (i.e. twice the maximum pressure rating of the restraint). The restraint mechanism shall be Star® Pipe Products, Stargrip® series 3100P or an approved equal.

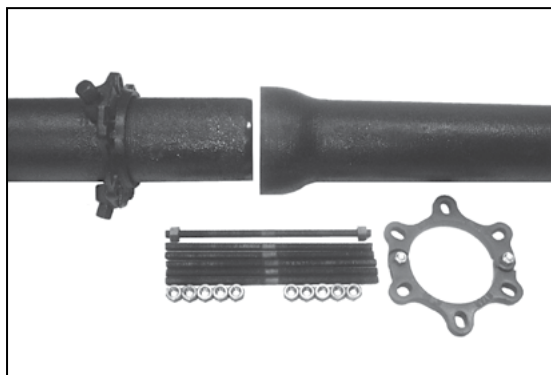
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Stargrip® series 3100P

Wedge Action Restraint
for Ductile Iron Pipe Bells - New Installations

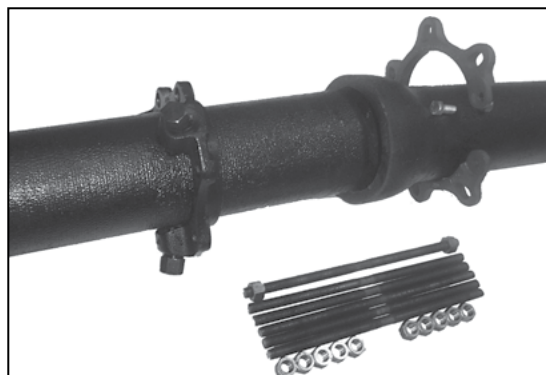
INSTALLATION INSTRUCTIONS - SIZES 3" - 48"*



STEP 1

Stargrip® Series 3100P is designed to restrain Push-On Ductile Iron Pipe connections (all thickness classes). It includes a Stargrip® Series 3000 restraint gland for the spigot end and an Split Back-Up Ring behind the bell.

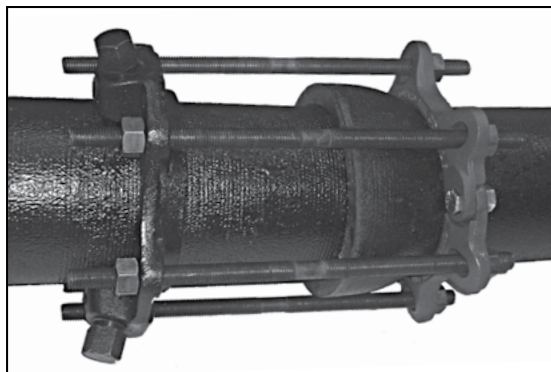
Place the Stargrip® Series 3000 restraint gland on the spigot end of the plain pipe with the lip extension facing towards the mating bell. Do not remove rubber washers prior to installation. Washers have been provided for proper wedge placement during shipment and installation.



STEP 2

Install the Split Back-Up Ring, behind the pipe bell in the direction indicated on the casting. Tighten clamping bolts on the Split Back-Up Ring 90 ft-lb.

Assemble the Pipe Push-On joint per the pipe manufacturer's installation instructions.

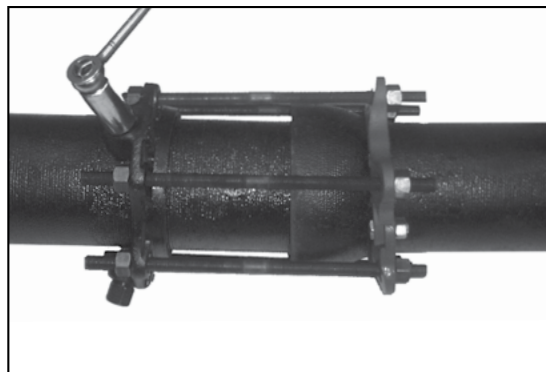


STEP 3

Rotate Stargrip® Series 3000 restraint gland on the spigot such that the boltholes are in alignment and adjust the position so that the distance between the glands is suitable for the double-ended rod length. Adequate length should be allowed on the double-ended rods so that nuts can be fully engaged with several threads showing.

Install the remaining double-ended rods provided in each bolt hole. Place nuts on the ends of each double-ended rod. Ensure that adequate length is allowed on rods to fully engage the nuts with several threads showing.

Pull Stargrip® Series 3000 restraint gland away from the joint until there is no slack in the rods.



STEP 4

Tighten the torque limiting twist off nuts in a clockwise direction until all the wedges are in firm contact with the pipe OD. Continue tightening in an alternative manner going on opposite sides (Star Pattern), until all of the nuts have been twisted off. Never turn a single nut over 180 degrees without alternating to another nut.

The nuts on the double-ended rods must be tightened until the Split Back-Up Ring is in firm contact with the back of the bell. These nuts should not be over tightened.

If removal of the Stargrip® Series 3000 restraint gland is necessary, utilize the 5/8" hex head provided. If reassembly is required, assemble the product in the same manner as above and tighten the wedge bolts to 90 ft-lbs on sizes 3"-20", 120 ft-lbs on sizes 24"-36", and 130 ft-lbs on sizes 42" and 48".

Important Note for Sizes 42" & 48":

- For sizes 42" & 48", two Stargrips are provided. Stargrip is placed on the spigot end of plain pipe with lip extension facing towards the mating bell. The other Stargrip is placed on the second pipe behind the bell with lip extension toward the bell. Proceed to follow steps 3 & 4 as listed above to complete installation.

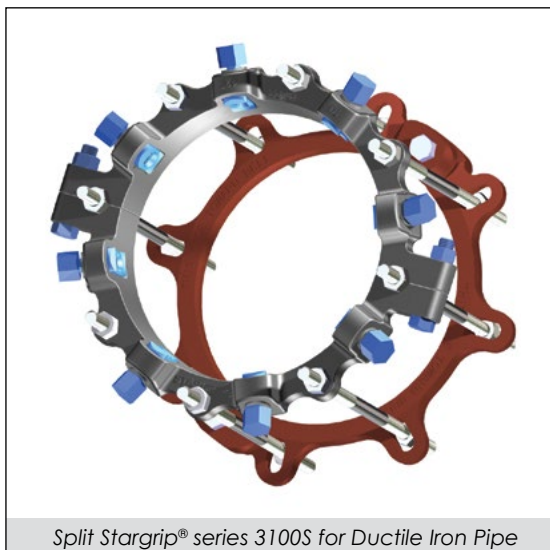
Notes:

- Not to be used on plain end fittings or PVC or HDPE pipe.
- May also be used on steel pipe up to 12". For 14" and larger steel applications, contact Star Pipe.
- Stargrips® must be adequately wrapped or protected if they are covered by concrete to ensure that concrete does not enter the wedge pocket.
- For applications exceeding the maximum pressure ratings listed, please contact Star Pipe Products for recommendations.
- For applications with vertical offsets please contact Star Pipe Products for technical assistance.
- For applications on existing pipe, the pipe needs to be structurally sound and the surface needs to be relatively free of any corrosive by-products in order for the wedges to function properly. Please contact Star Pipe Products for technical assistance.



Split Stargrip® series 3100S

Split Wedge Action Restraint
for Ductile Iron Pipe - New or Existing Installations



Split Stargrip® series 3100S for Ductile Iron Pipe

FEATURES & ADVANTAGES

- Split Stargrip® series 3000S and Split Back-Up ring produced from Ductile Iron per ASTM A536, Grade 65-45-12.
- Includes Stargrip® series 3000S, Split Back-Up Ring and high strength low alloy steel double ended rods and nuts which meet the requirements of ANSI/AWWA C111/A21.11
- Minimum Safety Factor 2:1
- For use on all classes of Ductile Iron Pipe - Stargrip® restraint pressure rating per table below
- For new and existing pipe to pipe installations
- Pipe OD must be gauged overall to assure restraint will fit properly.
- Please refer to chart for maximum bell outside diameter for rod clearance.
- Standard gland color is Graphite Black (RAL 9011).

TECHNICAL INFORMATION

SPLIT STARGRIP® 3100S SPECIFICATIONS*

NOM. SIZE	MAX PRESSURE RATING (PSI)	RODS (QTY)	ROD DIA x LENGTH	MAX. BELL OD	APPROX WT. (LBS)
3	350	4	5/8 x 17	5.57	22
4	350	4	3/4 x 17	6.75	26
6	350	6	3/4 x 17	9.27	36
8	350	6	3/4 x 17	11.63	42
10	300	8	3/4 x 24	13.37	64
12	300	8	3/4 x 24	16.60	78
14	300	8	3/4 x 24	19.17	122
16	300	10	3/4 x 24	21.41	142
18	200	10	3/4 x 24	23.64	154
20	200	12	3/4 x 24	26.05	186
24	200	14	3/4 x 24	30.78	288
30	200	18	1 x 24	37.39	485
36	200	22	1 x 24	44.42	600
**42	175	28	1 1/4 x 30	49.37	1176
**48	175	32	1 1/4 x 30	56.25	1366

*All dimensions in inches except where indicated.

** For sizes 42" and 48" split full body MJ Gland with links is provided along with split Star grip, follow it's assembly instructions during assembly.

Notes:

- For applications with vertical offsets, please contact Star Pipe Products for technical assistance.
- Pressure ratings shall not exceed the maximum pressure rating of the ductile iron pipe it is installed on.

SAMPLE SPECIFICATIONS

Restraint for DI push on bells shall incorporate the use of a split restraint and split follower into its design. Split restrainer mechanism shall be integrated into the design of the gland. As the mechanism is activated, multiple wedging action shall be imparted against the pipe increasing its resistance as internal pressure increases. After burial of the restraining mechanism, joint flexibility shall be maintained.

The actuating bolt shall be threaded into the restraining wedge and have a 1-1/4" hex operating nut. The operating nut shall be threaded onto the actuating bolt, not swaged or riveted. The restraining twist off nut bolt system shall have a torque-limiting feature designed to break off at preset torque levels, thus insuring proper action of restraining device. Split follower shall be manufactured of high strength ductile iron in accordance with ASTM A536 Grade 65-45-12 requirements. The wedge shall be manufactured of high strength ductile iron and be heat treated to a minimum hardness of 370 BHN.

The split mechanical joint restraint shall have a maximum water working pressure of 350 PSI for sizes 3" - 8", 300 PSI for sizes 10" - 16", 200 PSI for sizes 18" - 36" & 175 PSI for sizes 42" - 48". All sizes shall have a minimum safety factor of 2:1 (i.e. twice the maximum pressure rating of the restraint). The restraint mechanism shall be Star® Pipe Products, Split Stargrip® series 3100S or an approved equal.

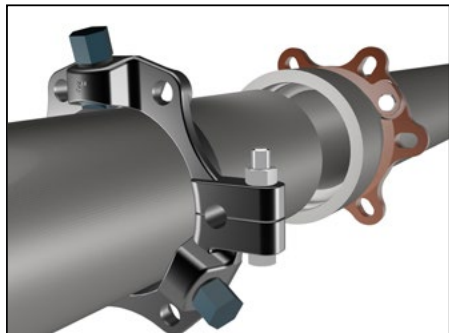
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Split Stargrip® series 3100S

Split Wedge Action Restraint
for Ductile Iron Pipe - New or Existing Installations

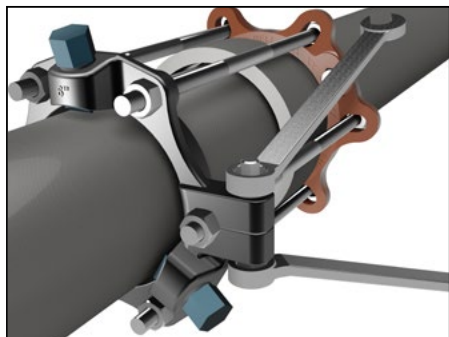
INSTALLATION INSTRUCTIONS - SIZES 3" - 36"

**STEP 1**

Split Stargrip® Series 3100S is designed to restrain new and existing installations of Ductile Iron Pipe, conforming to AWWA/ANSI C151/A21.51 (all thickness classes), push-on pipe bells. It includes a Split Stargrip® Series 3000S restraint gland for the spigot end and a Split Back-Up Ring behind the bell.

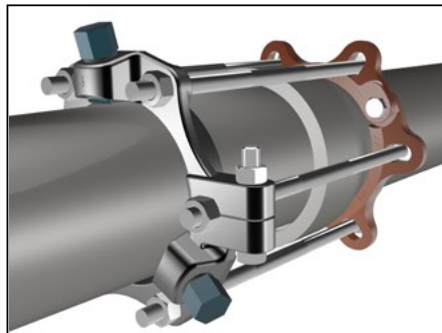
Assemble Push-On Pipe joint per pipe manufacturer's installation instructions in case of new installations or make sure that Push-On Pipe joint is installed correctly per manufacturer's installation instructions in case of existing joints.

Install the split back up ring behind the pipe bell in the direction indicated on the casting. Tighten clamping bolts on the split back-up ring to 90 ft-lbs on sizes 3" - 36". Remove the clamping bolts for the Split Stargrip® Series 3000S. Loosely assemble the halves on the spigot end of the pipe with clamping bolts, making sure that the lip extension on the halves is towards the mating pipe bell. Do not remove rubber washers prior to installation. Washers have been provided for proper wedge placement during shipment and installation.

**STEP 3**

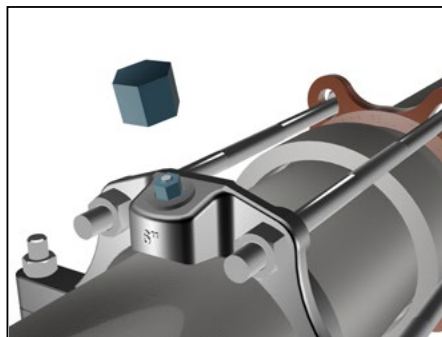
Pull Split Stargrip® Series 3000S restraint gland away from the joint until there is no slack in the rods. Tighten Clamping bolts on the Split Stargrip® Series to the following:

- 3" to 12" -- 100-125 FT-LBS
- 14" to 36" -- 250-275 FT-LBS

**STEP 2**

Rotate Split Stargrip® Series 3000S restraint gland on the spigot such that the bolt holes are in alignment and adjust the position so that the distance between the glands is suitable for the double-ended rod length. Adequate length should be allowed on the double-ended rods such that rod sticks out approximately 0.50" past the nut on each end.

Install the remaining double-ended rods provided in each bolt hole. Place nuts on the ends of each double-ended rod with rod approximately 0.50" past the nut on each end.

**STEP 4**

Tighten the torque limiting twist off nuts in a clockwise direction until all the wedges are in firm contact with the pipe OD. Continue tightening in alternative manner going on the opposite sides (Star Pattern), until all of the nuts have been twisted off. Never turn a single nut over 180 degrees without alternating to another nut.

The nuts on the double-ended rods for the Back-Up Ring must be tightened until the Back-Up Ring is in firm contact with the back of the bell. These nuts should not be over tightened.

If removal of the Split Stargrip® Series 3000S restraint gland is necessary, utilize the 5/8" hex head provided. If reassembly is required, assemble the product in the same manner as above and tighten the wedge bolts to 90ft-lbs on sizes 3"-20" & 120 ft-lbs on sizes 24"-36".

Notes:

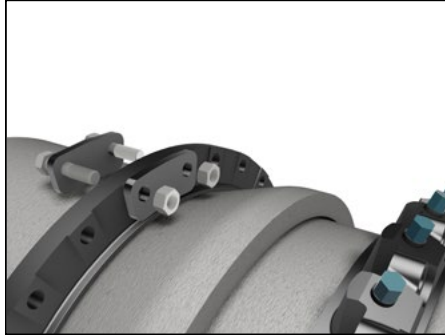
- Not to be used on plain end fittings, PVC or HDPE.
- Stargrips must be adequately wrapped or protected if they are covered by concrete to ensure that concrete is not allowed to enter the wedge pocket.
- Maximum pressure rating for sizes 3"-8" is 350psi, for sizes 10"-16" it is 300psi and for sizes 18"-36" it is 200psi. For applications exceeding the maximum pressure rating, please contact Star Pipe Products for recommendations.
- For applications with vertical offsets please contact Star Pipe Products for technical assistance.
- For applications on existing pipe, the surface of the pipe needs to be sufficient for proper wedge engagement. Please contact Star Pipe Products for technical assistance.



Split Stargrip® series 3100S

Split Wedge Action Restraint
for Ductile Iron Pipe - New or Existing Installations

INSTALLATION INSTRUCTIONS - SIZES 42" - 48"

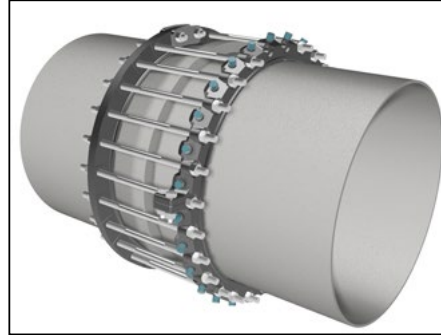
**STEP 1**

Series 3100S is designed to restrain new and existing installations of Ductile Iron Pipe, conforming to AWWA/ANSI C151 / A21.51 (all thickness classes), push-on pipe bells. It includes a Split Stargrip® Series 3000S restraint gland for the spigot end and a Split Back-Up Ring with links behind the bell.

Assemble Push-On Pipe joint per pipe manufacturer's installation instructions in case of new installations or make sure that Push-On Pipe joint is installed correctly per manufacturers installation instructions in case of existing joints.

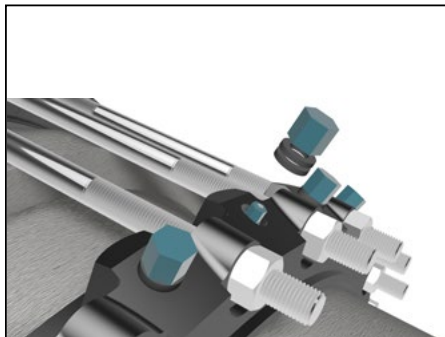
Remove the clamping bolts for the Split Stargrip® Series 3000S. Loosely assemble the halves on the spigot end of the pipe with clamping bolts making sure that the lip extension on the halves is towards the mating pipe bell. Do not remove rubber washers prior to installation. Washers have been provided for proper wedge placement during shipment and installation.

Install the split back up ring, with lip facing towards the pipe bell and it is in firm contact with back of the pipe bell, along with hex head bolts, nuts and links provided on both split ends. Tighten nuts on link to 300-325 ft-lbs. The Split Stargrip is positioned such that split surface of Stargrip is 90° to Split Surface of back up ring.

**STEP 2**

Pull Split Stargrip® Series 3000S restraint gland away from the joint such that double-ended rods provided sticks out approximately 0.50" past the nuts. Tighten Clamping bolts on the Split Stargrip® to 300-325 ft-lbs.

Install the double-ended rods provided in each bolt hole except the bolt holes directly facing the bolt holes on back-up ring where hex bolts have been used and assemble nuts on the ends of each double-ended rod.

**STEP 3**

Tighten the torque limiting twist off nuts in clockwise direction until all the wedges are in firm contact with the pipe OD. Continue tightening in an alternative manner going on the opposite sides (Star Pattern), until all of the nuts have been twisted off. Never turn a single nut over 180° without alternating to another nut.

If removal of the Split Stargrip® is necessary, utilize the 5/8" hex head provided. If reassembly is required, assemble the joint in the same manner as above and tighten the wedge bolt to 130 ft-lbs.

STAR® PIPE PRODUCTS

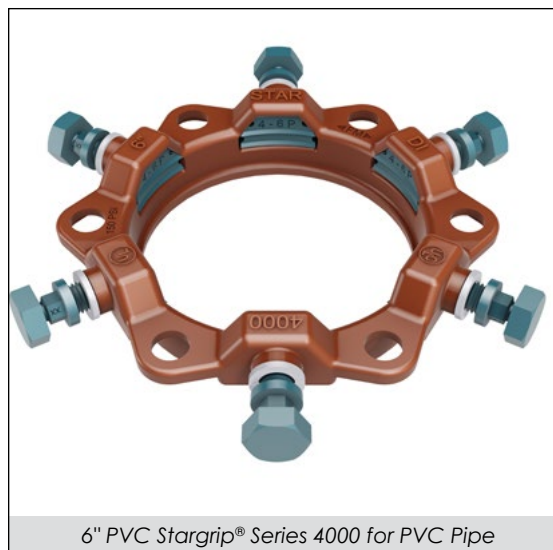
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STAR[®] PIPE PRODUCTS



PVC Stargrip® series 4000

Mechanical Joint Wedge Action Restraint
for Plastic Pressure Pipe



6" PVC Stargrip® Series 4000 for PVC Pipe

INFORMATION

The PVC Stargrip® Mechanical Joint Restraint System is a unique product with a proven design that provides an exceptional restraining system for mechanical joint fittings (AWWA C153 or C110), valves, fire hydrants on a variety of plastic pressure pipes.

Unique Product with a Proven Design

FEATURES & ADVANTAGES

- The design has been proven in the market since 1992.
- Can be used on AWWA C900, AWWA C905 PVC pipe, IPS PVC pipe, AWWA C909 PVCO pipe, and HDPE pipe. See pressure rating table for approved DRs and sizes. Plastic pressure pipes manufactured to an IPS diameter regimen will require a transition gasket. HDPE pipe requires use of stainless steel pipe stiffener.
- Gland is made from high strength Ductile Iron per ASTM A536 Grade 65-45-12 and is compatible with all Mechanical Joints conforming to ANSI/AWWA C111/A21.11.
- Eliminates the need for tie rods and thrust blocks
- Listed with Underwriters Laboratories and approved by Factory Mutual research in sizes 4"-12".
- Tested to and meets the requirements of ASTM F1674 through 14".
- The safety factor is twice (2:1) the standardized pressure rating listed on Page 19.
- Will fit any Mechanical Joint configuration, meaning compatibility with different types of installations.
- PVC Stargrip® offers 5° deflection through 12", 3° on 14"-24" and 2° on 30"-36".
- Larger ID allows easier installation on out-of-round pipe.
- Torque limiting bolts are designed to prevent over torquing.
- All sizes have curved wedges that do not flatten pipe.
- Standard gland color is Coral Red (RAL 3016).

SAMPLE SPECIFICATIONS

Restrainer mechanism shall be integrated into the design of the follower gland. As the mechanism is activated, multiple wedging action shall be imparted against the pipe increasing its resistance as internal pressure increases. After burial of the restraining mechanism, joint flexibility shall be maintained.

The actuating bolt shall be threaded into the gland and have a 1-1/4" hex operating nut. The actuating bolt system shall have a torque-limiting head designed to break off at preset torque levels, thus insuring proper action of the restraining device. After removal of the torque-limiting head, a secondary hex head shall remain to facilitate the removal and re-assembly of the gland. Glands, bolts and wedges shall be manufactured of high strength ductile iron in accordance with ASTM A536 Grade 65-45-12 requirements.

Applicable dimensions conforming to ANSI/AWWA C111/A21.11, C110/A21.10 and C153/A21.53 and shall be incorporated into the design so that the device facilitates use with standard mechanical joint sockets.

The restraining mechanism shall have a pressure rating as stated in most current catalog and shall have a safety factor of at least 2:1. The restraining device shall be Star® Pipe Products PVC Stargrip® Series 4000 or equal.

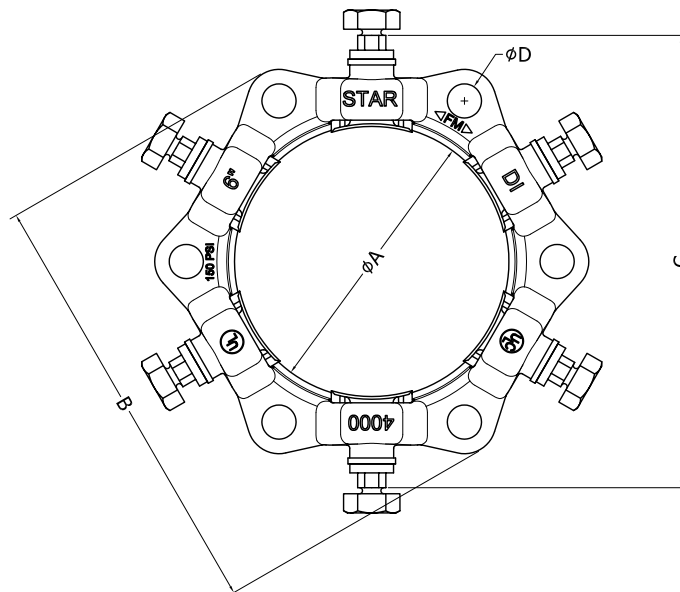
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PVC Stargrip® series 4000

Mechanical Joint Wedge Action Restraint
for Plastic Pressure Pipe

TECHNICAL INFORMATION



6" PVC Stargrip® Series 4000

PVC STARGRIP® 4000 SPECIFICATIONS*

NOM. SIZE	ØA	B	C ¹	ØD	T-BOLTS SIZE (QTY)	WEDGES (QTY)	APPROX WT. (LBS)
3	4.09	7.69	8.50	3/4	5/8 (4)	4	7
4	4.93	9.12	9.53	7/8	3/4 (4)	4	9
6	7.03	11.12	11.63	7/8	3/4 (6)	6	13
8	9.18	13.37	13.97	7/8	3/4 (6)	6	17
10	11.23	15.62	16.18	7/8	3/4 (8)	8	23
12	13.33	17.87	18.18	7/8	3/4 (8)	8	28
14	15.45	20.75	20.36	7/8	3/4 (10)	10	50
16	17.55	23.00	22.46	7/8	3/4 (12)	12	60
18	19.65	25.25	24.56	7/8	3/4 (12)	12	65
20	21.75	27.50	26.66	7/8	3/4 (14)	14	76
24	25.95	32.00	30.86	7/8	3/4 (16)	16	98
30	32.18	39.38	36.82	1-1/8	1 (20)	20	173
36	38.48	46.25	43.12	1-1/8	1 (24)	24	219

*All dimensions in inches except where indicated.

¹ - dimension after assembly on pipe



PVC Stargrip® series 4000

Mechanical Joint Wedge Action Restraint
for Plastic Pressure Pipe

TECHNICAL INFORMATION

Table A. Maximum Working Pressure Rating with Occasional or Recurring Surges in PSI for Plastic Pipes Made to a CIOD Diameter Regimen

NOM. SIZE (IN)	Actual Plastic Pipe OD	AWWA C900 PVC			AWWA C905 PVC				AWWA C909 PVCO			AWWA C906 HDPE*					
		DR14	DR18	DR25	DR18	DR21	DR25	DR32.5	IPEX PVCO PC235	JM EAGLE PVCO PC235	PC165	DR 7.3	DR 9	DR 9.3	DR11	DR13.5	DR17
4	4.80	305	235	165					235			254	200	193	160	130	100
6	6.90	305	235	165					235	235		254	200	193	160	130	100
8	9.05	305	235	165					235	235		254	200	193	160	130	100
10	11.10	305	235	165					235	235		254	200	193	160	130	100
12	13.20	305	235	165					235	235		254	200	193	160	130	100
14	15.30				235	200	165	125	235				200	193	160		
16	17.40				235	200	165	125	235		165				160		
18	19.50				235	200	165	125	200						160		
20	21.60				235	200	165	125									
24	25.80				235	200	165	125									
30	32.00						165	125									
36	38.30						165	125									

* A stainless steel pipe stiffener (provided by others) is required for the Series 4000 to be installed on HDPE pressure pipe. The stiffener must be installed in the HDPE pipe before installing the Series 4000. The stainless steel pipe stiffener must be of sufficient length to support the full bearing length of the restrainer.

Table B. Maximum Working Pressure Rating with Occasional or Recurring Surges in PSI for Plastic Pipes Made to an IPS Diameter Regimen

NOM. SIZE (IN)	Actual Plastic Pipe OD	ASTM D2241 PVC			AWWA C901 and AWWA C906 HDPE**					
		SDR17	SDR21	SDR26	DR 7.3	DR 9	DR 9.3	DR11	DR13.5	DR17
3	3.50	250	200	160	254	200		160	130	100
4	4.50	250	200	160	254	200	193	160	130	100
6	6.63	250	200	160	254	200	193	160	130	100
8	8.63	250	200	160	254	200	193	160	130	100
10	10.75	250	200	160	254	200	193	160	130	100
12	12.75	250	200	160	254	200	193	160	130	100

NOTE: A transition gasket is required for use with pipes made to an IPS diameter regimen.

** A stainless steel pipe stiffener (provided by others) is required for the Series 4000 to be installed on HDPE pressure pipe. The stiffener must be installed in the HDPE pipe before installing the Series 4000. The stainless steel pipe stiffener must be of sufficient length to support the full bearing length of the restrainer.



PVC Stargrip® series 4000

Mechanical Joint Wedge Action Restraint
for Plastic Pressure Pipe

INSTALLATION INSTRUCTIONS - SIZES 3" - 36"

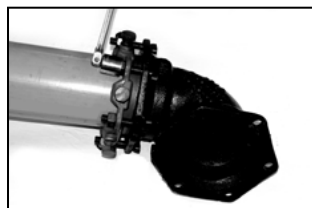


STEP 1

The rubber gasket seals more effectively if the surfaces with which it comes in contact are thoroughly cleaned just before assembly to remove all loose rust or foreign material. Lubrication and additional cleaning should be provided by brushing both the gasket and the plain end with soapy water or pipe lubricant. Slide the SERIES 4000 on the plain end, followed by the MJ gasket.

IMPORTANT: When used on IPS plastic pressure pipe, a transition MJ gasket must be used.

NOTE: If installing the Series 4000 on HDPE pressure pipe, a stainless steel pipe stiffener (provided by others) is required. The stiffener must be installed in the HDPE pipe before installing the Series 4000. The stainless steel pipe stiffener must be of sufficient length to support the full bearing length of the restrainer.



STEP 4

While tightening T-bolts, it is essential that the gland be brought up toward the bell flange evenly, maintaining approximately the same distance between the gland and the face of the flange at all points around the socket. In order to keep the spigot fully homed in the MJ bell, the joint will need to be kept in compression until the completion of step 6.

All T-bolts should be tightened until they are within the torque range as listed in Table C. This may require multiple rounds.

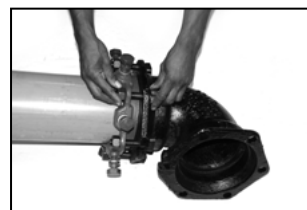
Notes:

- If effective sealing is not attained at the maximum torque indicated, then the joint should be disassembled, thoroughly cleaned, and reassembled. Overstressing the bolts to compensate for poor installation practice is not acceptable.*
- Not to be used on DI or steel pipe.*
- Stargrips must be adequately wrapped or protected if they are covered by concrete to ensure that concrete is not allowed to enter the wedge pocket.*
- For applications with vertical offsets please contact Star Pipe Products for technical assistance.*



STEP 2

After insertion of the pipe into the bell of the fitting firmly press the gasket into the gasket recess. During this process the joint should be kept straight.



STEP 3

Slide the SERIES 4000 toward the MJ bell with the gland lip against the gasket. Insert T-bolts and hand tighten nuts.

IMPORTANT: Make deflection after joint is assembled but before tightening T-bolts.



STEP 5

Tighten the Torque – limiting twist – off bolts in a clockwise direction until all wedges are in firm contact with the pipe surface.

IMPORTANT: When installing sizes 4" through 12" on IPS plastic pipe, the spacer washers must be removed from the torque limiting bolts.



STEP 6

Continue tightening in an alternating manner until all of the Torque – limiting twist – off bolt heads have been twisted off.

If removal is necessary, utilize the 5/8" hex head provided. If reassembly is required, assemble the joint in the same manner as above and tighten the wedge bolt to 90 ft-lbs.

Table C. T-Head Bolt and Nut Details

NOM. PIPE SIZE (IN)	BOLT SIZE (IN)	RANGE OF TORQUE (FT-LBS)				
		AWWA C900 (PVC)	ASTM D2241 (PVC)	AWWA C909 (PVC)	AWWA C905 (PVC)	AWWA C901/ AWWA C906 (HDPE)
3	5/8		45 - 60			75-90
4 to 12	3/4	75-90	75-90	55-65		75-90
14 to 18	3/4			75-90	75-90	75-90
20 to 24	3/4				75-90	
30 to 36	1				100 -120	



PVC Stargrip® series 4000G2

Mechanical Joint Wedge Action Restraint
for Plastic Pressure Pipe
Patent Pending



6" PVC Stargrip® Series
4000G2 for PVC Pipe

INFORMATION

The PVC Stargrip® Second Generation (Gen 2) Mechanical Joint Restraint System has all the performance advantages as its predecessor. However, the Gen 2 design offers these advantages with an installation that is quicker and easier. Gen 2 provides an exceptional restraint system for mechanical joint fittings (AWWA C153 or C110), valves, fire hydrants on a variety of plastic pressure pipes.

**Increased performance
with quicker and easier installation.**



FEATURES & ADVANTAGES

- Can be used on 4" through 12" AWWA C900 and AWWA C909 PVC pipe, HDPE pipe or 3"-12" IPS PVC pipe*. (*A transition gasket is required on IPS Plastic Pipe).
- Tested to and meets the requirements of ASTM F1674.
- Listed with Underwriters Laboratories in sizes 4" to 12".
- Approved by Factory Mutual Research in sizes 4" to 12".
- The safety factor is twice (2:1) the standardized pressure rating listed on next page.
- Improved design (Gen 2) provides same performance with fewer wedges and lower wedge-bolt torque (45 to 60 ft-lbs).
- Fewer wedges and lower torque results in a quicker and easier installation.
- Gen 2 design uses a spacer that is easily removed when restraint is used on IPS Plastic pipe. Wedge bolts no longer need to be removed and reinstalled to remove spacer.
- Curved wedges reduce the amount of localized pipe deformation.
- Gen 2 offers five degrees of deflection on all sizes of AWWA C900 pipe.
- The gland's larger inside diameter allows Gen 2 to be installed on pipe with more ovality.
- Improved design of the wedge bolts prevents over torquing which can damage PVC pipe.
- Wedges are mechanically attached to wedge bolts, which eliminates the possibility of falling out during shipping and handling.
- Gland is made from high strength Ductile Iron per ASTM A536 Grade 65-45-12 and is compatible with all Mechanical Joints that conform to ANSI/AWWA C111/A21.11. Standard gland color is Coral Red (RAL 3016).
- Eliminates the need for tie rods and thrust blocks.
- Patent Pending

SAMPLE SPECIFICATIONS

Restrainer mechanism shall be integrated into the design of the restraint gland. As the mechanism is activated, multiple wedge action shall be imparted against the pipe OD increasing its resistance as internal pressure increases. After burial of the restraining mechanism, joint flexibility shall be maintained.

The actuating bolt shall be threaded into the gland and have a 1-1/4" hex operating head. The actuating bolt system shall have a torque-limiting head designed to break off at preset torque levels, thus insuring proper action of the restraining device. After removal of the torque-limiting head, a secondary hex head shall remain to facilitate the removal and re-assembly of the gland. Glands, bolts and wedges shall be manufactured of high strength ductile iron in accordance with ASTM A536 Grade 65-45-12 requirements.

Applicable dimensions conforming to ANSI/AWWA C111/A21.11, C110/A21.10 and C153/A21.53 shall be incorporated into the design so that the device facilitates use with standard mechanical joint sockets.

The restraining mechanism shall have a pressure rating as stated in most current catalog and shall have a safety factor of at least 2:1. The restraining device for C900 PVC, C909 PVC and IPS PVC Pipe shall be Star® Pipe Products second Generation PVC Stargrip® Series 4000G2 or equal.

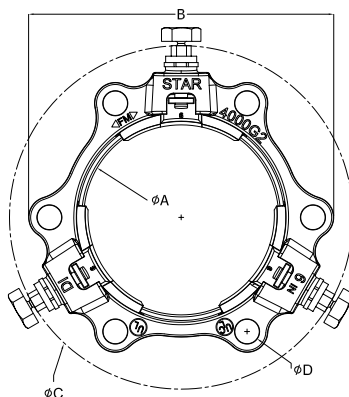
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PVC Stargrip® series 4000G2

Mechanical Joint Wedge Action Restraint
for Plastic Pressure Pipe
Patent Pending

TECHNICAL INFORMATION



6" PVC Stargrip® Series 4000G2 for PVC Pipe

PVC STARGRIP® 4000G2 SPECIFICATIONS*

NOM. SIZE	C900/C909 PIPE CI OD	IPS PIPE OD (TRANSITION GASKET REQUIRED)	ØA	B	ØC ¹	ØD	T-BOLT SIZE (QTY)	WEDGE (QTY)	APPROX WT. (LBS)
3	N/A	3.50	4.09	7.57	9.01	3/4	5/8 x 3 (4)	2	6
4	4.80	4.50	4.93	9.00	10.29	7/8	3/4 x 3 1/2 (4)	2	7
6	6.90	6.63	7.03	11.00	12.39	7/8	3/4 x 3 1/2 (6)	3	10
8	9.05	8.63	9.18	13.25	14.44	7/8	3/4 x 4 (6)	4	15
10	11.10	10.75	11.23	15.62	16.59	7/8	3/4 x 4 (8)	6	21
12	13.20	12.75	13.33	17.87	18.54	7/8	3/4 x 4 (8)	6	25

*All dimensions in inches except where indicated.

¹ - dimension after assembly on pipe

Table A. Maximum Working Pressure Rating with Occasional or Recurring Surges in PSI for Plastic Pipes Made to a CIOD Diameter Regimen

NOM. SIZE (IN)	Actual Plastic Pipe OD	AWWA C900 PVC			AWWA C909 PVCO		AWWA C906 HDPE*					
		DR14	DR18	DR25	IPEX PVCO PC235	JM EAGLE PVCO PC235	DR 7.3	DR 9	DR 9.3	DR11	DR13.5	DR17
4	4.80	305	235	165	235		254	200	193	160	130	100
6	6.90	305	235	165	235	235	254	200	193	160	130	100
8	9.05	305	235	165	235	235	254	200	193	160	130	100
10	11.10	305	235	165	235	235	254	200	193	160	130	100
12	13.20	305	235	165	235	235	254	200	193	160	130	100

* A stainless steel pipe stiffener (provided by others) is required for the Series 4000G2 to be installed on HDPE pressure pipe. The stiffener must be installed in the HDPE pipe before installing the Series 4000G2. The stainless steel pipe stiffener must be of sufficient length to support the full bearing length of the restrainer.

Table B. Maximum Working Pressure Rating with Occasional or Recurring Surges in PSI for Plastic Pipes Made to an IPS Diameter Regimen

NOM. SIZE (IN)	Actual Plastic Pipe OD	ASTM D2241 PVC			AWWA C901 and AWWA C906 HDPE**					
		SDR17	SDR21	SDR26	DR 7.3	DR 9	DR 9.3	DR11	DR13.5	DR17
3	3.50	250	200	160	254	200		160	130	100
4	4.50	250	200	160	254	200	193	160	130	100
6	6.63	250	200	160	254	200	193	160	130	100
8	8.63	250	200	160	254	200	193	160	130	100
10	10.75	250	200	160	254	200	193	160	130	100
12	12.75	250	200	160	254	200	193	160	130	100

NOTE: A transition gasket is required for use with pipes made to an IPS diameter regimen.

** A stainless steel pipe stiffener (provided by others) is required for the Series 4000G2 to be installed on HDPE pressure pipe. The stiffener must be installed in the HDPE pipe before installing the Series 4000G2. The stainless steel pipe stiffener must be of sufficient length to support the full bearing length of the restrainer.



PVC Stargrip® series 4000G2

Mechanical Joint Wedge Action Restraint
for AWWA C900/C909 and IPS PVC Pipe
Patent Pending

INSTALLATION INSTRUCTIONS - SIZES 3" - 12"



STEP 1

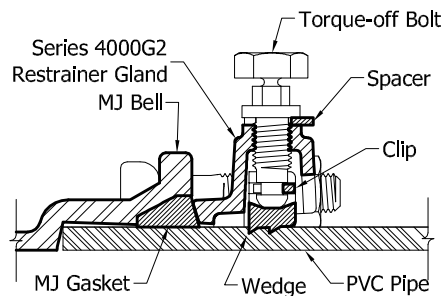
The rubber gasket seals more effectively if the surfaces with which it comes in contact are thoroughly cleaned just before assembly. Remove all foreign material while cleaning. Lubrication and additional cleaning should be provided by brushing both the gasket and the plain end with soapy water or pipe lubricant. Slide the SERIES 4000G2 on the plain end with lip facing the plain end, followed by the MJ gasket with tapered side facing the plain end.

IMPORTANT: When installing sizes 4" through 12" on IPS PVC pipe, MJ Transition gasket must be used.

STEP 4

While tightening T-bolts, it is essential that the gland be brought up toward the bell flange evenly, maintaining approximately the same distance between the gland and the face of the flange at all points around the socket. In order to keep the spigot fully homed in the MJ bell, the joint will need to be kept in compression until the completion of Step 6. All T-bolts should be tightened until they are within the torque range as listed in table below. This process may require multiple rounds.

After insertion of the pipe into the bell of the fitting, firmly press the gasket into the gasket recess. During this process the joint should be kept straight.



STEP 2

STEP 3

Slide the SERIES 4000G2 toward the MJ bell with the gland lip evenly pressed against the gasket. Insert T-bolts and hand tighten nuts.

IMPORTANT: Make deflection after joint is assembled but before tightening T-bolts to required torque range as listed in table below.



STEP 6

STEP 5

Hand tighten the Torque-limiting twist-off bolts in a clockwise direction until all wedges are in firm contact with the pipe surface.

IMPORTANT: When installing sizes 4" through 12" on IPS PVC pipe, spacers must be removed from the torque-limiting bolts.

Continue tightening in an alternating manner until all of the Torque-limiting twist-off bolt heads have been twisted off. If removal is necessary, utilize the 5/8" hex head provided. If reassembly is required, assure that all of the Torque-off bolts, wedges, clips and spacers (if required) are in place. Assemble the joint in the same manner as above and tighten the wedge bolts to 45-60 ft.-lbs. using 5/8" hex head provided.

Table C. T-Head Bolt and Nut Details

NOM. PIPE SIZE (IN)	BOLT SIZE (IN)	RANGE OF TORQUE (FT-LBS)			
		AWWA C900 (PVC)	ASTM D2241 (PVC)	AWWA C909 (PVC)	AWWA C901/AWWA C906 (HDPE)
3	5/8		45 - 60		75-90
4 to 12	3/4	75-90	75-90	55-65	75-90

* Deflection not allowed for C909.

Notes:

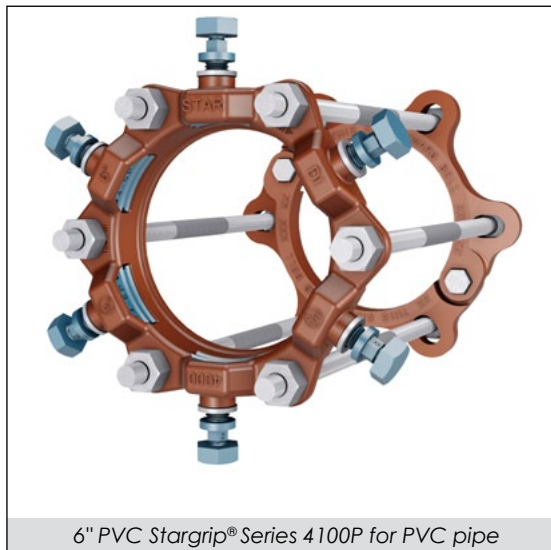
- If effective sealing is not attained at the maximum torque indicated, then the joint should be disassembled, thoroughly cleaned, and reassembled. **Overstressing the bolts to compensate for poor installation practice is not acceptable.**
- Not to be used on DI or steel pipe.
- PVC Stargrips must be adequately wrapped or protected if they are covered by concrete to ensure that concrete is not allowed to enter the wedge pocket.
- For applications with vertical offsets please contact Star Pipe Products for technical assistance.

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PVC Stargrip® series 4100P

Wedge Action Restraint for AWWA C900/C905 PVC Pipe Bells
New Installations Only



6" PVC Stargrip® Series 4100P for PVC pipe

FEATURES & ADVANTAGES

- For use on ANSI/AWWA C900/C905 CI OD PVC pipe
- For new Push-On Pipe Bell installations only
- Includes PVC Stargrip®, Split Back-Up Ring and high strength low alloy steel double ended rods and nuts which meet the requirements of ANSI/AWWA C111/A21.11
- Please refer to chart for maximum bell outside diameter for rod clearance.
- The safety factor is twice (2:1) the product pressure rating (see chart on pg. 18).
- Standard gland color is Coral Red (RAL 3016).

New Installations Only

TECHNICAL INFORMATION

PVC STARGRIP® 4100P SPECIFICATIONS*

NOM. SIZE	RODS (QTY)	ROD DIA x LENGTH	MAX. BELL OD	APPROX WT. (LBS)
4	4	3/4 x 17	6.75	24
6	6	3/4 x 17	9.23	34
8	6	3/4 x 17	11.50	42
10	8	3/4 x 24	14.15	61
12	8	3/4 x 24	16.53	70
14	8	3/4 x 24	19.57	121
16	10	3/4 x 24	21.13	144
18	10	3/4 x 24	23.47	161
20	12	3/4 x 24	25.55	189
24	14	3/4 x 30	30.79	250
30	18	1 x 40	37.99	470
36	22	1 x 40	45.40	576

*All dimensions in inches except where indicated. See page 22 for installation instructions.

SAMPLE SPECIFICATIONS

Restraint for PVC push-on bells shall incorporate the use of a solid wedge action restraint and split follower into its design. Restrainer mechanism shall be integrated into the design of the follower gland. As the mechanism is activated, multiple wedging action shall be imparted against the pipe increasing its resistance as internal pressure increases. After burial of the restraining mechanism, joint flexibility shall be maintained.

The actuating bolt shall be threaded into the gland and have a 1-1/4" hex operating nut. The actuating bolt system shall have a torque-limiting head designed to break off at preset torque levels, thus insuring proper action of the restraining device. After removal of the torque-limiting head, a secondary hex head shall remain to facilitate the removal and re-assembly of the gland. Glands, bolts and wedges shall be manufactured of high strength ductile iron in accordance with ASTM A536 Grade 65-45-12 requirements.

Applicable dimensions conforming to ANSI/AWWA C111/A21.11, C110/A21.10 and C153/A21.53 and shall be incorporated into the design so that the device facilitates use with standard mechanical joint sockets.

All sizes shall have a minimum safety factor of 2:1 (i.e. twice the product pressure rating as stated in most current catalog). The restraint mechanism shall be Star® Pipe Products, PVC Stargrip® series 4100P or approved equal.

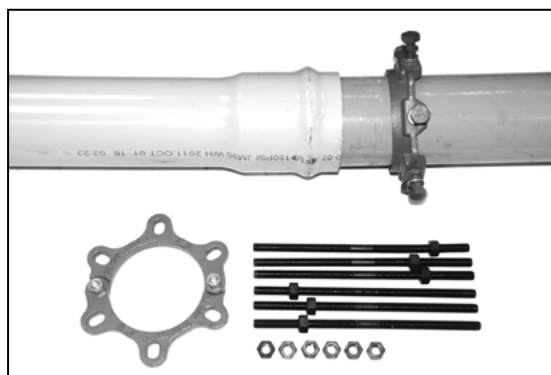
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PVC Stargrip® series 4100P

Wedge Action Restraint for AWWA C900/C905 PVC Pipe Bells
New Installations Only

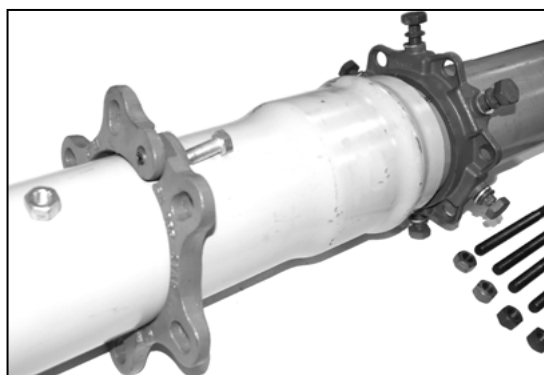
INSTALLATION INSTRUCTIONS - SIZES 4" - 36"

**STEP 1**

PVC Stargrip® Series 4100P is designed to restrain PVC Pipe, conforming to AWWA/ANSI AWWA C900/C905 (all pressure classes), push-on pipe bells. It includes a PVC Stargrip® Series 4000 gland for the spigot end and a split back-up ring behind the bell.

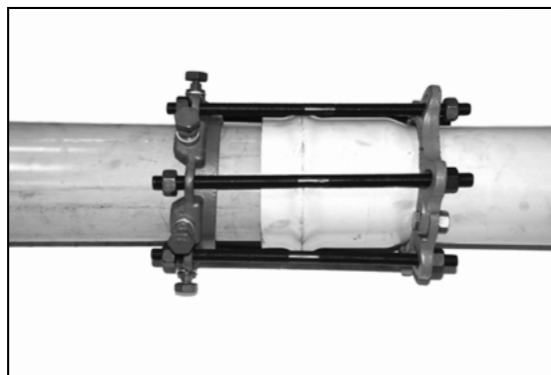
Place the PVC Stargrip® Series 4000 restraint gland on the spigot end of the second pipe with the lip extension facing towards the mating bell.

Assemble the PVC Pipe Push-On joint per the pipe manufacturer's installation instructions.

**STEP 2**

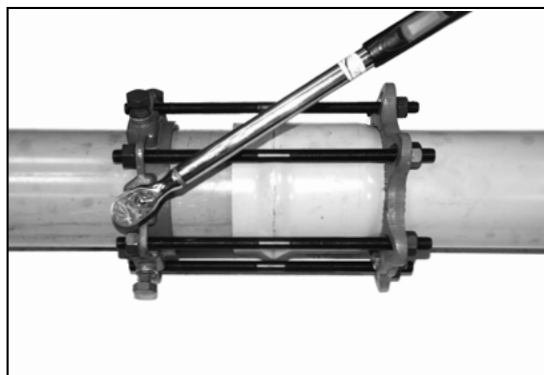
Install the split back up ring, behind the pipe bell in the direction indicated on the casting. Tighten clamping bolts on the split back-up ring to 90 ft-lb.

Rotate PVC Stargrip® Series 4000 restraint gland on the spigot such that the boltholes are in alignment and adjust the position so that the distance between the glands is suitable for the double-ended rod length. Adequate room should be allowed on the double-ended rods so that nuts can be fully engaged with several threads showing.

**STEP 3**

Install the remaining double-ended rods provided in each bolt hole for evenly distributing the operating load. Place nuts on the ends of each double-ended rod. It is to be ensured that adequate room is allowed on rods to fully engage the nuts with several threads showing.

Pull PVC Stargrip® Series 4000 restraint gland away from the joint until there is no slack in the rods.

**STEP 4**

Tighten the torque limiting twist off nuts in a clockwise direction until all the wedges are in firm contact with the pipe OD. Continue tightening in an alternating manner until all of the torque-limiting twist-off bolt heads have been twisted off.

The nuts on the double-ended rods must be tightened until the back-up ring is in firm contact with the back of the bell. These nuts should not be over tightened.

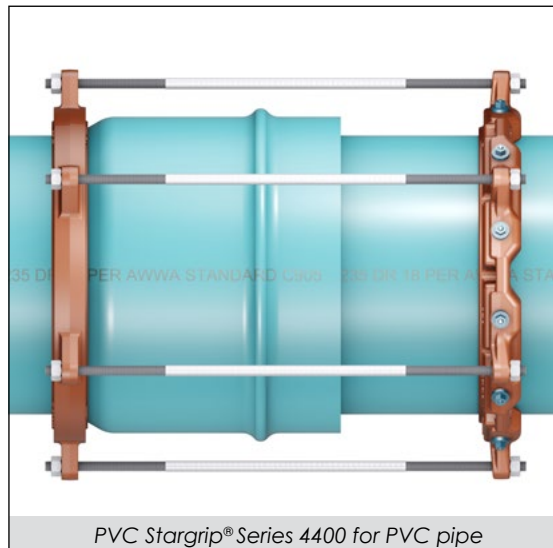
If removal of the PVC Stargrip® Series 4000 restraint gland is necessary, utilize the 5/8" hex head provided for 3" to 12", or 1 1/4" hex head provided for 14" to 36." If reassembly is required, assemble the product in the same manner as above and tighten the wedge bolts to 90 ft-lbs.

Notes:

- Not to be used on DI or steel pipe.
- Stargrips must be adequately wrapped or protected if they are covered by concrete to ensure that concrete is not allowed to enter the wedge pocket.
- For applications with vertical offsets please contact Star Pipe Products for technical assistance.



PVC Stargrip® series 4400

Wedge Action Bell Restraint for AWWA C905 PVC Pipe Joints (CI OD)
New Installations Only

PVC Stargrip® Series 4400 for PVC pipe

INFORMATION

The Series 4400 system consists of a restraint ring that has wedges and wedge bolts along with a harness ring. The wedge action restraint ring is connected to the solid harness ring using double ended threaded rods and nuts. The system is used to restrain AWWA C905 PVC pipe bell joints with CI outside diameter.

New Installations Only

FEATURES & ADVANTAGES

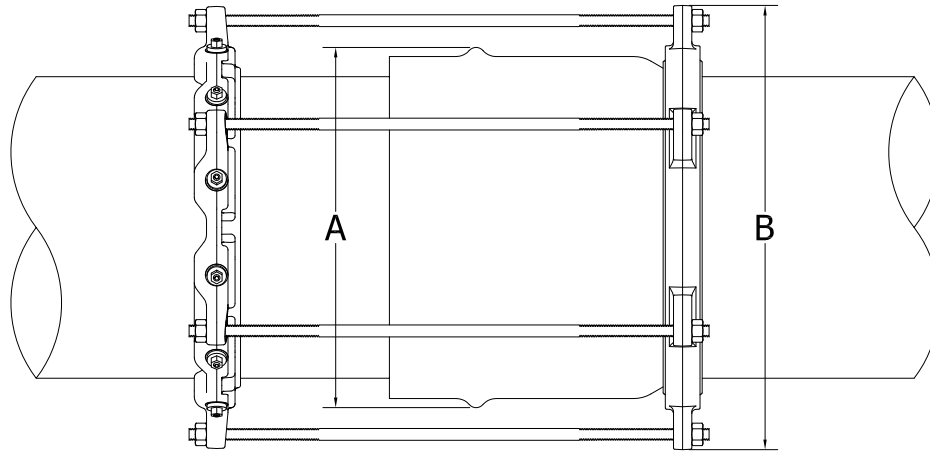
- For use on ANSI/AWWA C905 CI OD PVC pipe
- For new push-on pipe bell installations only
- The restraint system includes a modified PVC Stargrip®, a solid harness ring, nuts, and double-ended rods.
- The bolt circle diameter for the modified PVC Stargrip® is larger to allow extra clearance.
- By using larger diameter rods, fewer rods are needed to achieve its rated pressure. This results in less hardware to assemble.
- The rings, wedges, and actuating bolts are made of high strength ductile iron. The restraint rods and nuts are made of high-strength-low-alloy steel per the requirements of ANSI/AWWA C111/A21.11
- Please refer to the chart on the next page for the maximum bell outside diameter that the rods can clear.
- The safety factor is twice (2:1) the product pressure rating (see chart on next page).
- The standard color for the rings is Coral Red (RAL 3016).

SAMPLE SPECIFICATIONS

Restraint for PVC push-on bells (AWWA C905 CI OD) shall incorporate the use of a wedge action restraint ring and a solid harness ring into its design. Wedge action mechanisms shall be integrated into the design of the restraint ring. As the mechanisms are activated, multiple points of resistance shall be imparted onto the pipe and increase in resistance as internal pressure grows. After burial of the restraint mechanism, joint flexibility shall be maintained.

The actuating bolt shall be threaded into the restraint ring and have a 1-1/4" hex operating nut. The actuating bolt system shall have a torque-limiting head designed to break off at preset torque levels, thus insuring proper action of the restraining device. After the torque-limiting head has broken off, a secondary hex head shall remain to facilitate the removal and re-assembly of the restraint ring. Rings, bolts and wedges shall be manufactured of high strength ductile iron in accordance with ASTM A536 Grade 65-45-12 requirements.

All sizes shall have a minimum safety factor of 2:1 (i.e. twice the product pressure rating as stated in most current catalog). The restraint mechanism shall be Star® Pipe Products, PVC Stargrip® series 4400 or approved equal.

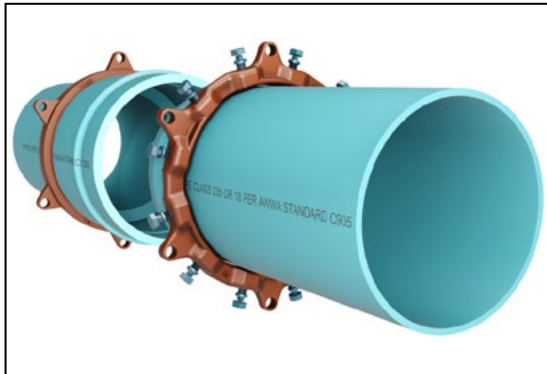
**PVC Stargrip® series 4400**Wedge Action Bell Restraint for AWWA C905 PVC Pipe Joints (CI OD)
New Installations Only**TECHNICAL INFORMATION****PVC STARGRIP® 4400 SPECIFICATIONS***

NOM. SIZE	C905 PIPE CI OD	RODS (QTY)	ROD DIA x LENGTH	MAX. BELL OD "A"	MAX. RESTRAINT OD "B"	APPROX WT. (LBS)
14	15.30	5	1 x 26	20.38	23.26	109
16	17.40	6	1 x 26	22.75	25.63	134
18	19.50	6	1 x 26	24.88	27.76	145
20	21.60	7	1 x 26	27.13	30.01	171
24	25.80	8	1 1/4 x 32	31.63	35.01	265
30	32.00	10	1 1/4 x 42	39.25	42.88	409
36	38.30	12	1 1/4 x 42	46.13	49.76	497

*All dimensions in inches except where indicated. See next page for installation instructions.

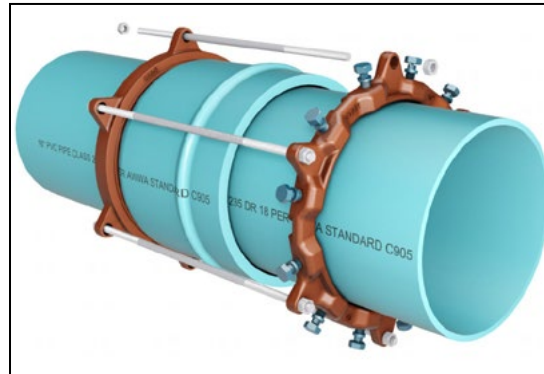
MAXIMUM WORKING PRESSURE RATING WITH OCCASSIONAL & RECURRING SURGES

NOM. SIZE (IN)	C905			
	DR18	DR21	DR25	DR32.5
14	235	200	165	125
16	235	200	165	125
18	235	200	165	125
20	235	200	165	125
24	200	200	165	125
30			165	125
36			125	125

**PVC Stargrip® series 4400**Wedge Action Bell Restraint for AWWA C905 PVC Pipe Joints (CI OD)
New Installations Only**INSTALLATION INSTRUCTIONS - SIZES 14" - 36"****STEP 1**

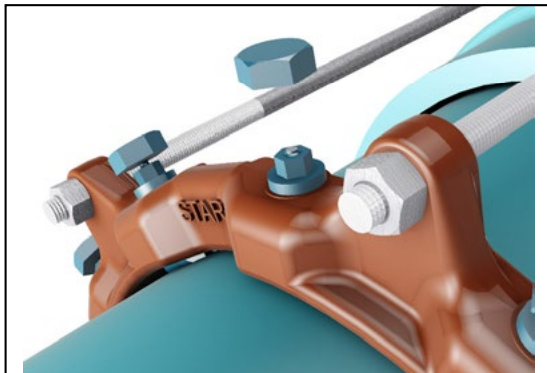
After making sure that pipe and pipe surface is in good and clean condition, slide the SERIES 4400 restraint ring with lip facing spigot end of first pipe.

Slide the harness ring along the length of second pipe to fit closely behind the pipe bell.

**STEP 2**

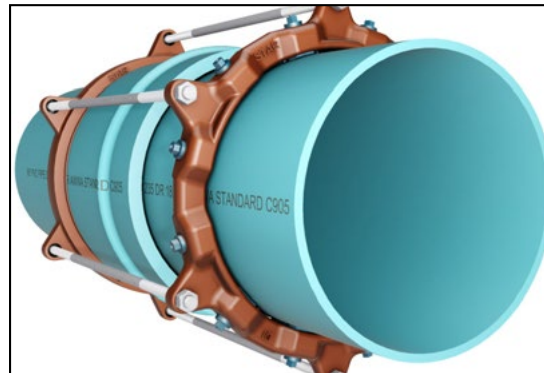
After completing the pipe joint assembly per the pipe manufacturer instructions, position restraint ring on spigot end of pipe by inserting one of the restraint rods provided into the restrainer ears of restraint ring and harness ring such that the restraint rod ends extend past each nut approximately 1/2". Continue inserting the remaining restraint rods through restrainer ears. Leave all the nuts untightened at this moment.

NOTE: Due to variability of PVC Pipe bell lengths, please contact Star Pipe Products if rod length is too short.

**STEP 3**

Tighten the torque limiting twist off bolts in a clockwise direction until all wedges are in firm contact with the pipe surface. Continue tightening in an alternating manner until all the torque limiting twist off bolt heads have been twisted off.

NOTE: If removal is necessary, utilize the 5/8" hex head provided.

**STEP 4**

Snug tighten all nuts such that the rods stick out approximately 1/2" past the nuts. Make sure that the harness ring is sitting evenly and is bearing against the pipe bell.

Caution: Do not over - tighten restraining nuts. Turn nut to hand tight plus half turn.

NOTE: If reassembly is required, assemble the joint in the same manner as above and tighten the wedge bolt to 90 ft-lbs.

Notes:

- Due to variability of PVC pipe bell lengths, please contact Star Pipe Products if rod length is too short.
- If removal is necessary, utilize the 5/8" hex head provided.
- If reassembly is required, assemble the joint in the same manner as above and tighten the wedge bolt to 90 ft-lbs.

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® REGISTERED TRADEMARK OF STAR PIPE PRODUCTS

Page 32



PVC Ring Lock series 3500 (PVCGRIP™)

Mechanical Joint 360° Ring Type Restraint System

Designed for C900/C905 and IPS PVC Pipe

Patent #5,947,527



PVC Ring Lock series 3500 for PVC pipe

INFORMATION

The PVC Ring Lock System is an innovative design with a 360° grip-ring feature. This feature provides uniform restraining pressure around the circumference of the pipe, thus avoiding pipe distortion and point loading. Its unique independent restraining and sealing features allows it to be used for Push-On and Mechanical Joint fittings, Valves and Fire Hydrants. It can be used on any class, C900 PVC and IPS PVC pipe.

Innovative 360° Grip-Ring Restraint

FEATURES & ADVANTAGES

- Unique ring design provides 360° pipe restraint, so there is no point loading on the pipe.
- No washers or spacers to remove when used on CI OD PVC pipe or IPS PVC pipe* (***transition gasket required on 12" and under IPS PVC Pipe**).
- One ring fits both CI OD PVC pipe and IPS PVC pipe used.
- Universal application for various types of PVC pipe simplifies inventory requirements and reduces carry cost.
- Double headed torque limiting bolts utilize 1 1/4" wrench size on both hex heads.
- Torque limiting bolts are designed with collars so that a wrench won't slip off bottom for easier installation.
- PVC Ring Lock sizes 4"-12" are listed with Underwriters Laboratories and Factory Mutual approved for use on DR18 class 235 C900 PVC pipe at 150 PSI.
- Tested to and meets the requirements of ASTM F1674 through 12" size
- Safety factor is twice (2:1) the standardized pressure rating of the pipe on which it is used.
- Offers a full 5° deflection through 12" and 3° on 16"
- Gland, ring and follower gland are made from high strength ductile iron per ASTM A536, grade 65-45-12 and are compatible with all mechanical joints conforming to ANSI/AWWA C111/A21.11.
- Eliminates tie rods and thrust blocks
- For use on HDPE or C909 pipe, please contact Star Engineering
- Standard gland color is Coral Red (RAL 3016).

SAMPLE SPECIFICATIONS

Restrainer mechanism shall be integrated into the design of the follower gland. The gripping or restraining mechanism shall transmit uniform restraining pressure around the circumference of the pipe, thus avoiding point loading or pipe distortion. This restraining process shall be kept separate from the mechanical joint sealing process and not a part of the sealing function. Gland and ring components shall be manufactured of ductile iron conforming to ASTM A536, grade 65-45-12.

The restraining torque limiting bolt system shall have a torque-limiting feature designed to break off at preset torque limit to ensure proper actuation. Both the twist off head and the removal head shall be the same size as the T-bolt nut.

The restraining mechanism design can replace the standard mechanical joint gland and can be used with the standard mechanical joint bells conforming to ANSI/AWWA C111/A21.11, C110/A21.10 and C153/A21.53 of the latest revision.

The restraining mechanism shall have a pressure rating equal to that of the pipe on which it is used. All sizes shall have a minimum safety factor of 2:1 (i.e. twice the pressure rating of the pipe on which it is used). The restraining mechanism through 12" size shall be Listed by Underwriters Laboratories, Inc., Approved by Factory Mutual Research and shall be tested to ASTM F 1674. The restraining device for C900/C905 PVC and IPS PVC Pipe shall be Star Pipe Products PVC Ring Lock Series 3500 or equal.



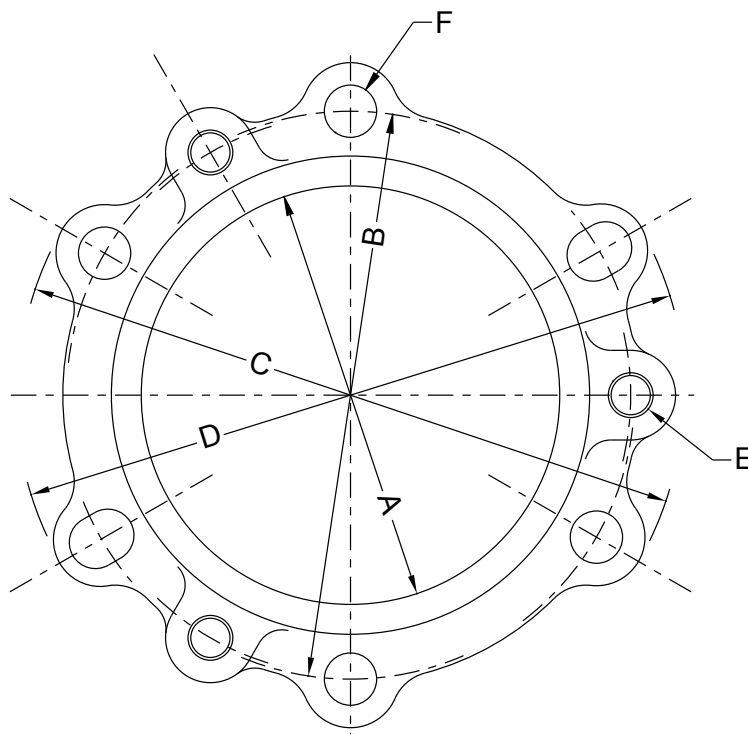
PVC Ring Lock^{series} 3500 (PVCGRIP™)

Mechanical Joint 360° Ring Type Restraint System

Designed for C900/C905 and IPS PVC Pipe

Patent #5,947,527

TECHNICAL INFORMATION



PVC RING LOCK 3500 SPECIFICATIONS*

SIZE	ANSI/AWWA C900/C905 PIPE O.D.	IPS PIPE O.D. (TRANSITION GASKET REQUIRED)	A	B	C	D	E	F	APPROX WT. (LBS)
4	4.80	4.50	4.90	7.50	9.13	9.13	4 @ .75	4 @ .75	9
6	6.90	6.63	7.00	9.50	11.13	11.75	3 @ .75	6 @ .75	14
8	9.05	8.63	9.15	11.75	13.38	14.00	4 @ .75	6 @ .75	18
10	11.10	10.75	11.20	14.00	15.63	16.75	6 @ .75	8 @ .75	27
12	13.20	12.75	13.30	16.25	17.88	19.13	8 @ .75	8 @ .75	34
16	17.40	N/A	17.54	21.00	22.50	22.50	10 @ .75	12 @ .75	73

*All dimensions in inches except where indicated.

STANDARDIZED PRESSURE RATINGS**

ANSI/AWWA C900 CI OD		ANSI/AWWA C905 CI OD		ASTM D2241 IPS OD	
DR 14	305 PSI	DR 18	235 PSI	SDR 17	250 PSI
DR 18	235 PSI	DR 21	200 PSI	SDR 21	200 PSI
DR 25	165 PSI	DR 25	165 PSI	SDR 26	160 PSI
		DR 32.5	125 PSI		

**For the ordinary water works with Transient surges only. Ratings are for PVC pipes with SERIES 3500 Restrainer.



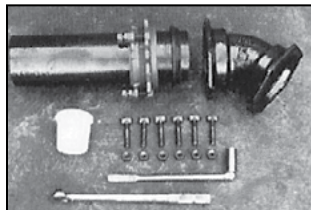
PVC Ring Lock series 3500 (PVCGRIP™)

Mechanical Joint 360° Ring Type Restraint System

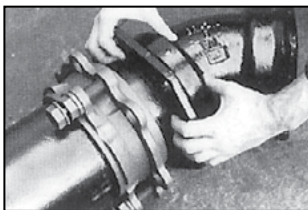
Designed for C900/C905 and IPS PVC Pipe

Patent #5,947,527

INSTALLATION INSTRUCTIONS - SIZES 4" - 16"

**STEP 1**

The rubber gasket will seal more effectively if the surfaces with which it comes in contact are thoroughly cleaned just before assembly to remove all loose foreign material. Lubrication and additional cleaning should be provided by brushing both the gasket and the plain end with soapy water or pipe lubricant. Slide the PVCGRIP on the plain end, followed by the MJ gasket.

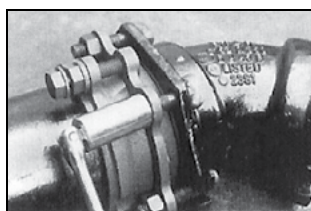
**STEP 2**

After insertion of the pipe into the bell of the fitting firmly press the gasket into the gasket recess. During this process the joint should be kept straight.

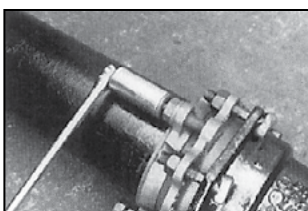
**STEP 3**

Slide the PVCGRIP toward the MJ bell with the gland lip against the gasket. Insert T-bolts and hand tighten nuts.

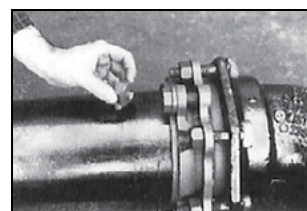
IMPORTANT: Make deflection after joint is assembled but before tightening T-bolts.

**STEP 4**

When tightening bolts, it is essential that the gland be brought up toward the bell flange evenly, maintaining approximately the same distance between the gland and the face of the flange at all points around the socket. All T-bolts should be tightened until they are within the torque range per ANSI/AWWA C600 (See table A below). T-Bolts should be tightened alternately on opposite sides (Star Pattern).

**STEP 5**

After correct assembly of the mechanical joint, tighten each torque limiting bolt by turning approximately 180 degrees in a clockwise direction, alternating between bolts on opposite sides (Star Pattern), until the break away heads twist off. Never turn a single head over 180 degrees without alternating to another bolt.

**STEP 6**

If removal is necessary, utilize the 1 1/4" hex head provided. [If reassembly is required, assemble the joint in the same manner as above and tighten the wedge bolt to 90 ft-lbs].

(TABLE A) T-HEAD BOLT & NUT DETAILS

PIPE SIZE (IN)	BOLT SIZE (IN)	RANGE ¹ OF TORQUE (FT-LBS)
3	5/8	45-60
4-16	3/4	75-90

¹These torque ranges are requirements of AWWA C600

Notes:

- Not to be used on DI or steel pipe.

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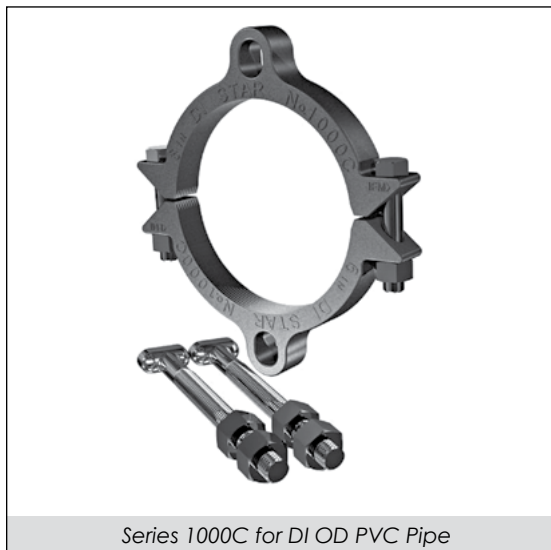
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Pipe Restrainers series 1000

1000C Restrainers for AWWA C900/C905 PVC Pipe and MJ or Push-On Fittings
1000S Restrainer for IPS PVC and MJ or Push-On Fittings



Series 1000C for DI OD PVC Pipe

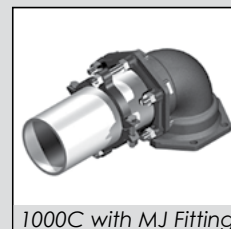
INFORMATION

The Series 1000 provides joint restraint between PVC pipe and ductile iron fittings. The device works with fittings with either mechanical joint ends or push-on, and it may be installed on new or existing systems. Mechanical joint restraints totally eliminate the need for thrust blocks. The restraints have internal serrations that lock onto the pipe and give 360 degrees of contact and pipe wall support. These restraints may be used with PVC pipe made to either a CIOD or IPS OD diameter regimen.

Can be Installed on New or Existing Systems

FEATURES & ADVANTAGES

- 360° contact, no pipe distortion or point loading and supports the wall of the pipe
- Made of Ductile Iron - ASTM Grade A536, Grade 65-45-12
- Restrainers work with Mechanical Joint Fittings (Table A) or Push-On Fittings (Table B).
- All restraints are machined to exact tolerances.
- Rated pressures carry a 2:1 safety factor.
- Can be installed outside the trench, to ease installation
- Maintains full deflection on Mechanical Joint and Push-On Fittings
- T-Bolts/Rods/Hex Nuts: low alloy steel per ANSI/AWWA C111/A21.11
- Clamping Bolts: SAE J429 Grade 5
- Series 1000C is approved by Factory Mutual Research in sizes 4" - 6" for use on C900 PVC DR18 for 150 PSI.
- Standard color is Graphite Black (RAL 9011).
- Casting halves for IPS PVC pipe are painted Moss Green (RAL 6005).



1000C with MJ Fitting

Table A - Pressure Rating (PSI) For PVC Pipe To Ductile Iron MJ Fitting Connections

AWWA C900 (CIOD)		AWWA C905 (CIOD)		ASTMD2241* (IPS OD)	
DR 14	200	DR 18	235	SDR 17	250
DR 18	150	DR 21	200	SDR 21	200
DR 25	100	DR 25	165	SDR 26	160
		DR 32.5	125		

* Transition Gasket Required

Table B - Pressure Rating (PSI) For PVC Pipe To Ductile Iron Push-On Fitting Connections

NOMINAL SIZE	AWWA C900			ASTMD2241*		
	DR14	DR18	DR25	SDR17	SDR21	SDR26
4	200	150	100	250	200	160
6	200	150	100	250	200	160
8	200	150	100	250	200	160
10	100	75	50	125	100	80
12	100	75	50	125	100	80

* Transition Gasket Required

SAMPLE SPECIFICATIONS

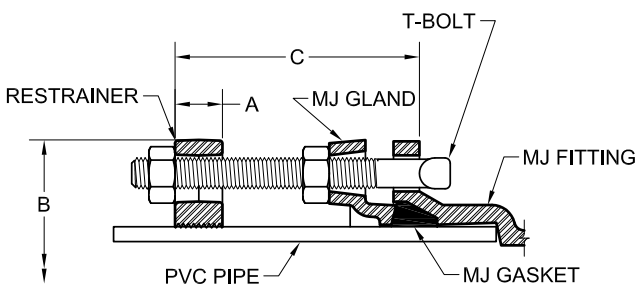
PVC restraint devices shall be manufactured of high strength ductile iron in accordance to ASTM A536 Grade 65-45-12 for all sizes. Internal serrations will be machined to provide exact tolerances to provide 360° contact and support of the pipe wall. PVC Restraint devices shall have a safety factor of 2:1 over the pressure rating.



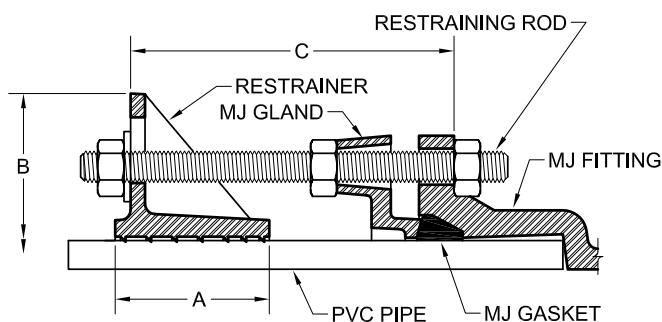
Pipe Restrainers series 1000

1000C Restrainers for AWWA C900/C905 PVC Pipe and MJ or Push-On Fittings
1000S Restrainer for IPS PVC and MJ or Push-On Fittings

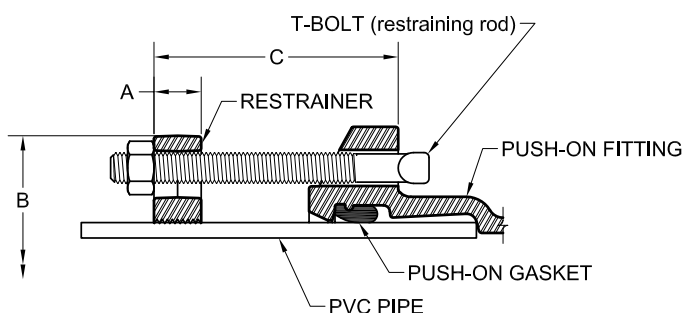
TECHNICAL INFORMATION



4"-12" Sizes with MJ Fittings



14"-48" Sizes with MJ Fittings



4"-12" Sizes with Push-On Fittings

PIPE RESTRAINERS 1000 SPECIFICATIONS*

NOM. SIZE	PVC PIPE WITH DUCTILE IRON PIPE O.D. STYLE 1000C	PVC PIPE WITH STEEL PIPE O.D. STYLE 1000S	A	B APPROX.	C MAX.	RESTRAINT BOLTS/RODS		CLAMPING BOLTS		APPROX WT. (LBS)
	O.D.	O.D.				QTY	SIZE	QTY	SIZE	
4	4.80	4.50	1.12	9.12	6.00	2	3/4 x 7	2	5/8 x 3 1/2	8
6	6.90	6.63	1.15	11.12	6.00	2	3/4 x 7	2	5/8 x 3 1/2	10
8	9.05	8.63	1.47	14.75	6.00	2	3/4 x 7	2	3/4 x 4	15
10	11.10	10.75	1.38	16.82	6.00	4	3/4 x 7	2	7/8 x 5	25
12	13.20	12.75	1.42	19.46	6.00	4	3/4 x 7	2	7/8 x 5	27
14	15.30	N/A	4.00	22.68	15.00	6	3/4 x 17	4	7/8 x 7	68
16	17.40	N/A	3.75	24.65	15.00	6	3/4 x 17	4	7/8 x 6 1/2	62
18	19.50	N/A	4.25	26.65	15.00	8	3/4 x 17	4	7/8 x 6 1/2	78
20	21.60	N/A	5.00	28.88	22.00	8	3/4 x 24	4	1 1/8 x 8 1/2	113
24	25.80	N/A	5.00	33.98	22.00	12	3/4 x 24	4	1 1/8 x 8 1/2	145
30	32.00	N/A	7.00	42.48	22.00	12	1 x 24	6	1 1/8 x 6	247
36	38.30	N/A	7.00	48.61	22.00	12	1 x 24	6	1 1/8 x 6	304
42	44.50	N/A	11.00	57.00	26.00	16	1-1/4 x 30	6	1 1/2 x 10	1003
48	50.80	N/A	11.00	63.88	26.00	16	1-1/4 x 30	6	1 1/2 x 10	1166

*All dimensions in inches except where indicated.



Pipe Restrainers series 1000

1000C Restrainers for AWWA C900/C905 PVC Pipe and MJ or Push-On Fittings

1000S Restrainer for IPS PVC and MJ or Push-On Fittings

INSTALLATION INSTRUCTIONS, SERIES 1000 4"-12", WITH MJ FITTINGS



STEP 1

Insert pipe into the MJ fitting bell. Then insert one of the provided long T-bolts through one of the flange holes to mark a line about 1" away from the end of the bolt and towards the MJ socket as shown.



STEP 2

Assemble the MJ joint using the gland, gasket and T-bolts to AWWA standards. Assemble the restrainer on the pipe so that it is even with the marked line on the pipe while making sure restrainer ears line up with the bolt holes of the MJ gland. Evenly tighten the restrainer clamping bolts to recommended torque (see Table B).



STEP 3

Insert one of the long T-bolts provided, installing one nut each between the gland and the restrainer as shown. Follow the same procedure for remaining long T-bolts. Tighten nuts against MJ Gland to AWWA standards (See table A). T-bolts should be tightened alternately on opposite sides (Star Pattern).



STEP 4

Snug tighten the second nut on each long T-bolt against the restrainer as shown.

Caution: Do not over-tighten the restrainer nuts. Turn nut to hand tight plus half turn.

INSTALLATION INSTRUCTIONS, SERIES 1000 14"-48", WITH MJ FITTINGS



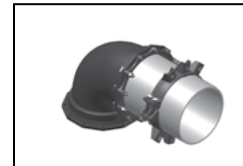
STEP 1

Insert pipe into the MJ fitting bell. Then insert one of the provided long restraint rods through one of the flange holes to mark a line about 1" away from the end of the bolt and towards the MJ socket as shown.



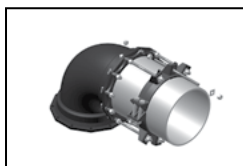
STEP 2

Assemble the MJ joint using the gland, gasket and T-bolts to AWWA standards. Assemble the restrainer on the pipe so that it is even with the marked line on the pipe while making sure restrainer ears line up with the bolt holes of the MJ gland. Evenly tighten the restrainer clamping bolts to recommended torque (see Table B).



STEP 3

Insert one of the long rods provided, installing one nut each between the gland and the restrainer as shown. Follow the same procedure for remaining long rods. Tighten nuts against MJ Gland to AWWA standards (see table A). T-bolts should be tightened alternately on opposite sides (Star Pattern).



STEP 4

Snug tighten the second nut on each rod against the restrainer as shown.

Caution: Do not over-tighten the restrainer nuts. Turn nut to hand tight plus half turn.

(TABLE A) T-HEAD BOLT & NUT DETAILS

PIPE SIZE (IN)	BOLT SIZE (IN)	RANGE ¹ OF TORQUE (FT-LBS)
4-24	3/4	75-90
30-36	1	100-120
42-48	1 1/4	120-150

¹These torque ranges are requirements of AWWA C600

(TABLE B) CLAMPING BOLTS RECOMMENDED TORQUE

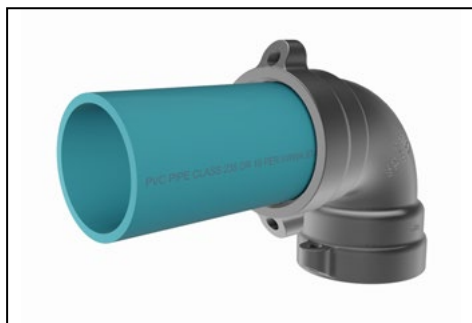
PIPE SIZE (IN)	RANGE OF TORQUE (FT-LBS)
4-12	90-110
14-36	130 min.
42-48	300-350



Pipe Restrainers series 1000

1000C Restrainers for AWWA C900/C905 PVC Pipe and MJ or Push-On Fittings
1000S Restrainer for IPS PVC and MJ or Push-On Fittings

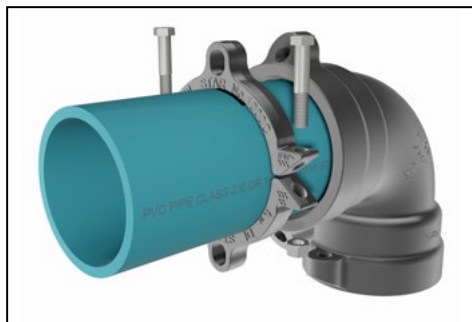
INSTALLATION INSTRUCTIONS, SERIES 1000 4"-12", WITH PUSH-ON FITTINGS

**STEP 1**

Insert pipe into the fitting bell according to standard procedure.

**STEP 2**

Use one of the T-bolts (provided) as an alignment guide to position serrated restrainer on pipe. Leave sufficient room for threads on the rod ends to fully engage nuts (provided). Full engagement occurs when there are at least two threads showing past the nut on the bolt.

**STEP 3**

Assemble the restrainer on the pipe as shown above. Make sure that the entire length of all the serrations are in contact with the pipe before installing the clamping bolts. Tighten the clamping bolts evenly between 90 and 110 ft-lbs of torque. Make sure the gap between the bolt pads on both sides remain the same.

**STEP 4**

Insert the restraining T-bolts (provided) through the fitting lugs and the restrainer as shown. Snug tighten the nuts so that the spigot end is secured into the bell end.

CAUTION: Do not over-tighten restraint nuts. Turn nuts to hand tight plus half a turn.

Notes:

- Not recommended for use with Push-On fittings in sizes 14-inch and larger.



Pipe Restrainers series 1100

1100C Bell Restrainers for AWWA C900/C905 PVC Pipe
and 1100S Bell Joint for IPS PVC Pipe



Series 1100C for C900/C905 PVC Pipe

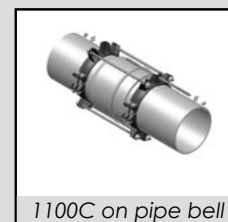
INFORMATION

The Series 1100 provides joint restraint for PVC pipe-to-pipe joints, and it may be installed on new or existing systems. Joint restraints totally eliminate the need for thrust blocks. The restraints have internal serrations that lock onto the pipe and give 360 degrees of contact and pipe wall support. These restraints may be used with PVC pipe made to either a CIOD or IPS OD diameter regimen. See the table below for the product's rated pressure.

**Can be Installed on New
or Existing Systems**

FEATURES & ADVANTAGES

- 360° contact, no pipe distortion or point loading
- Made of Ductile Iron - ASTM Grade 536, Grade 65-45-12
- Restrainers work with Push-On Pipe Bells.
- All restraints are machined to exact tolerances.
- Rated pressures carry a 2:1 safety factor.
- Can be installed outside the trench, to ease installation
- T-Bolts/Rods/Hex Nuts: low alloy steel per ANSI/AWWA C111/A21.11
- Clamping Bolts: SAE J429 Grade 5
- Series 1100C is approved by Factory Mutual Research in sizes 4"-6" for use on C900 PVC DR18, for 150 PSI.
- Available in sizes 4"-48"
- Standard color is Graphite Black (RAL 9011).
- Casting halves for IPS PVC pipe are painted Moss Green (RAL 6005).



1100C on pipe bell

STANDARDIZED PRESSURE RATINGS**

ANSI/AWWA C900 CI OD		ANSI/AWWA C905 CI OD		ASTMD2241 IPS OD	
DR 14	200 PSI	DR 18	235 PSI	SDR 17	250 PSI
DR 18	150 PSI	DR 21	200 PSI	SDR 21	200 PSI
DR 25	100 PSI	DR 25	165 PSI	SDR 26	160 PSI
		DR 32.5	125 PSI		

**For ordinary water works with transient surges only. Ratings are for PVC pipes with SERIES 1100 Restrainer.

SAMPLE SPECIFICATIONS

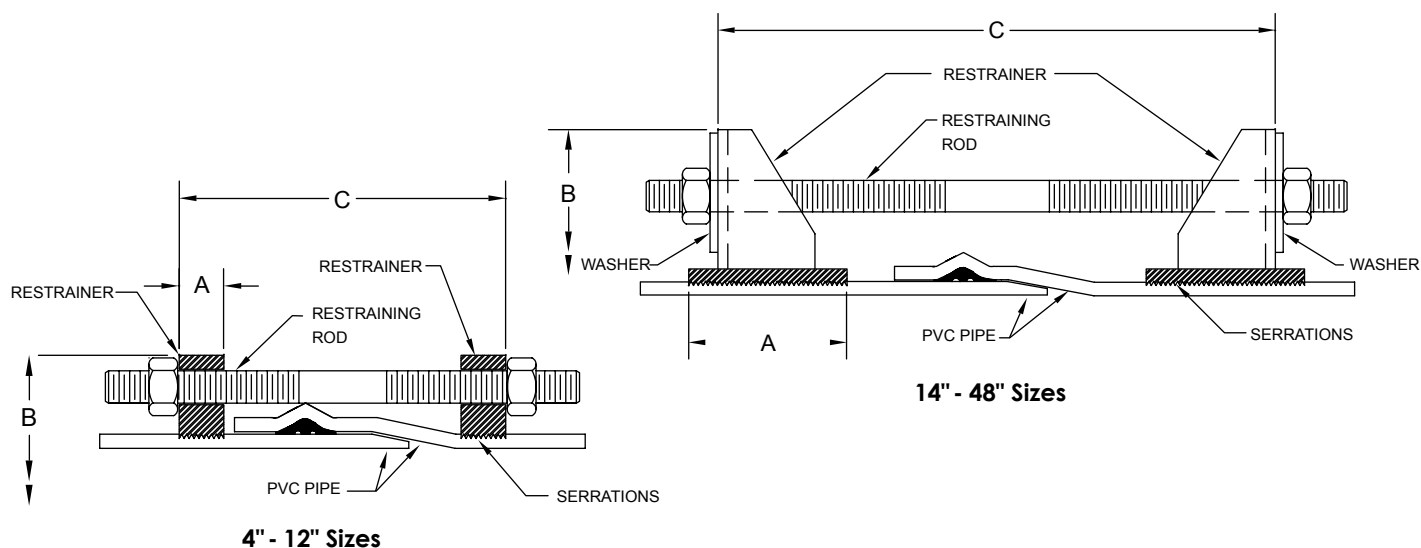
PVC restraint devices shall be manufactured of high strength ductile iron in accordance to ASTM A536 Grade 65-45-12 for all sizes. Internal serrations will be machined to provide exact tolerances to provide 360° contact and support of the pipe wall. PVC Restraint devices shall have a safety factor of 2:1 over the pressure rating.



Pipe Restrainers series 1100

1100C Bell Restrainers for AWWA C900/C905 PVC Pipe
and 1100S Bell Joint for IPS PVC Pipe

TECHNICAL INFORMATION



PIPE RESTRAINERS 1100 SPECIFICATIONS*

NOM. SIZE	PVC PIPE WITH DUCTILE IRON PIPE O.D. STYLE 1100C	PVC PIPE WITH STEEL PIPE O.D. STYLE 1100S	A	B APPROX.	C MAX.	RESTRAINT BOLTS/RODS		CLAMPING BOLTS		APPROX WT. (LBS)
	O.D.	O.D.				QTY	SIZE	QTY	SIZE	
4	4.80	4.50	1.12	9.12	15.00	2	3/4 x 17	4	5/8 x 3 1/2	16
6	6.90	6.63	1.15	11.12	15.00	2	3/4 x 17	4	5/8 x 3 1/2	20
8	9.05	8.63	1.47	14.75	15.00	2	3/4 x 17	4	3/4 x 4	32
10	11.10	10.75	1.38	16.82	22.00	4	3/4 x 24	4	7/8 x 5	52
12	13.20	12.75	1.42	19.46	22.00	4	3/4 x 24	4	7/8 x 5	56
14	15.30	N/A	4.00	22.68	27.00	6	3/4 x 30	8	7/8 x 7	150
16	17.40	N/A	3.75	24.65	27.00	6	3/4 x 30	8	7/8 x 6 1/2	117
18	19.50	N/A	4.25	26.65	27.00	8	3/4 x 30	8	7/8 x 6 1/2	147
20	21.60	N/A	5.00	28.88	33.00	8	3/4 x 36	8	1 1/8 x 8 1/2	206
24	25.80	N/A	5.00	33.98	33.00	12	3/4 x 36	8	1 1/8 x 8 1/2	265
30	32.00	N/A	7.00	42.48	44.00	12	1 x 48	12	1 1/8 x 6	492
36	38.30	N/A	7.00	48.61	44.00	12	1 x 48	12	1 1/8 x 6	561
42	44.50	N/A	11.00	57.00	50.00	16	1 1/4 x 54	12	1 1/2 x 10	1916
48	50.80	N/A	11.00	63.88	50.00	16	1 1/4 x 54	12	1 1/2 x 10	2242

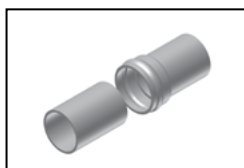
*All dimensions in inches except where indicated.



Pipe Restrainers series 1100

1100C Bell Restrainers for AWWA C900/C905 PVC Pipe
and 1100S Bell Joint for IPS PVC Pipe

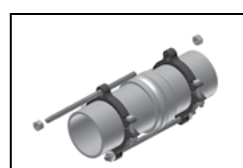
INSTALLATION INSTRUCTIONS (SERIES 1100 4"-12")

**STEP 1**

Assemble the spigot end of first pipe into the pipe bell using standard procedure per pipe manufacturer.

**STEP 2**

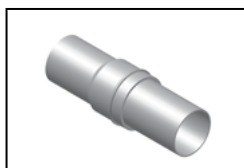
Assemble one restrainer behind the bell of pipe and evenly tighten the restrainer clamping bolts to the recommended torque. Then insert one of the provided restraint rods through one of the restrainer holes. Mark a line about 1" away from the end of the rod and towards the end of the bell as shown. Assemble the second restrainer even with the mark on the spigot end of pipe. Use one of the provided restraining rods as a guide to align restraint holes. Tighten restrainer clamping bolts to the recommended torque on the second restrainer after it is aligned with the first one (see Table B).

**STEP 3**

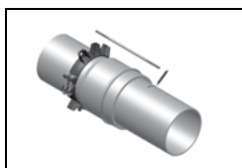
Insert the restraining rods through the restrainers as shown. Snug tighten the remaining nuts behind each restraint so that the spigot end is secured into the bell end.

Caution: Do not over-tighten the restrainer nuts. Turn nut to hand tight plus half turn.

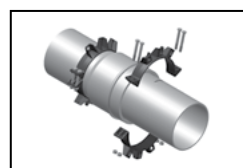
INSTALLATION INSTRUCTIONS (SERIES 1100 14"- 48")

**STEP 1**

Assemble the spigot end of first pipe into the pipe bell using standard procedure per pipe manufacturer.

**STEP 2**

Assemble one restrainer behind the bell of pipe as shown above. The flat side of the restrainer ears must face away from the assembled joint. Make sure that the entire length of all the serrations are in contact with the pipe before installing the clamping bolts. Evenly tighten the restrainer clamping bolts to the recommended torque, Table B. Then insert one of the restraint rods (provided) through one of the restrainer holes. Mark a line away from the end of the rod and towards the end of the spigot that allows sufficient room for threads on the rod ends to fully engage nuts (provided). Full engagement occurs when there are at least two threads showing past the nut on the rod.

**STEP 3**

Assemble the second restrainer even with the mark on the spigot end of pipe. Use one of the provided restraining rods as a guide to align restraint holes. Tighten clamping bolts to the recommended torque (see Table B) on the second restrainer after it is aligned with the first one.

**STEP 4**

Insert the restraining rods through the restrainers as shown. Snug tighten the remaining nuts behind each restraint so that the spigot end is secured into the bell end.

Caution: Do not over-tighten the restrainer nuts. Turn nut to hand tight plus half turn.

(TABLE B) CLAMPING BOLTS RECOMMENDED TORQUE

PIPE SIZE (IN)	RANGE OF TORQUE (FT-LBS)
4-12	90-110
14-36	130 min.
42-48	300-350

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

® REGISTERED TRADEMARK OF STAR PIPE PRODUCTS

Page 44



Pipe Restrainers series 1000C & 1100C

1000C & 1100C For Use On Ductile Iron Pipe



Above Image Represents Series 1100C

INFORMATION

Pipe restrainers for ductile iron pipe-to-pipe joints, ductile iron pipe to mechanical joint fitting connections, or ductile iron to push-on fitting joints.

Pipe restrainers can be installed on new or existing systems, totally eliminating the use of thrust blocks. These restrainers have internal serrations that lock onto the pipe and give 360° contact and support the pipe wall.

For Use on Ductile Iron Pipe

FEATURES & ADVANTAGES

- Castings made of Ductile Iron - ASTM A536, Grade 65-45-12
- Restrainers work with Mechanical Joint Fittings (Table A), Push-On Fittings (Table B), and Pipe-to-Pipe connections (Table A). Ductile iron pipe to be manufactured in accordance with ANSI/AWWA C151/A21.51.
- All restrainers are machined to exact tolerances
- Maintains full deflection on Mechanical Joint and Push-On Fittings
- T-Bolts/Rods/Hex Nuts: Low alloy steel per ASTM/AWWA C111/A21.11
- Clamping Bolts: SAE J429 Grade 5

Notes:

- *Not recommended for installations on machined end pipe or fittings*
- *Installation requires the clamping bolts to be installed to the torque shown in Table A & B on next page.*
- *Installation and testing to be in accordance with the latest version of ANSI/AWWA C600*
- *For higher pressure requirements, please contact Star® Pipe Products*
- *Pipe hardness not to exceed 230 BHN.*
- *Not recommended for use with Push-On fittings in sizes 14-inch and larger.*

SAMPLE SPECIFICATIONS

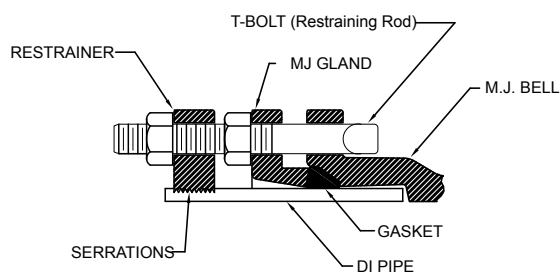
Pipe restraining devices shall be manufactured of high strength ductile iron in accordance to ASTM A536 Grade 65-45-12 for all sizes. Internal serrations will be machined to provide exact tolerance to provide 360° contact and support of the pipe well. Pipe restraining devices shall have a safety factor of 2:1 over the pressure rating.



Pipe Restrainers series 1000C & 1100C

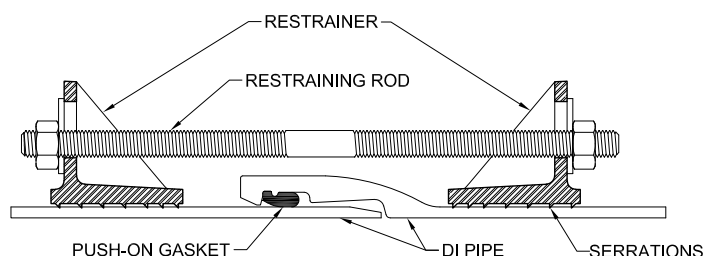
1000C & 1100C For Use On Ductile Iron Pipe

TECHNICAL INFORMATION



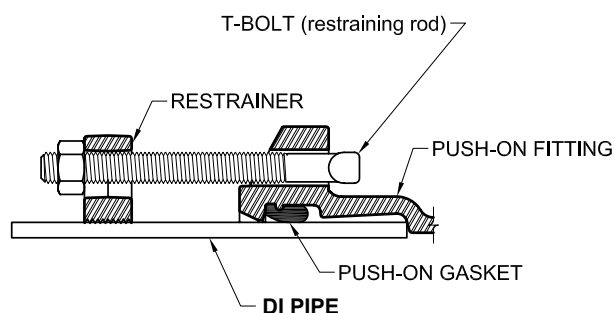
Series 1000C

4" - 16" Sizes with MJ Fittings



Series 1100C

4" - 16" Sizes for Pipe-to-Pipe



Series 1000C

4" - 12" Sizes with Push-On Fittings

TABLE A - Pressure Rating For Ductile Iron Pipe-To-Pipe Connections and Ductile Iron Pipe to MJ Fitting Connections

NOMINAL SIZE	MAXIMUM PRESSURE RATINGS (PSI)	CLAMP BOLT TORQUE (FT-LBS)
4" - 8"	250	110 min.
10" - 12"	200	110 min.
14"	150	200 min.
16"	100	200 min.

TABLE B - Pressure Rating For DI Pipe To Ductile Iron Push-On Fitting Connections

NOMINAL SIZE	MAXIMUM PRESSURE RATINGS (PSI)	CLAMP BOLT TORQUE (FT-LBS)
4" - 8"	250	110 min.
10" - 12"	100	110 min.



Pipe Restrainers series 1200

1200C Restrainers for PVC Pipe and PVC Pressure Fittings
w/Ductile Iron Pipe OD



1200C Restrainers for C900/C905 PVC Pipe.

INFORMATION

PVC Restrainers are for restraining bell joints between AWWA C900 PVC pipe and PVC pressure fittings. The PVC pressure fitting may be PC235 psi molded AWWA C907 PVC pressure fittings or PR235 psi fabricated PVC pressure fittings.

PVC restrainers can be installed on new or existing systems, totally eliminating the use of thrust blocks. These restrainers have internal serrations that lock onto the pipe and give 360° contact and support the pipe wall.

Can be Installed on New or Existing Systems

FEATURES & ADVANTAGES

- 360° contact, no pipe distortion or point loading
- Made of Ductile Iron - ASTM Grade 536, Grade 65-45-12
- Restrainers work with either
 - PC235 psi molded AWWA C907 PVC pressure fittings or
 - PR235 psi fabricated PVC pressure fittings.
- All restrainers are machined to exact tolerances.
- Rated at 150 PSI with a 2:1 safety factor
- Supports wall of pipe with 360 degree contact
- Can be installed outside the trench, to ease installation
- T-Bolts/Rods/Hex Nuts: low alloy steel per ANSI/AWWA C111/A21.11
- Clamping Bolts: SAE J429 Grade5
- Standard gland color is Graphite Black (RAL 9011).



1200C on PVC Fitting

SAMPLE SPECIFICATIONS

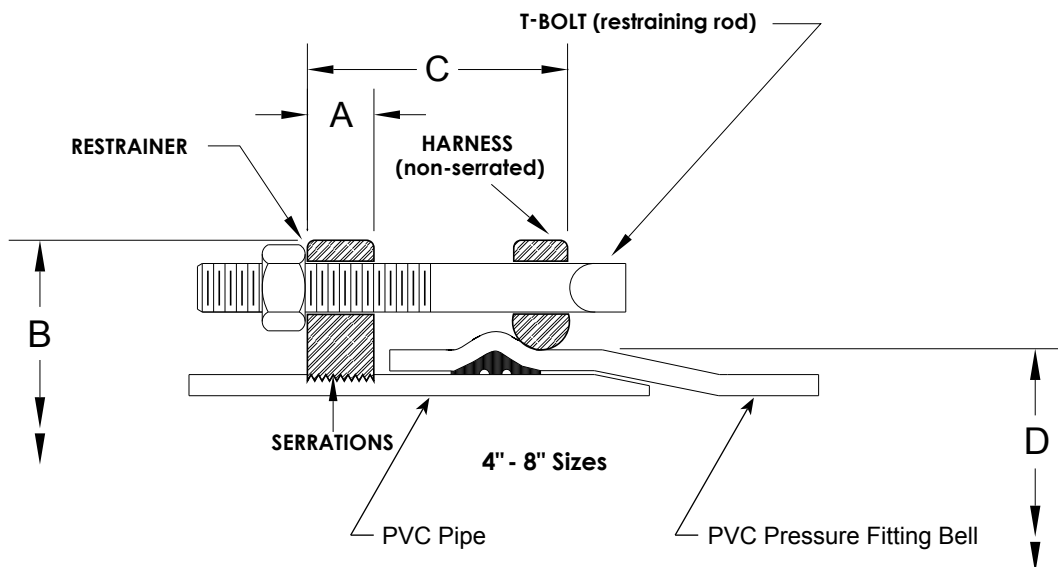
PVC restraint devices shall be manufactured of high strength ductile iron in accordance to ASTM A536 Grade 65-45-12 for all sizes. Internal serrations will be machined to provide exact tolerances to provide 360° contact and support of the pipe wall. PVC Restraint devices shall have a safety factor of 2:1 over the pressure rating.



Pipe Restrainers series 1200

1200C Restrainers for PVC Pipe and PVC Pressure Fittings
w/Ductile Iron Pipe OD

TECHNICAL INFORMATION



PIPE RESTRAINERS 1200 SPECIFICATIONS*

NOM. SIZE	PVC PIPE WITH DUCTILE IRON PIPE O.D. STYLE 1200C	PVC FITTING BELL OD "D"		A	B APPROX.	C MAX.	RESTRAINT BOLTS/ RODS		CLAMPING BOLTS		APPROX WT. (LBS)
	O.D.	MIN	MAX				QTY	SIZE	QTY	SIZE	
4	4.80	5.44	5.61	1.12	9.12	6.00	2	3/4 x 9	4	5/8 x 3-1/2	13.8
6	6.90	7.84	8.03	1.15	11.12	6.00	2	3/4 x 9	4	5/8 x 3-1/2	17.0
8	9.05	10.29	10.55	1.47	14.75	8.00	2	3/4 x 12	4	3/4 x 4	28.0

*All dimensions in inches except where indicated.

INSTALLATION INSTRUCTIONS (SERIES 1200 4"- 8")

**STEP 1**

Insert the pipe into the Push-On fitting according to standard procedure. Assemble serrated restrainer on pipe using the provided restraining rods (or T-Bolts if applicable) as a guide to position the restraint. Tighten restrainer clamp bolts to recommended torque (see Table B).

**STEP 2**

Assemble harness behind the bell of fitting (or pipe) and restrainer on spigot end of pipe using restraining T-Head bolt/rod as an alignment guide. Evenly tighten harness clamp bolts and nuts to recommended torque (see Table B).

**STEP 3**

Insert the restraining rods (or T-bolts) through the restrainers as shown. Snug tighten the remaining nuts so that the spigot end is secured into the bell end.

Caution: Do not over-tighten the restrainer nuts. Turn nut to hand tight plus half turn.

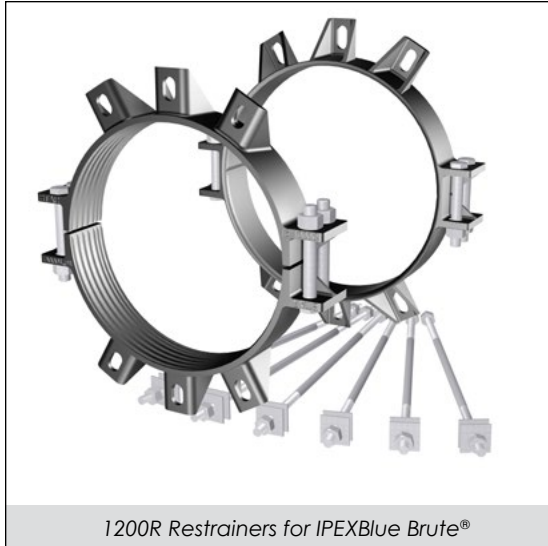
(TABLE B) CLAMPING BOLTS RECOMMENDED TORQUE

PIPE SIZE (IN)	RANGE OF TORQUE (FT-LBS)
4-8	90-110



Pipe Restrainers series 1200R

1200R Restrainer only
for 14"-24" IPEX / Blue Brute® PVC Pressure Fittings



1200R Restrainers for IPEXBlue Brute®

INFORMATION

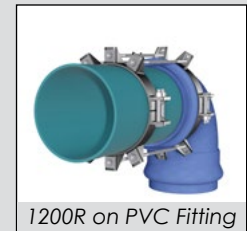
1200R Restrainers are for restraining IPEX Blue Brute® PVC Pressure Fittings to C905 PVC Pressure Pipe. These restraints have pressure ratings up to 235 psi.

PVC restrainers can be installed on new or existing systems, totally eliminating the use of thrust blocks. These restrainers have internal serrations that lock onto the pipe and give 360° contact and support the pipe wall.

Can be Installed on New or Existing Systems

FEATURES & ADVANTAGES

- 360° contact, no pipe distortion or point loading
- Made of Ductile Iron - ASTM A 536, Grade 65-45-12
- Restrainers work with IPEX Blue Brute® PVC Pressure Fittings and C905 PVC Pressure Pipe.
- All restrainers are machined to exact tolerances.
- Rated at the full rated pressure of IPEX PVC Pipe fitting or the C905 pipe being installed, whichever is less with a 2:1 Safety Factor
- Supports wall of pipe with 360 degree contact
- Can be installed outside the trench, to ease installation
- Rods/Hex Nuts: Low Alloy Steel Per ANSI/AWWA C111/A21.11
- Clamping Bolts: SAE J429 Grade5
- Standard gland color is Graphite Black (RAL 9011).



1200R on PVC Fitting

* Blue Brute® is a trademark of IPEX Branding, Inc.

SAMPLE SPECIFICATIONS

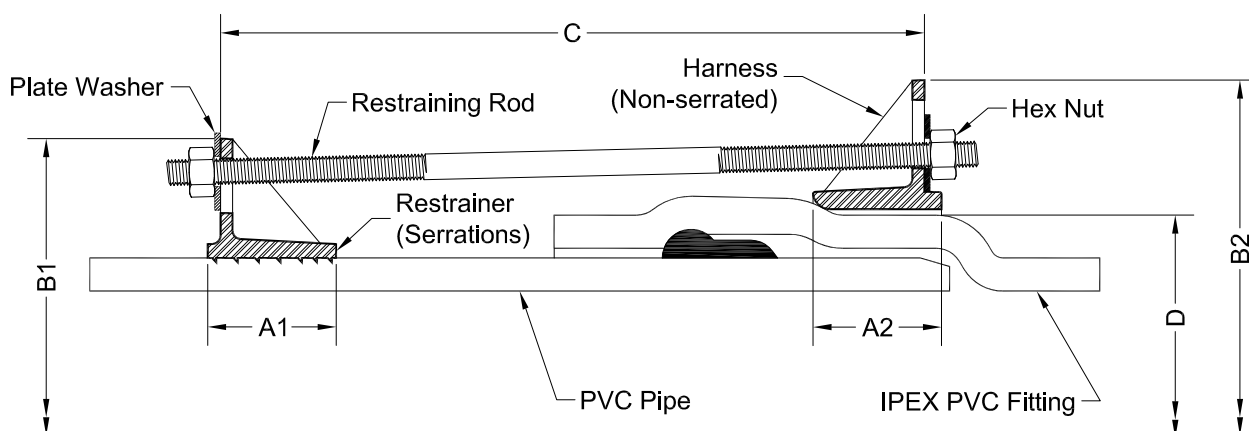
PVC restraint devices shall be manufactured of high strength ductile iron in accordance to ASTM A536 Grade 65-45-12 for all sizes. Internal serrations will be machined to provide exact tolerances to provide 360° contact and support of the pipe wall. PVC Restraint devices shall possess a pressure rating equal that of the fitting on which it is used with a 2:1 safety factor.



Pipe Restrainers series 1200R

1200R Restrainer only
for 14"-24" IPEX / Blue Brute® PVC Pressure Fittings

TECHNICAL INFORMATION



PIPE RESTRAINERS 1200R SPECIFICATIONS*

NOM. SIZE ¹	PVC PIPE WITH DUCTILE IRON PIPE O.D. STYLE 1200C	PVC FITTING BELL OD "D"		A1	A2	B1 APPROX.	B2 APPROX.	C MAX.	RESTRAINT BOLTS/ RODS		CLAMPING BOLTS		APPROX WT. (LBS)
	O.D.	MIN.	MAX.						QTY	SIZE	QTY	SIZE	
14	15.30	17.28	17.73	4.00	3.75	22.68	25.27	21	6	3/4 x 24	8	7/8 x 7**	130
16	17.40	19.64	20.17	3.75	3.75	24.65	27.71	27	6	3/4 x 30	8	7/8 x 6 1/2	123
18	19.50	22.25	22.50	4.25	4.00	26.65	30.04	27	8	3/4 x 30	8	7/8 x 6 1/2	150
20	21.60	25.00	25.25	5.00	5.00	28.88	32.79	27	8	3/4 x 30	8	1 1/8 x 8 1/2	220
24	25.80	30.00	30.25	5.00	5.00	33.98	37.93	33	12	3/4 x 36	8	1 1/8 x 8 1/2	290

*All dimensions in inches except where indicated.

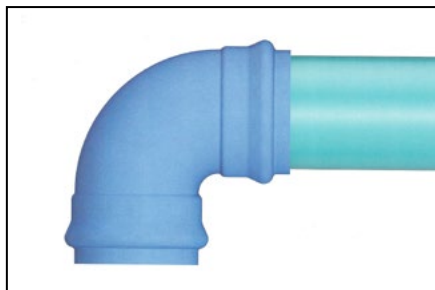
** Clamping bolt size for harness is 7/8 x 6 1/2



Pipe Restrainers series 1200R

1200R Restrainer only
for 14"-24" IPEX / Blue Brute® PVC Pressure Fittings

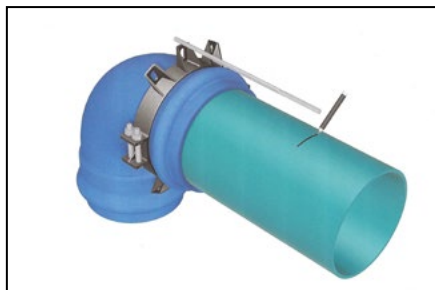
INSTALLATION INSTRUCTIONS (SERIES 1200R 14" - 24")

**STEP 1**

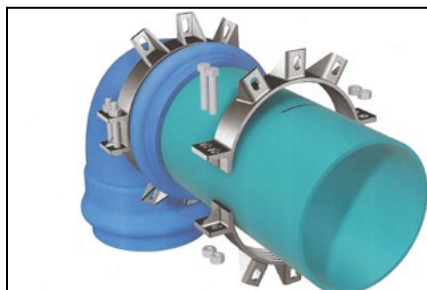
Insert the pipe into fitting bell according to standard procedure.

**STEP 2**

Assemble harness on the body of the fitting bell behind the hump of the gasket raceway using hex head clamping bolts and nuts. It must be oriented as shown above. The flat side of the restraint ears must face away from the assembled joint. Evenly tighten to recommended torque (Table A).

**STEP 3**

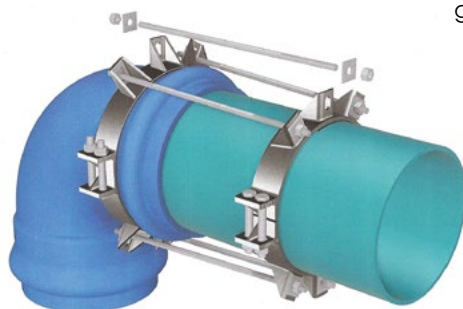
Use one of the rods (provided) as an alignment guide to position serrated restrainer on pipe, leave sufficient threads on the rod ends to fully engage nuts (provided). Full engagement occurs when there are at least two threads showing past the nut on the rod.

**STEP 4**

Assemble the restraint on the pipe as shown above. The flat side of the restraint ears must face away from the assembled joint. Make sure that the entire length of all the serrations are in contact with the pipe before installing the clamping bolts. Tighten serrated restrainer clamping bolts evenly to recommended torque (Table A) making sure the gap between bolt pads on both sides remain same.

(TABLE A) CLAMPING BOLTS RECOMMENDED TORQUE

PIPE SIZE (IN)	MINIMUM TORQUE (FT-LBS)
14 - 24	130

**STEP 5**

Insert the restraining rods (provided) through restrainers as shown. Place a washer (provided) on each end of rod behind the restrainer ears. Snug tighten the nuts so that the spigot end is secured into the bell end.

CAUTION: Do not over-tighten restraining nuts. Turn nut to hand tight plus one full.

[illegible]



Pipe Restrainers series 1000G2

1000G2C Restrainers for AWWA CI OD C900/C909 PVC/PVCO Pipe
with MJ or Ductile Iron Push-On Fittings
(Formerly Series 9000)



Series 1000G2C for C900 PVC Pipe/C909 PVCO Pipe

INFORMATION

Second Generation (Gen 2) PVC Restrainers for restraining mechanical joint or ductile iron push-on fittings with PVC pipe. These restraints work in any type of soil for a guaranteed joint restraint with rated pressure as listed below.

PVC restrainers can be installed on new or existing systems, totally eliminating the use of thrust blocks. These restrainers have internal serrations that lock onto the pipe and give 360° contact and support the pipe wall.

**Rated to the New, Higher
Pressure Classes in Latest Editions
of AWWA C900 and C909**

FEATURES & ADVANTAGES

- 360° contact, no pipe distortion or point loading and supports the wall of the pipe
- Made of Ductile Iron - ASTM Grade A536, Grade 65-45-12
- Restrainers work with Mechanical Joint or Ductile Iron Push-On Fittings.
- For use on 4" - 12" C900 PVC and C909 PVCO Pipe.
- The safety factor is twice (2:1) the maximum pressure rating listed on next page.
- Can be installed outside the trench, to ease installation
- Maintains full deflection on Mechanical Joint and Ductile Iron Push-On Fittings
- T-Bolts/Hex Nuts: low alloy steel per ANSI/AWWA C111/A21.11
- Clamping Bolts: SAE J429 Grade 5
- Series 1000G2 is approved by Factory Mutual Research in sizes 4" - 12" for use on C900 DR18 pipe for 150 PSI.
- Standard color is Graphite Black (RAL 9011).
- Originally introduced as the 9000, this improved design (Gen 2) provides increased performance and is rated to the new, higher pressure classes in latest editions of AWWA C900 and C909.



1000G2C with MJ Fitting

SAMPLE SPECIFICATIONS

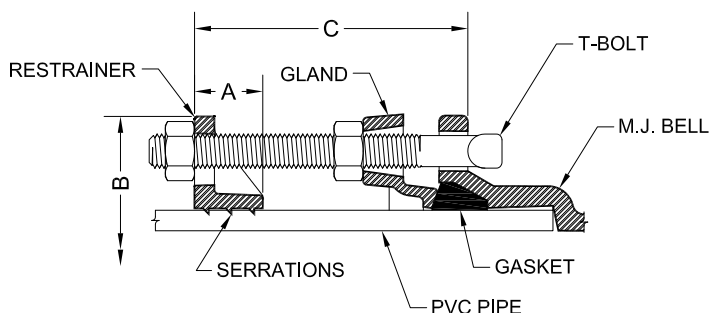
PVC restraint devices shall be manufactured of high strength ductile iron in accordance to ASTM A536 Grade 65-45-12 for all sizes. Internal serrations will be provided with exact tolerances for a 360° contact and support of the pipe wall. PVC Restraint devices shall have a safety factor of 2:1 over the pipe pressure rating.



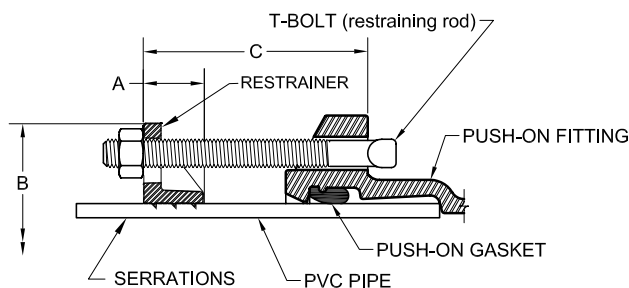
Pipe Restrainers series 1000G2

1000G2C Restainers for AWWA CI OD C900/C909 PVC/PVCO Pipe
with MJ or Ductile Iron Push-On Fittings
(Formerly Series 9000)

TECHNICAL INFORMATION



4" - 12" Sizes with MJ Fittings



4" - 12" Sizes with Push-On Fittings

PIPE RESTRAINERS 1000G2C SPECIFICATIONS*

NOM. SIZE	PVC/PVCO PIPE WITH DUCTILE IRON PIPE O.D. STYLE 1000G2C	A	B APPROX.	C MAX.	RESTRAINT BOLTS (T-BOLTS)		CLAMPING BOLTS		APPROX WT. (LBS)
	O.D.				QTY	SIZE	QTY	SIZE	
4	4.80	1.44	9.32	6.00	2	3/4 x 7	2	5/8 x 3 1/2	7.24
6	6.90	1.50	11.26	6.00	2	3/4 x 7	2	5/8 x 3 1/2	8.10
8	9.05	2.00	14.76	8.00	2	3/4 x 9	2	3/4 x 4	14.92
10	11.10	2.38	17.26	8.00	4	3/4 x 9	2	7/8 x 5	26.49
12	13.20	2.38	20.00	8.00	4	3/4 x 9	2	7/8 x 5	30.67

* All dimensions in inches except where indicated.

Table A - Maximum Working Pressure Rating with Occasional or Recurring Surges in PSI for Plastic Pipes Made to CI OD Diameter Regimen

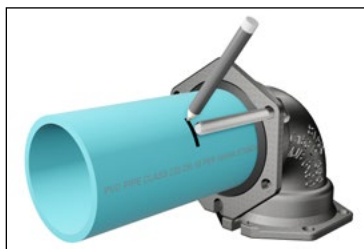
NOM. SIZE (IN)	C900			C909
	DR14	DR18	DR25	PC 235
4	305	235	165	235
6	305	235	165	235
8	305	235	165	235
10	305	235	165	235
12	305	235	165	235



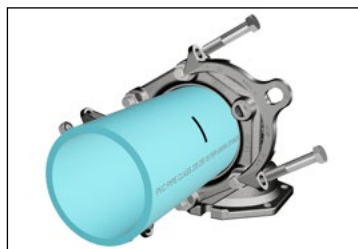
Pipe Restrainers series 1000G2

1000G2C Restrainers for AWWA CI OD C900/C909 PVC/PVCO and Ductile Iron Pipe with MJ or Ductile Iron Push-On Fittings
(Formerly Series 9000)

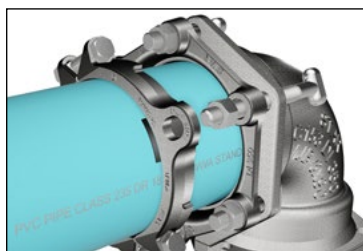
INSTALLATION INSTRUCTIONS (SERIES 1000G2 4"-12")

**STEP 1**

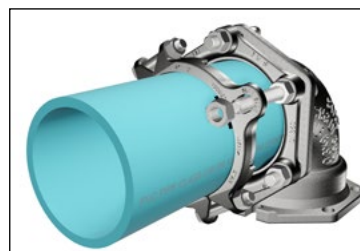
To ensure the rubber gasket will seal effectively, clean and remove all loose materials from the mating surfaces. If the pipe being installed is PVC/PVCO, verify that the end going into the MJ bell is square cut. If not, remove all but 1/8" of the bevel and debur it. Insert and completely home the pipe into the MJ fitting bell. Then insert one of the long T-bolts provided through one of the holes as shown. Mark a line 1 1/4" away from the end of the T-bolt and towards the MJ bell as shown.

**STEP 2**

Assemble the MJ joint using the gland, gasket and T-bolts per the AWWA standards and as modified for AWWA C909 pipe in these guidelines. (Note that the long T-bolts are installed later.) Next, assemble the restrainer on the pipe so that it is even with the line marked on the pipe in Step No. 1. Make sure that the open ends of the restrainer ears are toward the MJ fitting bell. Also ensure that the holes in the restrainer ears line up with the bolt holes of the MJ gland. Evenly tighten the restrainer clamping bolts to the recommended torque shown below.

**STEP 3**

Insert one of the long T-bolts provided, installing one nut each between the gland and the restrainer as shown. Follow the same procedure for the remaining long T-bolts. Tighten nuts against the MJ gland per the AWWA standards and as modified for AWWA C909 pipe in these guidelines. (See table for T-bolt/nut torque details.)

**STEP 4**

Snug tighten the second nut on each long T-Bolt against the restrainer as shown. Washers are provided for sizes 8" to 12".

Caution: Do not over-tighten the restraining nuts. Turn nut to hand tight plus half turn.

T-HEAD BOLT & NUT DETAILS			
PIPE SIZE (IN)	BOLT SIZE (IN)	RANGE OF TORQUE (FT-LBS)	
		C900/DI PIPE	C909
4-12	3/4	75 - 90	55 - 65

RECOMMENDED TORQUE (CLAMPING BOLTS)		
PIPE SIZE (IN)	C900/C909 (FT-LBS)	DI PIPE (FT-LBS)
4-10	100	110
12	130	130

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.



Pipe Restrainers series 1100G2

1100G2C Bell Restrainers for AWWA CI OD C900/C909 PVC/PVCO Pipe Joints
(Formerly Series 9100)



Series 1100G2C for C900 PVC/C909 PVCO Pipe

INFORMATION

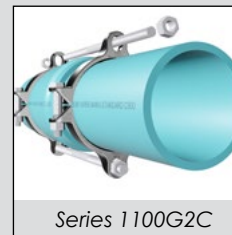
Second Generation (Gen 2) PVC Restrainers for restraining PVC pipe bell joints. These restraints work in any type of soil for a guaranteed joint restraint with rated pressure as listed below.

PVC restrainers can be installed on new or existing systems, totally eliminating the use of thrust blocks. These restrainers have internal serrations that lock onto the pipe and give 360° contact and support the pipe wall. Restraint devices may be used with any type of PVC piping system.

**Rated to the New, Higher
Pressure Classes in Latest Editions
of AWWA C900 and C909***

FEATURES & ADVANTAGES

- 360° contact, no pipe distortion or point loading
- Made of Ductile Iron - ASTM Grade 536, Grade 65-45-12
- Restrainers work with Push-On Pipe Bells.
- For use on 4" - 12" C900 PVC and C909 PVCO pipe.
- The safety factor is twice (2:1) the maximum pressure rating listed on next page.
- Can be installed outside the trench, to ease installation
- Rods/Hex Nuts: low alloy steel per ANSI/AWWA C111/A21.11
- Clamping Bolts: SAE J429 Grade 5
- Series 1100G2 is approved by Factory Mutual Research in sizes 4" - 12" for use on C900 PVC DR18 for 150 PSI.
- Standard color is Graphite Black (RAL 9011).
- Originally introduced as the 9100, this improved design (Gen 2) provides increased performance and is rated to the new, higher pressure classes in latest editions of AWWA C900 and C909*.



Series 1100G2C

* See table on next page.

SAMPLE SPECIFICATIONS

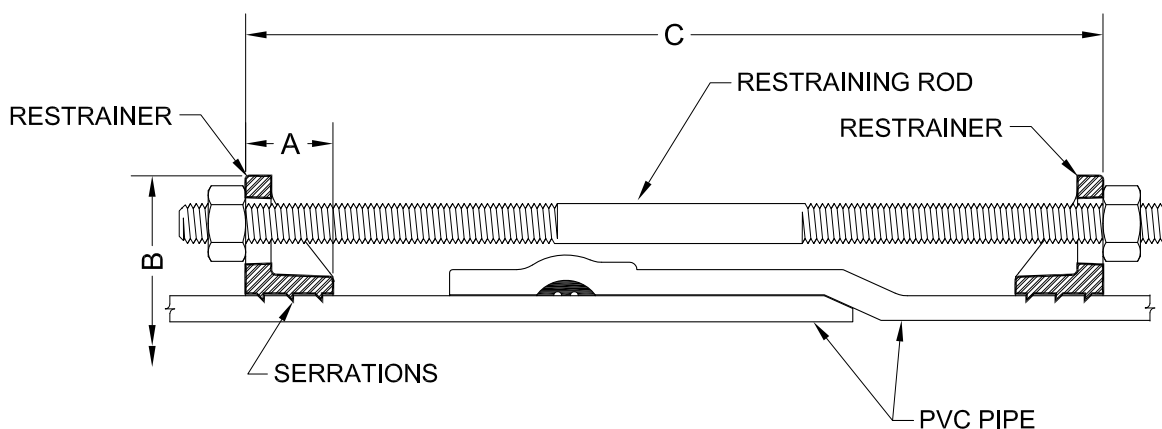
PVC restraint devices shall be manufactured of high strength ductile iron in accordance to ASTM A536 Grade 65-45-12 for all sizes. Internal serrations will be provided with exact tolerances for a 360° contact and support of the pipe wall. PVC Restraint devices shall have a safety factor of 2:1 over the pressure rating.



Pipe Restrainers series 1100G2

1100G2C Bell Restrainers for AWWA CI OD C900/C909 PVC/PVCO Joints
(Formerly Series 9100)

TECHNICAL INFORMATION



4" - 12" Sizes

PIPE RESTRAINERS 1100G2C SPECIFICATIONS*

NOM. SIZE	PVC/PVCO PIPE WITH DUCTILE IRON PIPE O.D. STYLE 1100G2C	A	B APPROX.	C MAX.	RESTRAINT RODS		CLAMPING BOLTS		APPROX WT. (LBS)
	O.D.				QTY	SIZE	QTY	SIZE	
4	4.80	1.44	9.32	15.00	2	3/4 x 17	4	5/8 x 3 1/2	12.63
6	6.90	1.50	11.26	15.00	2	3/4 x 17	4	5/8 x 3 1/2	14.35
8	9.05	2.00	14.76	22.00	2	3/4 x 24	4	3/4 x 4	27.45
10	11.10	2.38	17.26	22.00	4	3/4 x 24	4	7/8 x 5	48.21
12	13.20	2.38	20.00	22.00	4	3/4 x 24	4	7/8 x 5	56.57

* All dimensions in inches except where indicated.

MAXIMUM WORKING PRESSURE RATING WITH OCCASIONAL & RECURRING SURGES

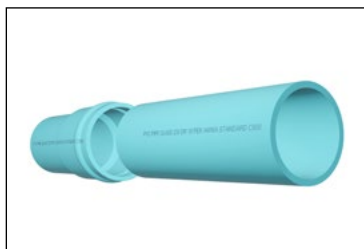
NOM. SIZE (IN)	C900			C909
	DR14	DR18	DR25	PC 235
4	305	235	165	235
6	305	235	165	235
8	305	235	165	235
10	305	235	165	235
12	305	235	165	235



Pipe Restrainers series 1100G2

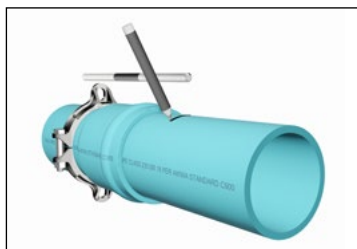
1100G2C Bell Restrainers for AWWA CI OD C900/C909 PVC/PVCO
and Ductile Iron Pipe Joints
(Formerly Series 9100)

INSTALLATION INSTRUCTIONS (SERIES 1100G2 4"-12")



STEP 1

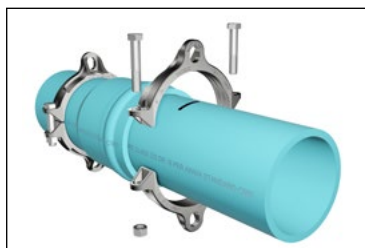
Assemble the spigot end of first pipe into the second pipe's bell per the pipe manufacturer's instructions.



STEP 2

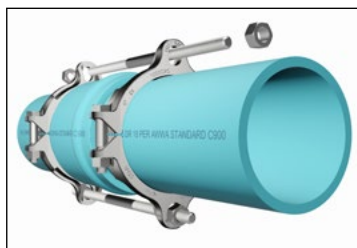
Assemble one restrainer behind the bell of pipe. Make sure that the open end of the restrainer ears are toward the joint. Evenly tighten the restrainer clamping bolts to the recommended torque, ensuring the gap between pads on both sides remain even. Use one of the restraint rods as a guide to position the restraint on spigot end. Mark a reference line such that the restraint rod ends extend past each nut approximately 1/2".

NOTE: The length of the PVC pipe bell varies from manufacturer to manufacturer. Please contact Star Pipe Products if rod length is too short.



STEP 3

Assemble the second restrainer on the spigot end of pipe. Make sure that the open end of the restrainer ears are toward the joint. After aligning the second restrainer with the first one, tighten the clamping bolts to recommended torque evenly such that the gap between pads on both sides remain even.



STEP 4

Insert the restraining rods through the restrainer ears. Snug tighten all nuts such that rods stick out approximately 0.50" past the nut on each end. Washers are provided for size 8"-12".

Caution: Do not over - tighten restraining nuts. Turn nut to hand tight plus half turn.

RECOMMENDED TORQUE (CLAMPING BOLTS)

PIPE SIZE (IN)	C900/C909 (FT-LBS)	DI PIPE (FT-LBS)
4-10	100	110
12	130	130

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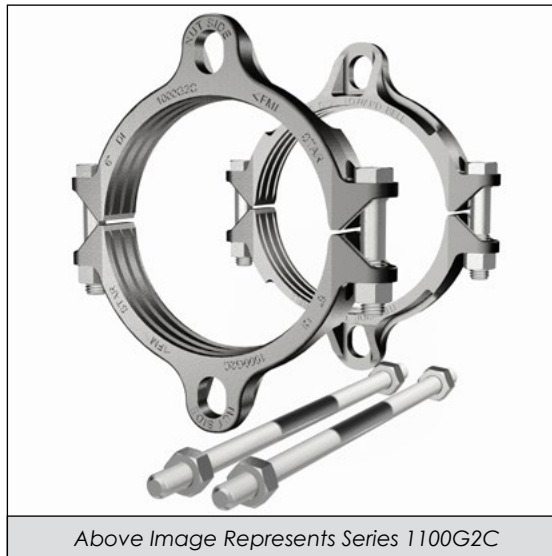
® REGISTERED TRADEMARK OF STAR PIPE PRODUCTS

Page 60



Pipe Restrainers series 1000G2 & 1100G2

1000G2C & 1100G2C For Use On Ductile Iron Pipe



Above Image Represents Series 1100G2C

INFORMATION

Second Generation (Gen 2) Pipe restrainers for restraining ductile iron pipe with mechanical joint or push-on fittings and DIP bell joints.

Pipe restrainers can be installed on new or existing systems, totally eliminating the use of thrust blocks. These restrainers have internal serrations that lock onto the pipe and give 360° contact and support the pipe wall.

For Use on Ductile Iron Pipe

FEATURES & ADVANTAGES

- Castings made of Ductile Iron - ASTM A536, Grade 65-45-12
- Restrainers work with Mechanical Joint or Ductile Iron Push-On Fittings and with Ductile Iron Pipe manufactured per ANSI/AWWA C-151/A21.51.
- The safety factor is twice (2:1) the maximum pressure rating listed on next page.
- Maintains full deflection on Mechanical Joint and Push-On Fittings
- T-Bolts/Rods/Hex Nuts: Low alloy steel per ANSI/AWWA C111/A21.11
- Clamping Bolts: SAE J429 Grade 5

Notes:

- *Not recommended for installations on machined end pipe or fittings*
- *Installation requires clamp bolt torque values be applied as indicated on the next page.*
- *Installation and testing to be in accordance with the latest version of ANSI/AWWA C600*
- *For higher pressure requirements, please contact Star® Pipe Products*
- *Pipe hardness not to exceed 230 BHN.*

SAMPLE SPECIFICATIONS

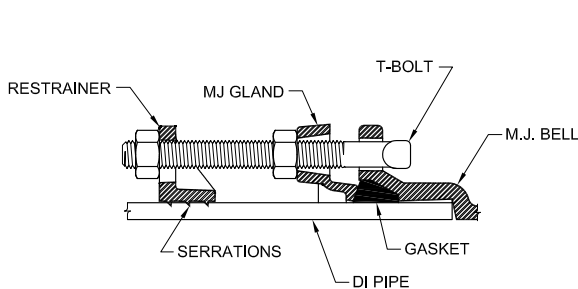
Pipe restraining devices shall be manufactured of high strength ductile iron in accordance to ASTM A536 Grade 65-45-12 for all sizes. Internal serrations will be provided with exact tolerance for a 360° contact and support of the pipe wall. Pipe restraining devices shall have a safety factor of 2:1 over the pressure rating.



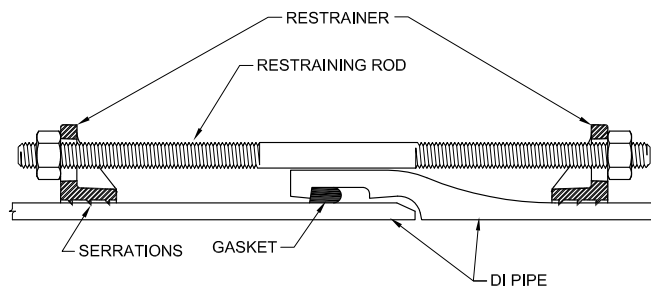
Pipe Restrainers series 1000G2 & 1100G2

1000G2C & 1100G2C For Use On Ductile Iron Pipe

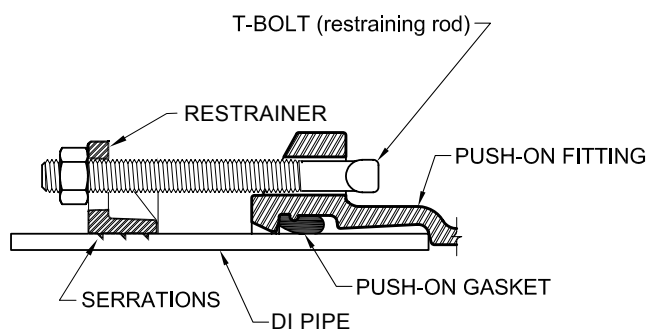
TECHNICAL INFORMATION



Series 1000G2
(4" - 12" Sizes with MJ Fittings)



Series 1100G2
(4" - 12" Sizes with Pipe to Pipe Connection)



Series 1000G2
(4" - 12" Sizes with Push-On Fittings)

TABLE A - Pressure Rating For Ductile Iron Pipe-To-Pipe Connections and Ductile Iron Pipe to MJ Fitting Connections

NOMINAL SIZE	MAXIMUM PRESSURE RATINGS (PSI)	CLAMP BOLT TORQUE (FT-LBS)
4" - 10"	250	110 min.
12"	200	110 min.

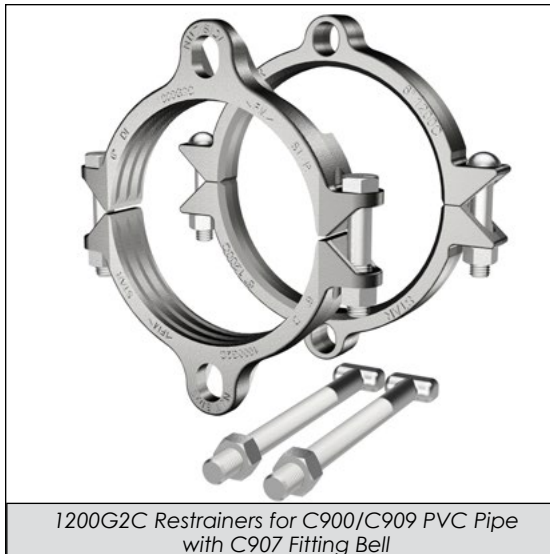
TABLE B - Pressure Rating For DI Pipe To Ductile Iron Push-On Fitting Connections

NOMINAL SIZE	MAXIMUM PRESSURE RATINGS (PSI)	CLAMP BOLT TORQUE (FT-LBS)
4" - 8"	250	110 min.
10" - 12"	100	110 min.



Pipe Restrainers series 1200G2

1200G2C Restrainers for C900/C909 PVC/PVCO Pipe and PVC Pressure Fittings
w/Ductile Iron Pipe OD
(Formerly Series 9200)



INFORMATION

Second Generation (Gen 2) PVC Restrainers are for restraining bell joints between AWWA C900/C909 PVC/PVCO pipe and PVC pressure fittings. The PVC pressure fitting may be PC235 psi molded AWWA C907 PVC pressure fittings or PR 235 psi fabricated PVC pressure fittings.

PVC restrainers can be installed on new or existing systems, totally eliminating the use of thrust blocks. These restrainers have internal serrations that lock onto the pipe and give 360° contact and support the pipe wall.

Rated to the New, Higher Pressure Classes in Latest Editions of AWWA C900 and C909*

FEATURES & ADVANTAGES

- 360° contact, no pipe distortion or point loading and supports the wall of the pipe and fitting bell.
- Made of Ductile Iron - ASTM Grade 536, Grade 65-45-12
- Restrainers work with either
 - PC235 psi molded AWWA C907 PVC pressure fittings or
 - PR235 psi fabricated PVC pressure fittings.
- The safety factor is twice (2:1) the maximum pressure rating listed on next page.
- Can be installed outside the trench, to ease installation
- T-Bolts/Rods/Hex Nuts: low alloy steel per ANSI/AWWA C111/A21.11
- Clamping Bolts: SAE J429 Grade5
- Standard gland color is Graphite Black (RAL 9011).
- Originally introduced as the 9200, this improved design (Gen 2) provides increased performance and is rated to the new, higher pressure classes in latest editions of AWWA C900 and C909*.



1200G2 Restrainer

* See table on next page.

SAMPLE SPECIFICATIONS

PVC restraint devices shall be manufactured of high strength ductile iron in accordance to ASTM A536 Grade 65-45-12 for all sizes. Internal serrations will be provided with exact tolerances for a 360° contact and support of the pipe wall. PVC Restraint devices shall have a safety factor of 2:1 over the pressure rating.

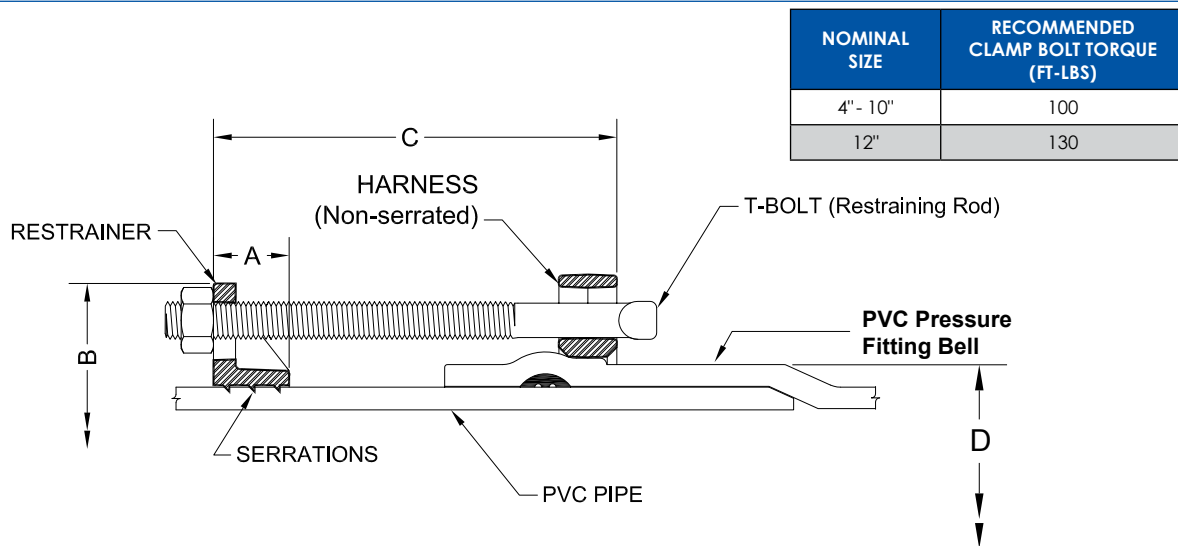
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Pipe Restrainers series 1200G2

1200G2C Restrainers for C900/C909 PVC/PVCO Pipe and PVC Pressure Fittings
w/Ductile Iron Pipe OD
(Formerly Series 9200)

TECHNICAL INFORMATION



4" - 12" SIZES

PIPE RESTRAINERS 1200G2C SPECIFICATIONS*

NOM. SIZE ¹	PVC/PVCO PIPE WITH DUCTILE IRON PIPE O.D. STYLE 1200G2C	A	B APPROX.	C MAX.	PVC FITTING BELL OD "D"		RESTRAINT BOLTS/RODS		CLAMPING BOLTS		APPROX WT. (LBS)
	O.D.				MIN	MAX	QTY	SIZE	QTY	SIZE	
4	4.80	1.44	9.32	8.00	5.44	5.61	2	3/4 x 9	4	5/8 x 3-1/2	13.58
6	6.90	1.50	11.26	8.00	7.84	8.03	2	3/4 x 9	4	5/8 x 3-1/2	16.84
8	9.05	2.00	14.76	11.00	10.29	10.55	2	3/4 x 12	4	3/4 x 4	28.28
10	11.10	2.38	17.26	11.00	12.63	12.96	4	3/4 x 12	4	7/8 x 5	43.10
12	13.20	2.38	20.00	11.00	15.07	15.46	4	3/4 x 12	4	7/8 x 5	54.38

* All dimensions in inches except where indicated.

MAXIMUM WORKING PRESSURE RATING WITH OCCASIONAL & RECURRING SURGES

NOM. SIZE (IN)	C900			C909
	DR14+	DR18	DR25	PC 235
4	235	235	165	235
6	235	235	165	235
8	235	235	165	235
10	235	235	165	235
12	235	235	165	235

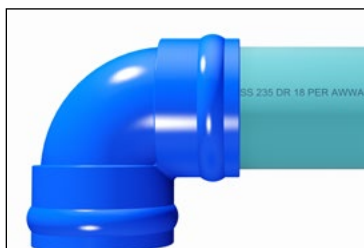
+ Derated due to rating of PVC pressure fitting.



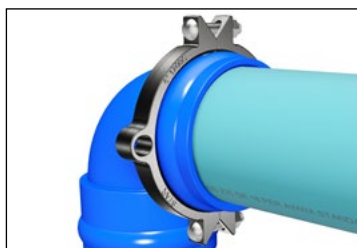
Pipe Restrainers series 1200G2

1200G2C Restrainers for C900/C909 PVC/PVCO Pipe and PVC Pressure Fittings
w/Ductile Iron Pipe OD
(Formerly Series 9200)

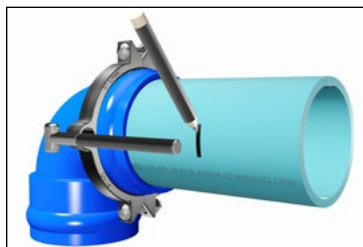
INSTALLATION INSTRUCTIONS (SERIES 1200G2 4"-12")

**STEP 1**

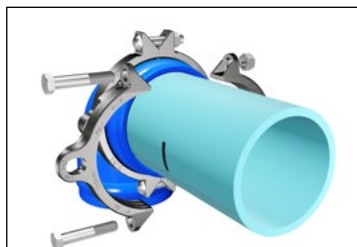
Insert the pipe into fitting bell per fitting manufacturer's instructions.

**STEP 2**

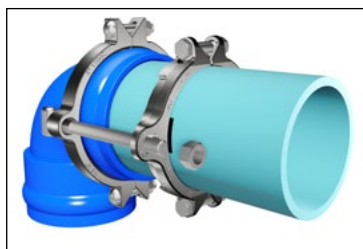
Assemble harness behind the bell of fitting using clamping bolts and nuts supplied. Evenly tighten to recommended torque.

**STEP 3**

Using one of the T-bolts / rods (provided) mark a reference line such that the T-bolt / rod end extends past the nut by approximately 1/2".

**STEP 4**

Make sure the open end of the restrainer ears are toward the joint. Tighten serrated restrainer clamp bolts evenly to recommended torque making sure the gap between bolt pads on both sides remain even.

**STEP 5**

Insert the T-bolts / rods (provided) through restrainers as shown. For size 8" to 12", place a washer (provided) on each end of rod behind the restrainer ears. Snug tighten the nuts so that the spigot end is secured into the bell end.

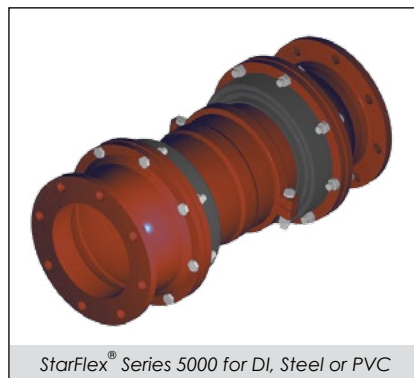
Caution: Do not over-tighten restraining nuts. Turn nut to hand tight plus half turn.

RECOMMENDED CLAMP BOLT TORQUE	
PIPE SIZE (IN)	C900/C909 (FT-LBS)
4-10	100
12	130

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StarFlex® series 5000

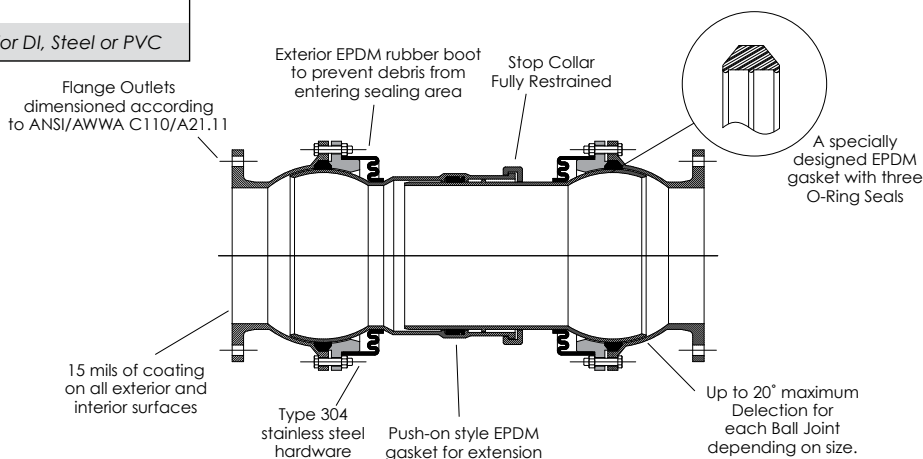
Double-Ball Flexible Expansion Joint
for the Protection of Water Wastewater, and Industrial Pipelines

StarFlex® Series 5000 for DI, Steel or PVC

INFORMATION

StarFlex® Flexible Expansion Joints can deflect up to 40 degrees, depending on size, in any direction while expanding and contracting at the same time. This flexible expansion joint design provides pipeline protection needed due to the results of natural and man-made stresses. The StarFlex® Flexible Joint is available for use on Ductile Iron, Steel and PVC pipe in the size range of 3" through 48". For units of expansion that are not listed please contact your Star® Pipe Products representative.

For Use with Ductile Iron, Steel or PVC



FEATURES & ADVANTAGES

- Each StarFlex® is coated inside and outside with 15 mils of Fusion Bonded Epoxy that is NSF compliant.
- Each ball on the StarFlex® can deflect a minimum of 20 degrees for 3"-10", 18 degrees for 12", 15 degrees for 14"-24", 14 degrees for 30", 13.5 degrees for 36" and 13 degrees for 42"-48".
- All cast components are made entirely of ductile Iron grade 65-45-12.
- All fasteners are Type 304 Stainless Steel.
- Every unit is pressurized and cycled while maintaining 350 PSI on sizes 3" - 24", 250 PSI on sizes 30" and above.
- Each unit is shipped in a cradle at its preset position, but can be adjusted to the desired dimension in the field.
- All sizes have external EPDM rubber boots to prevent debris from entering the sealing areas.
- Pressure seals are EPDM. Maximum operating temperature is 175° F.
- The StarFlex® may be used on ductile iron, steel, HDPE or PVC pipe.
- Flanged outlets are dimensioned according to ANSI/AWWA C110/A21.11 which is also equal to ASME B16.1 Class 125 & ASME B16.5 Class 150 without a raised face.
- Standard color is Coral Red (RAL 3016).
- NSF61 Approved Fusion Bonded Epoxy coating is used in wetted areas.

Note: StarFlex® series 5000 and 5100 flexible expansion joints are designed to expand when internally pressurized. End thrust generated from expansion of the StarFlex® under internal pressure must be accommodated in the piping system design.

SAMPLE SPECIFICATIONS

Flexible expansion joints shall be manufactured of ductile iron in accordance with ASTM A536 Grade 65-45-12. Each flexible expansion joint shall be capable of deflecting and expanding at the same time to the amounts shown on the drawing or indicated in the specifications. Each ball joint shall possess an external rubber boot to prevent penetration of outside debris.

All hardware nuts, bolts and straps shall be type 304 stainless steel. All ductile iron components shall be coated internally and externally with 15 mils of fusion bonded epoxy and shall be holiday tested with a 1500 volt spark test, both of which conform to the requirements ANSI/AWWA C213. Every flexible joint unit shall be cycled and pressure tested at 350 PSI for 3"-24" and 250 PSI for 30" and above prior to shipment. Flexible expansion joints shall be Star® Pipe Products, StarFlex® Series 5000 or an approved equal.

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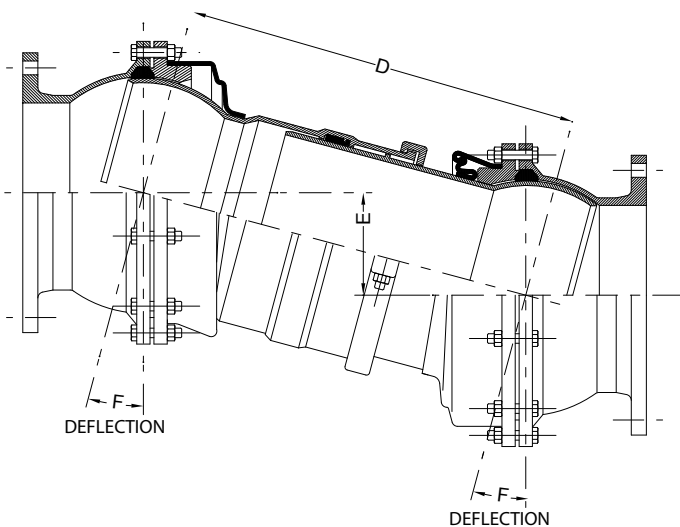
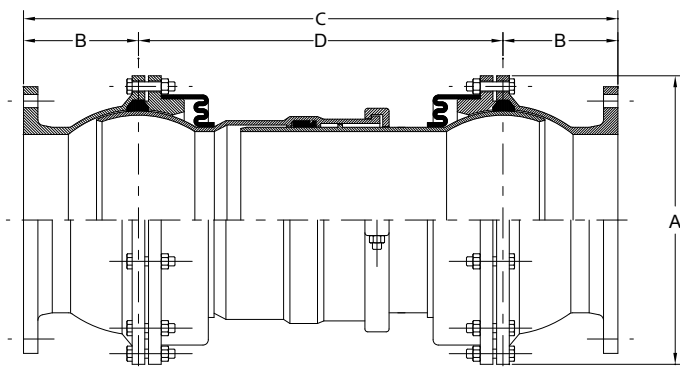


StarFlex® series 5000

Double-Ball Flexible Expansion Joint
for the Protection of Water, Wastewater, and Industrial Pipelines

STARFLEX® 5000 SPECIFICATIONS*

NOM. SIZE	F	A (OD)	B	EXPANSION¹	C	D	E (OFF SET)		APPROX WT. (LBS)
							Min	Max	
3	20°	9.69	5.31	+2 /-2	29.52	18.90	5.78	7.15	109
	20°	9.69	5.31	+4 /-4	39.37	28.75	8.46	11.20	132
4	20°	10.87	5.91	+2 /-2	32.28	20.46	6.31	7.68	141
	20°	10.87	5.91	+4 /-4	42.13	30.31	9.00	11.73	173
	20°	10.87	5.91	+6 /-6	51.97	40.15	11.68	15.78	196
	20°	10.87	5.91	+8 /-8	61.82	50.00	14.36	19.84	219
6	20°	13.11	5.91	+2 /-2	33.46	21.64	6.72	8.09	202
	20°	13.11	5.91	+4 /-4	43.70	31.88	9.54	12.27	256
	20°	13.11	5.91	+6 /-6	53.54	41.72	12.22	16.32	290
	20°	13.11	5.91	+8 /-8	63.39	51.57	14.90	20.37	323
	20°	13.11	5.91	+12 /-12	83.07	71.25	20.26	28.47	402
8	20°	15.31	6.3	+2 /-2	35.83	23.23	7.26	8.63	273
	20°	15.31	6.3	+4 /-4	45.67	33.07	9.94	12.68	342
	20°	15.31	6.3	+6 /-6	55.51	42.91	12.62	16.73	386
	20°	15.31	6.3	+8 /-8	65.36	52.76	15.31	20.78	430
	20°	15.31	6.3	+12 /-12	85.04	72.44	20.67	28.88	518
10	20°	17.32	6.69	+2 /-2	37.79	24.41	7.66	9.03	331
	20°	17.32	6.69	+4 /-4	47.24	33.86	10.21	12.95	428
	20°	17.32	6.69	+6 /-6	57.09	43.71	12.90	17.00	483
	20°	17.32	6.69	+8 /-8	66.93	53.55	15.58	21.05	536
	20°	17.32	6.69	+12 /-12	86.61	73.23	20.94	29.15	659
12	18°	19.76	7.87	+2 /-2	41.34	25.60	7.29	8.53	463
	18°	19.76	7.87	+4 /-4	52.36	36.62	10.08	12.55	575
	18°	19.76	7.87	+6 /-6	62.20	46.46	12.50	16.21	639
	18°	19.76	7.87	+8 /-8	72.05	56.31	14.93	19.87	703
	18°	19.76	7.87	+12 /-12	91.73	75.99	19.77	27.19	849
14	15°	22.56	9.06	+4 /-4	55.51	37.39	8.64	10.71	839
	15°	22.56	9.06	+6 /-6	65.75	47.63	10.77	13.88	998
	15°	22.56	9.06	+8 /-8	75.59	57.47	12.80	16.94	1095
	15°	22.56	9.06	+12 /-12	108.27	90.15	20.23	26.44	1288
16	15°	24.69	9.45	+4 /-4	57.09	38.19	8.85	10.92	969
	15°	24.69	9.45	+6 /-6	66.93	48.03	10.88	13.98	1148
	15°	24.69	9.45	+8 /-8	79.92	61.02	13.72	17.86	1258
	15°	24.69	9.45	+12 /-12	99.61	80.71	17.78	24.00	1507
18	15°	26.81	10.24	+4 /-4	59.45	38.97	9.05	11.12	1080
	15°	26.81	10.24	+6 /-6	69.69	49.21	11.18	14.29	1305
	15°	26.81	10.24	+8 /-8	81.50	61.02	13.72	17.86	1430
	15°	26.81	10.24	+12 /-12	110.63	90.15	20.23	26.44	1761
20	15°	28.94	11.02	+4 /-4	61.81	39.77	9.26	11.33	1251
	15°	28.94	11.02	+6 /-6	72.05	50.01	11.39	14.50	1538
	15°	28.94	11.02	+8 /-8	83.07	61.03	13.73	17.87	1686
	15°	28.94	11.02	+12 /-12	112.20	90.16	20.23	26.44	1980
24	15°	33.15	11.42	+4 /-4	63.78	40.94	9.56	11.63	1672
	15°	33.15	11.42	+6 /-6	74.02	51.18	11.69	14.80	2029
	15°	33.15	11.42	+8 /-8	88.19	65.35	14.84	18.98	2216
	15°	33.15	11.42	+12 /-12	119.69	96.85	21.96	28.17	2606
30	14°	44.49	15.16	+6 /-6	90.75	60.43	13.17	16.07	4291
	14°	44.49	15.16	+12 /-12	120.28	89.96	18.86	24.67	5060
36	13.5°	50.51	16.54	+6 /-6	95.87	62.79	13.26	16.06	5437
	13.5°	50.51	16.54	+12 /-12	137.40	104.32	21.55	27.15	6633
48	13°	64.49	19.02	+6 /-6	107.72	69.68	14.32	17.02	9049
	13°	64.49	19.02	+12 /-12	142.36	104.32	20.77	26.17	10536



*Dimensions "C" & "D" are factory set position.

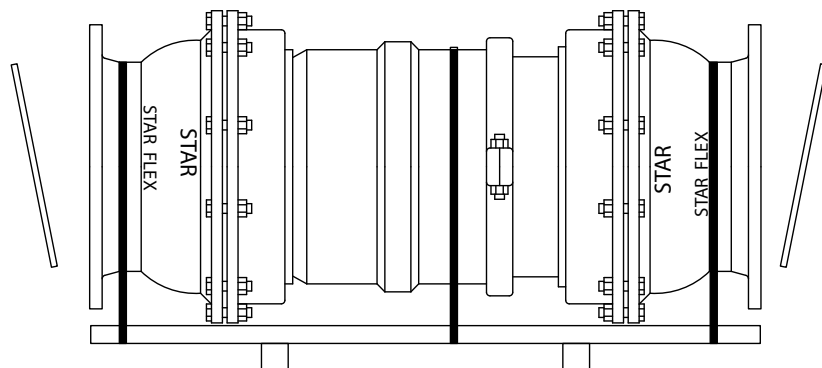
*All dimensions in inches except where indicated.

¹For units of expansion that are not listed, please contact your Star® Pipe representative.

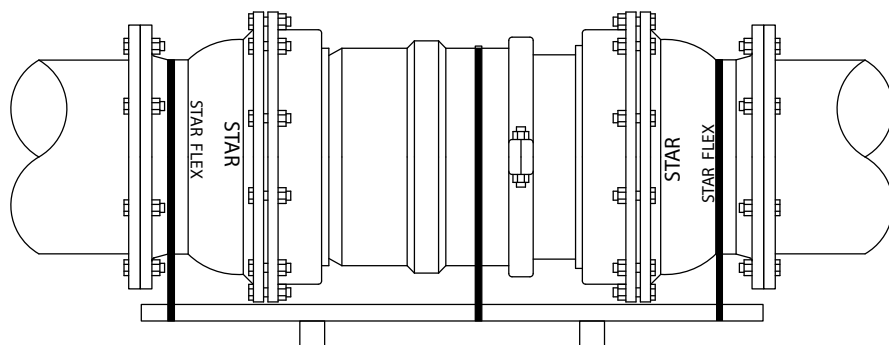
**StarFlex® series 5000**

Double-Ball Flexible Expansion Joint
for the Protection of Water, Wastewater, and Industrial Pipelines

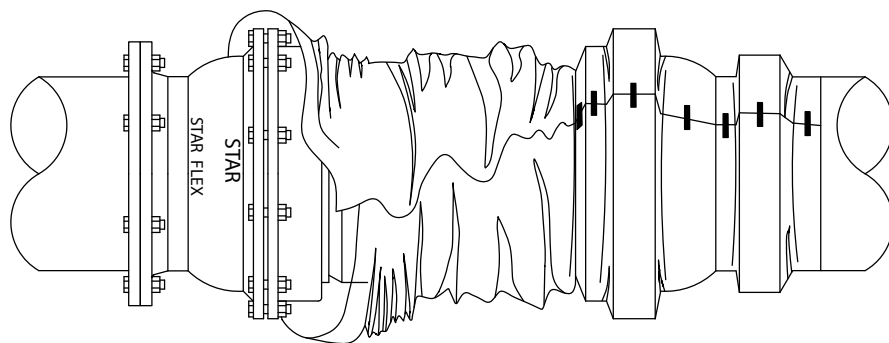
INSTALLATION INSTRUCTIONS

**STEP 1**

- Remove external shipping crate and wooden covers from the ends of the Flexible Pipe Joint. (Attention: Do not remove steel bands or wooden cradle until assembly is completed.)

**STEP 2**

- Assemble StarFlex® flanged ends in accordance to ANSI/AWWA C110/A21.10 Appendix A. (Flanged Fittings-Bolts, Gaskets, and Installation).

**STEP 3**

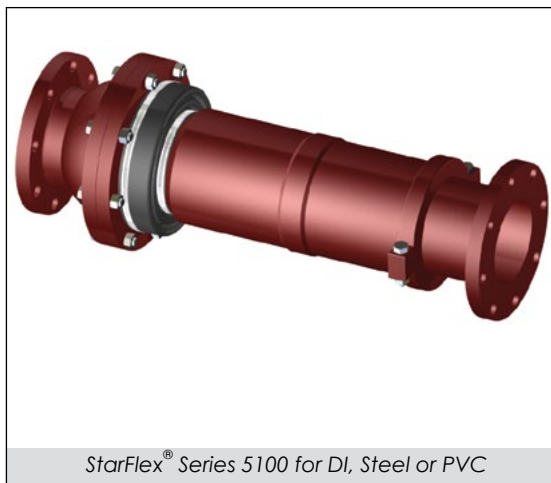
- After installation and both ends are assembled, remove steel straps and wooden cradle.
- In an above ground application, it is unnecessary to use a PE sleeve on the Flexible Expansion Joint.
- In a below grade application, if a PE sleeve is required, tape the sleeve on the pipe joint firmly. During backfill use caution to not puncture or damage PE sleeve.
- If a pressure test is required before backfilling, the piping system on each side of the Starflex must be restrained to prevent movement.
- If plain end pipe is used to connect to the StarFlex a Flange x MJ adapter fitting with a DI or PVC Stargrip is recommended.

This image shows a full page of blank, lined paper. It features approximately 20 evenly spaced horizontal grey lines across its entire width, typical of notebook or primary school writing paper. The background is white, and there are no margins, text, or other markings present.



StarFlex® series 5100

Single-Ball Flexible Expansion Joint
for the Protection of Water, Wastewater, and Industrial Pipelines



StarFlex® Series 5100 for DI, Steel or PVC

INFORMATION

StarFlex® Single-Ball Flexible Expansion Joints can deflect up to 20 degrees, depending on size, in any direction while expanding and contracting at the same time. This flexible expansion joint design provides pipeline protection needed due to the results of natural and man-made stresses. The StarFlex® Flexible Joint is available for use on Ductile Iron, Steel and PVC pipe in the size range of 3" through 48". For units of expansion that are not listed please contact your Star® Pipe Products representative.

For Use with Ductile Iron, Steel or PVC

FEATURES & ADVANTAGES

- Rated 350 PSI working pressure sizes 3"-24". Sizes 30" and above rated for 250 PSI working pressure.
- Each StarFlex® is coated inside and outside with 15 mils of Fusion Bonded Epoxy that is NSF compliant.
- Each ball on the StarFlex® can deflect a minimum of 20 degrees for 3"-10", 18 degrees for 12", 15 degrees for 14"-24", 14 degrees for 30", 13.5 degrees for 36" and 13 degrees for 42"-48".
- All cast components are made entirely of ductile Iron grade 65-45-12.
- All fasteners are Type 304 Stainless Steel.
- Every unit is pressurized and cycled while maintaining 350 PSI on sizes 3" - 24", 250 PSI on sizes 30" and above. Each unit is shipped in a cradle at its position, but can be adjusted to the desired dimension in the field.
- All sizes have external EPDM rubber boots to prevent debris from entering the sealing areas.
- Pressure seals are EPDM. Maximum operating temperature is 175° F.
- The StarFlex® may be used on ductile iron, steel, HDPE or PVC pipe.
- Flanged outlets are dimensioned according to ANSI/AWWA C110/A21.11 which is also equal to ASME B16.1 Class 125 & ASME B16.5 Class 150 without a raised face.
- Standard color is Coral Red (RAL 3016).
- NSF61 Approved Fusion Bonded Epoxy coating is used in wetted areas.

Note: StarFlex® series 5000 and 5100 flexible expansion joints are designed to expand when internally pressurized. End thrust generated from expansion of the StarFlex® under internal pressure must be accommodated in the piping system design.

SAMPLE SPECIFICATIONS

Flexible expansion joints shall be manufactured of ductile iron in accordance with ASTM A536 Grade 65-45-12. Each flexible expansion joint shall be capable of deflecting and expanding at the same time to the amounts shown on the drawing or indicated in the specifications. Each ball joint shall possess an external rubber boot to prevent penetration of outside debris.

All hardware nuts, bolts and straps shall be type 304 stainless steel. All ductile iron components shall be coated internally and externally with 15 mils of fusion bonded epoxy and shall be holiday tested with a 1500 volt spark test, both of which conform to the requirements ANSI/AWWA C213. Every flexible joint unit shall be cycled and pressure tested at 350 PSI for 3"-24" and 250 PSI for 30" and above prior to shipment. Flexible expansion joints shall be Star® Pipe Products, StarFlex® Series 5100 or an approved equal.

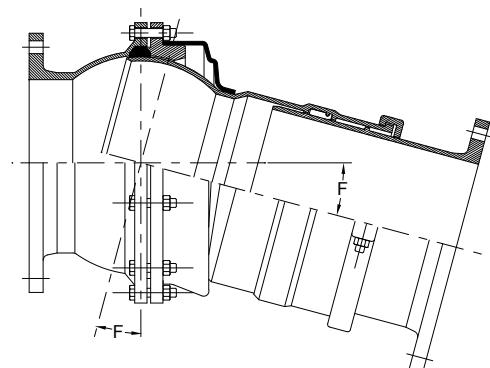
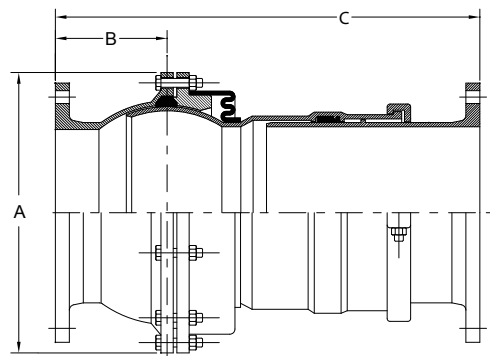


StarFlex® series 5100

Single-Ball Flexible Expansion Joint
for the Protection of Water, Wastewater, and Industrial Pipelines

STARFLEX® 5100 SPECIFICATIONS*

NOM. SIZE	F	A (OD)	B	EXPANSION¹	C	WEIGHT (LBS)
3	20°	9.69	5.31	+2 /-2	24.41	79
	20°	9.69	5.31	+4 /-4	34.25	100
4	20°	10.87	5.91	+2 /-2	25.59	119
	20°	10.87	5.91	+4 /-4	35.04	133
	20°	10.87	5.91	+6 /-6	44.88	156
	20°	10.87	5.91	+8 /-8	54.72	179
6	20°	13.11	5.91	+2 /-2	26.38	146
	20°	13.11	5.91	+4 /-4	36.42	198
	20°	13.11	5.91	+6 /-6	46.26	232
	20°	13.11	5.91	+8 /-8	56.1	266
	20°	13.11	5.91	+12 /-12	75.79	341
8	20°	15.31	6.3	+2 /-2	27.95	227
	20°	15.31	6.3	+4 /-4	37.4	295
	20°	15.31	6.3	+6 /-6	47.64	340
	20°	15.31	6.3	+8 /-8	57.48	382
	20°	15.31	6.3	+12 /-12	77.17	471
10	20°	17.32	6.69	+2 /-2	29.13	252
	20°	17.32	6.69	+4 /-4	38.39	335
	20°	17.32	6.69	+6 /-6	48.62	389
	20°	17.32	6.69	+8 /-8	58.46	444
	20°	17.32	6.69	+12 /-12	78.15	561
12	18°	19.76	7.87	+2 /-2	31.1	335
	18°	19.76	7.87	+4 /-4	40.75	450
	18°	19.76	7.87	+6 /-6	50.98	506
	18°	19.76	7.87	+8 /-8	60.83	571
	18°	19.76	7.87	+12 /-12	80.51	710
14	15°	22.56	9.06	+4 /-4	43.31	627
	15°	22.56	9.06	+6 /-6	53.94	780
	15°	22.56	9.06	+8 /-8	63.78	878
	15°	22.56	9.06	+12 /-12	89.96	1073
16	15°	24.69	9.45	+4 /-4	44.09	724
	15°	24.69	9.45	+6 /-6	54.72	903
	15°	24.69	9.45	+8 /-8	65.57	1014
	15°	24.69	9.45	+12 /-12	84.65	1239
18	15°	26.81	10.24	+4 /-4	45.28	801
	15°	26.81	10.24	+6 /-6	56.3	1013
	15°	26.81	10.24	+8 /-8	66.34	1141
	15°	26.81	10.24	+12 /-12	92.13	1433
20	15°	28.94	11.02	+4 /-4	46.46	913
	15°	28.94	11.02	+6 /-6	57.48	1232
	15°	28.94	11.02	+8 /-8	67.72	1375
	15°	28.94	11.02	+12 /-12	93.31	1671
24	15°	33.15	11.42	+4 /-4	47.64	1247
	15°	33.15	11.42	+6 /-6	59.84	1615
	15°	33.15	11.42	+8 /-8	71.85	1805
	15°	33.15	11.42	+12 /-12	97.24	2184
30	14°	44.49	15.16	+6 /-6	69.69	3241
	14°	44.49	15.16	+12 /-12	98.82	3917
36	13.5°	50.51	16.54	+4 /-4	61.42	3630
	13.5°	50.51	16.54	+6 /-6	72.44	3912
	13.5°	50.51	16.54	+12 /-12	108.46	4998
48	13°	64.49	19.02	+6 /-6	79.53	6513
	13°	64.49	19.02	+12 /-12	112.6	7954



*All dimensions in inches except where indicated.

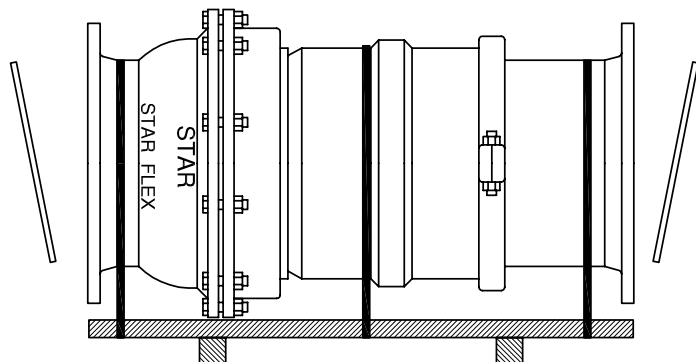
*Dimensions "C" are factory set position.

¹For units of expansion that are not listed, please contact your Star® Pipe representative.

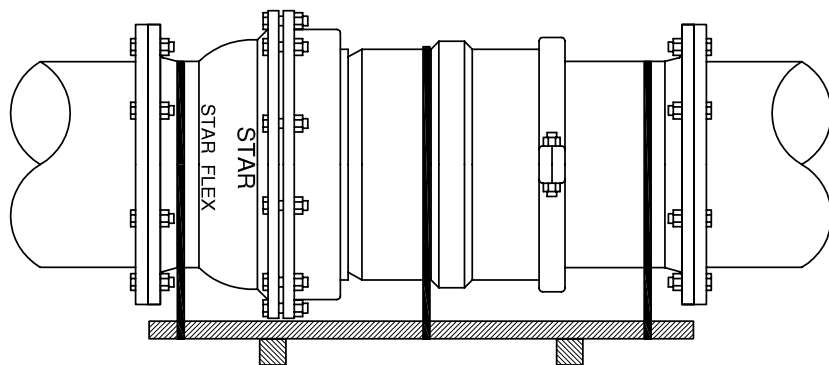
**StarFlex® series 5100**

Single-Ball Flexible Expansion Joint
for the Protection of Water, Wastewater, and Industrial Pipelines

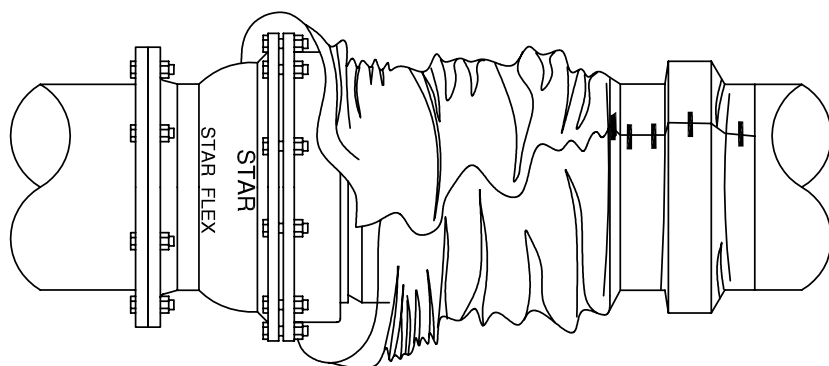
INSTALLATION INSTRUCTIONS

**STEP 1**

- Remove external shipping crate and wooden covers from the ends of the Flexible Pipe Joint. (Attention: Do not remove steel bands or wooden cradle until assembly is completed.)

**STEP 2**

- Assemble StarFlex® flanged ends in accordance to ANSI/AWWA C110/A21.10 Appendix A. (Flanged Fittings-Bolts, Gaskets, and Installation).

**STEP 3**

- After installation and both ends are assembled, remove steel straps and wooden cradle.
- In an above ground application, it is unnecessary to use a PE sleeve on the Flexible Expansion Joint.
- In a below grade application, if a PE sleeve is required, tape the sleeve on the pipe joint firmly. During backfill use caution as to not puncture or damage PE sleeve.
- If a pressure test is required before backfilling, the piping system on each side of the Starflex must be restrained to prevent movement.
- If plain end pipe is used to connect to the StarFlex a Flange x MJ adapter fitting with a DI or PVC Stargrip is recommended.

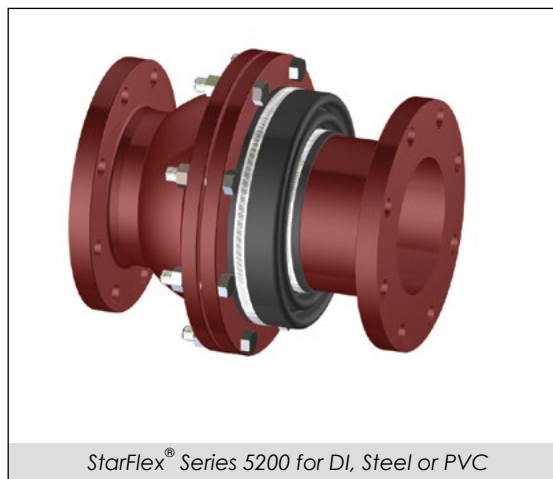
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STAR[®] PIPE PRODUCTS



StarFlex® series 5200

Single-Ball Flexible Joint
for the Protection of Water, Wastewater, and Industrial Pipelines



StarFlex® Series 5200 for DI, Steel or PVC

INFORMATION

StarFlex® Single-Ball Flexible Joints can deflect up to 20 degrees, depending on size. This flexible joint design provides pipeline protection needed due to the results of natural and man-made ground movements. The StarFlex® Flexible Joint is available for use on Ductile Iron, Steel and PVC pipe in the size range of 3" through 48".

For Use with Ductile Iron, Steel or PVC

FEATURES & ADVANTAGES

- Rated 350 PSI working pressure sizes 3"-24". Sizes 30" and above rated for 250 PSI working pressure.
- Each StarFlex® is coated inside and outside with 15 mils of Fusion Bonded Epoxy that is NSF compliant.
- Each ball on the StarFlex® can deflect a minimum of 20 degrees for 3"-10", 18 degrees for 12", 15 degrees for 14" - 24", 14 degrees for 30" and 13.5 degrees for 36" and 13 degrees for 42" - 48".
- All cast components are made entirely of ductile Iron grade 65-45-12.
- All fasteners are Type 304 Stainless Steel.
- Every unit is pressurized and cycled while maintaining 350 PSI on sizes 3" - 24" and 250 PSI on sizes 30" and above.
- All sizes have external EPDM rubber boots to prevent debris from entering the sealing areas.
- Pressure seals are EPDM. Maximum operating temperature is 175° F.
- The StarFlex® may be used on ductile iron, steel, HDPE or PVC pipe.
- Flanged outlets are dimensioned according to ANSI/AWWA C110/A21.11 which is also equal to ASME B16.1 Class 125 & ASME B16.5 Class 150 without a raised face.
- Standard color is Coral Red (RAL 3016).
- NSF61 Approved Fusion Bonded Epoxy coating is used in wetted areas.

SAMPLE SPECIFICATIONS

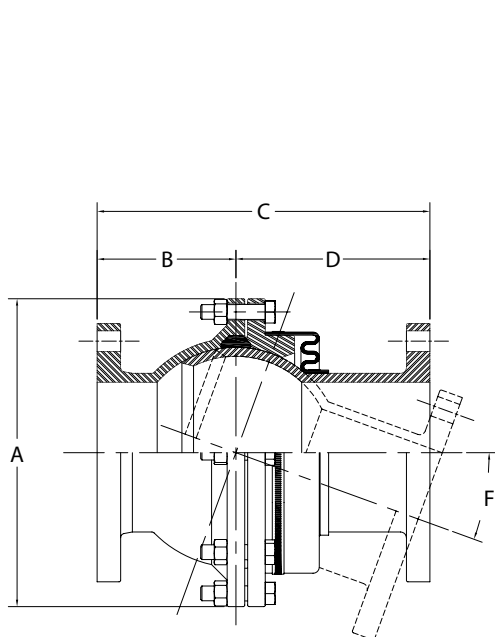
Flexible joints shall be manufactured of ductile iron in accordance with ASTM A536 Grade 65-45-12. Each flexible joint shall be capable of deflecting to the amounts shown on the drawing or indicated in the specifications. Each ball joint shall possess an external rubber boot to prevent penetration of outside debris.

All hardware nuts, bolts and straps shall be type 304 stainless steel. All ductile iron components shall be coated internally and externally with 15 mils of fusion bonded epoxy and shall be holiday tested with a 1500 volt spark test, both of which conform to the requirements ANSI/AWWA C213. Every flexible joint unit shall be cycled and pressure tested at 350 PSI for 3"-24" and 250 PSI for 30" and above prior to shipment. Flexible joints shall be Star® Pipe Products, StarFlex® Series 5200 or an approved equal.

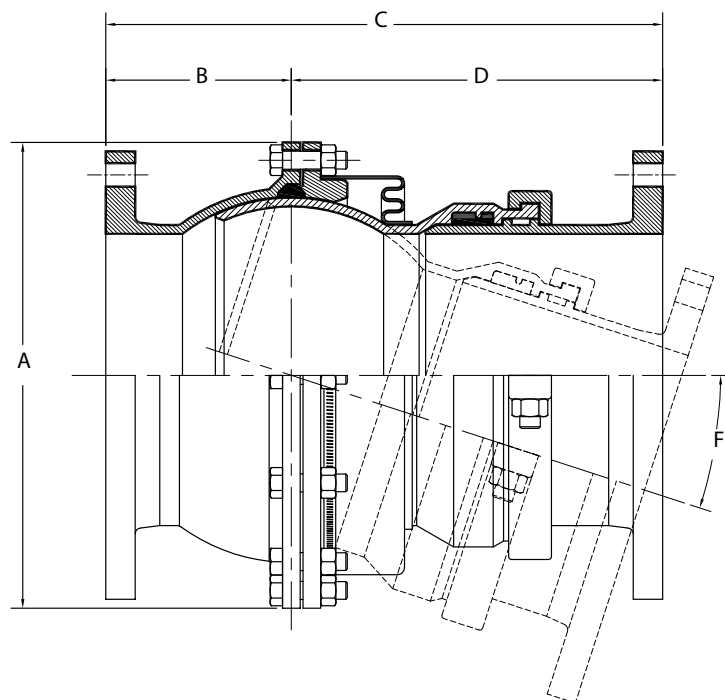


StarFlex® series 5200

Single-Ball Flexible Joint
for the Protection of Water, Wastewater, and Industrial Pipelines



3"-10"



12"-48"

STARFLEX® 5200 SPECIFICATIONS*

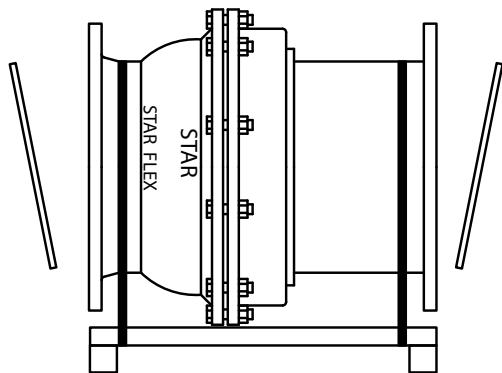
NOM. SIZE	A	B	C	D	F	WEIGHT (LBS)
3	9.69	5.31	12.60	7.29	20.0°	53
4	10.87	5.91	13.39	7.48	20.0°	70
6	13.11	5.91	14.17	8.26	20.0°	102
8	15.31	6.30	15.36	9.06	20.0°	174
10	17.32	6.69	15.75	9.06	20.0°	184
12	19.76	7.87	23.62	15.75	18.0°	300
14	22.56	9.06	27.17	18.11	15.0°	489
16	24.69	9.45	27.76	18.31	15.0°	571
18	26.81	10.24	30.31	20.07	15.0°	641
20	29.72	11.02	31.89	20.87	15.0°	734
24	33.54	11.42	34.45	23.03	14.0°	1029
30	44.49	15.16	45.67	30.51	14.0°	2357
36	50.51	16.54	48.43	31.89	13.5°	3161
42	58.98	19.09	54.53	35.44	13.0°	4575
48	64.49	19.02	56.30	37.28	13.0°	5412

*All dimensions in inches except where indicated.

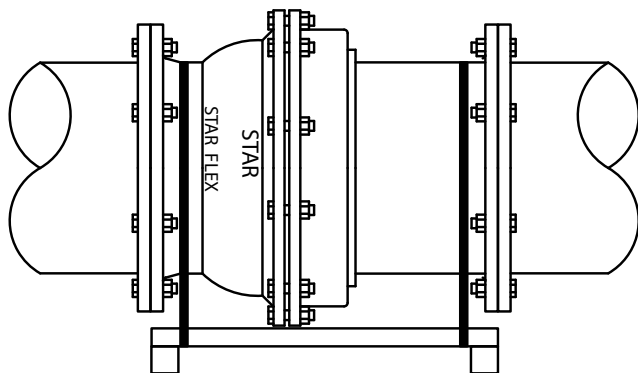
**StarFlex® series 5200**

Single-Ball (No Sleeve) Flexible Expansion Joint
for the Protection of Water, Wastewater, and Industrial Pipelines

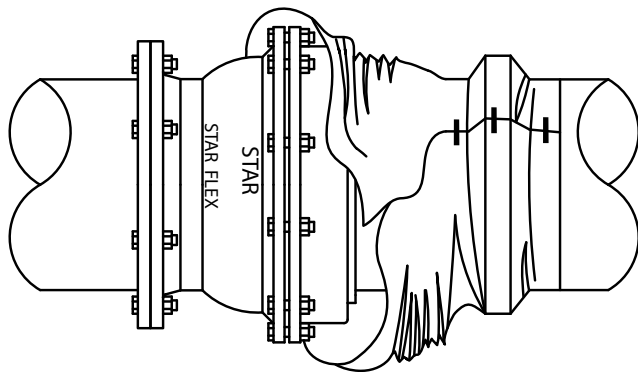
INSTALLATION INSTRUCTIONS

**STEP 1**

- Remove external shipping crate and wooden covers from the ends of the Flexible Pipe Joint. (Attention: Do not remove steel bands or wooden cradle until assembly is completed.)

**STEP 2**

- Assemble StarFlex® flanged ends in accordance to ANSI/AWWA C110/A21.10 Appendix A. (Flanged Fittings-Bolts, Gaskets, and Installation).

**STEP 3**

- After installation and both ends are assembled, remove steel straps and wooden cradle.
- In an above ground application, it is unnecessary to use a PE sleeve on the Flexible Expansion Joint.
- In a below grade application, if a PE sleeve is required, tape the sleeve on the pipe joint firmly. During backfill use caution to not puncture or damage PE sleeve.
- If plain end pipe is used to connect to the StarFlex a Flange x MJ adapter fitting with a DI or PVC Stargrip is recommended.

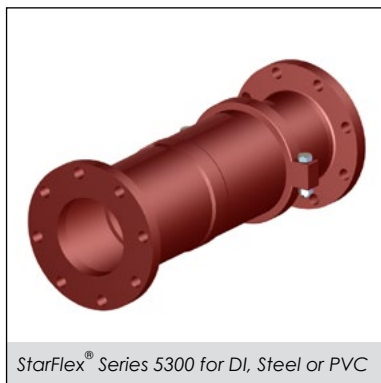
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STAR[®] PIPE PRODUCTS



StarFlex® series 5300

Flexible Expansion Joint
for the Protection of Water Wastewater, and Industrial Pipelines



INFORMATION

StarFlex® Flexible Expansion Joints are designed to provide pipeline protection needed due to the results of natural and man-made stresses. The StarFlex® Flexible Joint is available for use on Ductile Iron, Steel and PVC pipe in the size range of 3" through 48". For units of expansion that are not listed please contact your Star® Pipe Products representative.

For Use with Ductile Iron, Steel or PVC



FEATURES & ADVANTAGES

- Each StarFlex® is coated inside and outside with 15 mils of Fusion Bonded Epoxy that is NSF compliant.
- Every unit is pressurized and cycled while maintaining 350 PSI on sizes 3" - 24", 250 PSI on sizes 30" and above.
- Each unit is shipped in a cradle at its preset position, but can be adjusted to the desired dimension in the field.
- All sizes have external EPDM rubber boots to prevent debris from entering the sealing areas.
- Pressure seals are EPDM. Maximum operating temperature is 175° F.
- The StarFlex® may be used on ductile iron, steel, HDPE or PVC pipe.
- Flanged outlets are dimensioned according to ANSI/AWWA C110/A21.11 which is also equal to ASME B16.1 Class 125 & ASME B16.5 Class 150 without a raised face.
- NSF61 Approved Fusion Bonded Epoxy coating is used in wetted areas.

Note: StarFlex® series 5300 flexible expansion joints are designed to expand when internally pressurized. End thrust generated from expansion of the StarFlex® under internal pressure must be accommodated in the piping system design.

MATERIAL SPECIFICATIONS:

- All cast components are made entirely of Ductile Iron per ASTM A536, Grade 65-45-12.
- All fasteners are Type 304 Stainless Steel.



StarFlex® series 5300

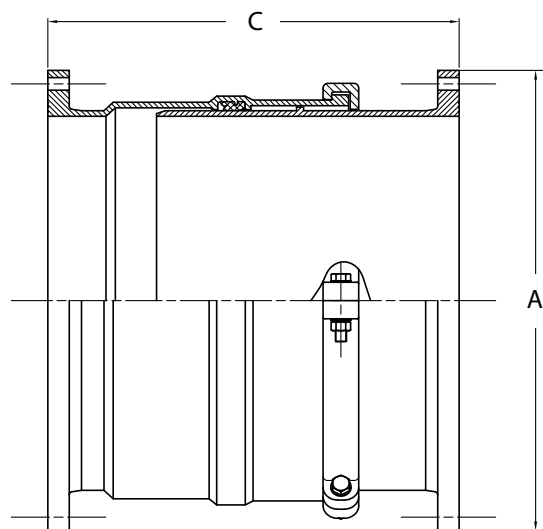
Flexible Expansion Joint
for the Protection of Water, Wastewater, and Industrial Pipelines

STARFLEX® 5300 SPECIFICATIONS*				
NOM. SIZE	A (OD)	EXPANSION ¹	C (LENGTH)	WEIGHT (LBS)
3	7.50	+2 /-2	18.90	47
	7.50	+4 /-4	32.68	75
	7.50	+6 /-6	46.46	103
	7.50	+8 /-8	60.24	131
4	9.00	+2 /-2	19.29	63
	9.00	+4 /-4	33.07	99
	9.00	+6 /-6	46.85	134
	9.00	+8 /-8	60.63	170
6	11.00	+2 /-2	19.69	90
	11.00	+4 /-4	33.46	141
	11.00	+6 /-6	47.24	192
	11.00	+8 /-8	61.02	243
8	13.50	+2 /-2	20.47	126
	13.50	+4 /-4	34.25	190
	13.50	+6 /-6	48.03	255
	13.50	+8 /-8	61.81	319
10	16.00	+2 /-2	21.46	173
	16.00	+4 /-4	35.63	251
	16.00	+6 /-6	49.80	328
	16.00	+8 /-8	63.98	406
12	19.00	+2 /-2	22.05	213
	19.00	+4 /-4	36.22	306
	19.00	+6 /-6	50.39	398
	19.00	+8 /-8	64.57	490
14	21.00	+4 /-4	33.86	424
	21.00	+8 /-8	62.20	701
	21.00	+12 /-12	90.55	978
16	23.50	+4 /-4	34.06	500
	23.50	+8 /-8	62.01	817
	23.50	+12 /-12	89.96	1134
18	25.00	+4 /-4	34.65	554
	25.00	+8 /-8	62.20	904
	25.00	+12 /-12	89.76	1254
20	27.50	+4 /-4	35.43	655
	27.50	+8 /-8	62.60	1049
	27.50	+12 /-12	89.76	1445
24	32.00	+4 /-4	36.61	871
	32.00	+8 /-8	63.19	1366
	32.00	+12 /-12	89.76	1861
30	38.75	+5 /-5	45.77	1690
	38.75	+10 /-10	77.76	2758
	38.75	+15 /-15	109.74	3826
36	46.00	+5 /-5	47.74	2314
	46.00	+10 /-10	80.12	3668
	46.00	+15 /-15	112.50	5023
48	59.50	+6 / -6	53.15	**

* All dimensions in inches except where indicated.

** Contact Star for details.

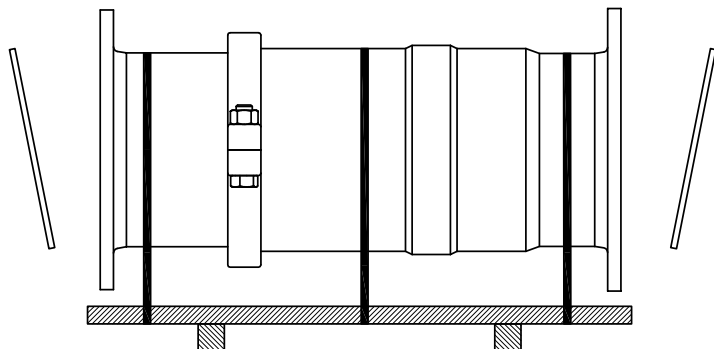
¹ For units of expansion that are not listed, please contact your Star® Pipe representative.



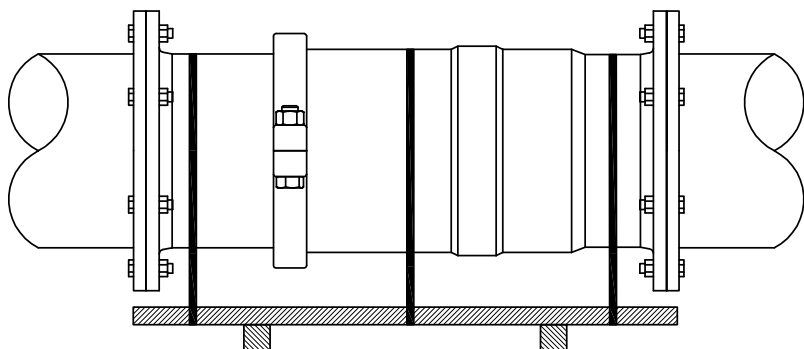
STAR® PIPE PRODUCTS



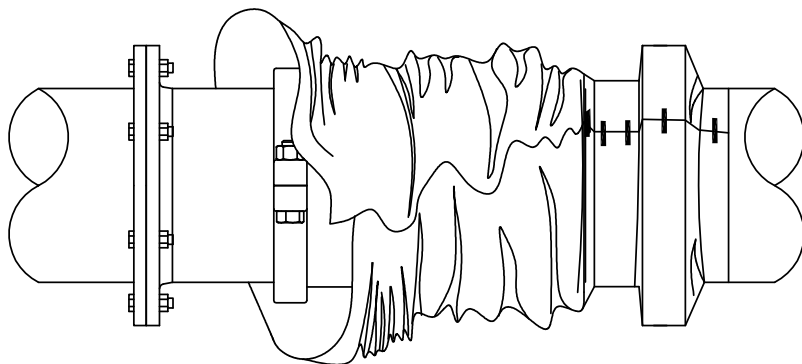
INSTALLATION INSTRUCTIONS

**STEP 1**

- Remove external shipping crate and wooden covers from the ends of the Flexible Pipe Joint. (Attention: Do not remove steel bands or wooden cradle until assembly is completed.)

**STEP 2**

- Assemble StarFlex® flanged ends in accordance to ANSI/AWWA C110/A21.10 Appendix A. (Flanged Fittings-Bolts, Gaskets, and Installation).

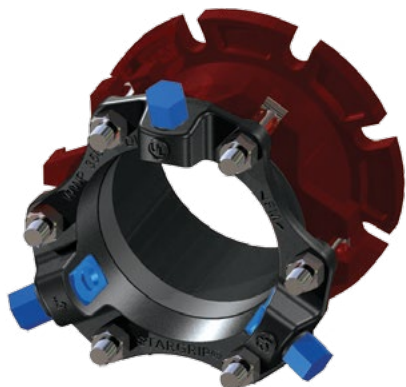
**STEP 3**

- After installation and both ends are assembled, remove steel straps and wooden cradle.
- In an above ground application, it is unnecessary to use a PE sleeve on the Flexible Expansion Joint.
- In a below grade application, if a PE sleeve is required, tape the sleeve on the pipe joint firmly. During backfill use caution to not puncture or damage PE sleeve.
- If a pressure test is required before backfilling, the piping system on each side of the Starflex must be restrained to prevent movement.
- If plain end pipe is used to connect to the StarFlex a Flange x MJ adapter fitting with a DI or PVC Stargrip is recommended.

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StarFlange™ series 3200

Restrained Adapter Flange Coupling
for Ductile Iron Pipe

StarFlange™ Series 3200 for Ductile Iron Pipe

INFORMATION

StarFlange™ Series 3200 is a restrained adapter flange coupling device designed to connect plain end ductile iron pipe to a flanged pipe, valve or fitting. A ductile iron flange body provides the flange connection and includes an O-ring gasket that seals with the mating flange. The Stargrip® Series 3000 provides restraint for the plain end ductile iron pipe.

No Special Tools Required for Installation

FEATURES & ADVANTAGES

- Provides flexibility to accommodate pipe misalignment
- No special tools required for installation
- Fully restrained to pressure rating of pipe with a 2:1 safety factor
- Pipe end does not need to be square cut.
- StarFlange™ body and Stargrip® are manufactured from high strength Ductile Iron per ASTM A536, Grade 65-45-12.
- Flange meets ANSI Class 125/150 and ANSI/AWWA C115/A21.15 drill pattern.
- MJ gasket and O-ring flange gasket are made from styrene butadiene rubber (SBR) per ANSI/AWWA C111/A-21.11.
- T-bolts / nuts are produced from high strength low alloy steel per ANSI/AWWA C111/A-21.11
- Restraint wedges are heat-treated to minimum 370 BHN.
- Includes Stargrip®, Flange Adapter, MJ Gasket, O-Ring gasket and low alloy steel T-bolts
- StarFlange™ size 3"-12" are listed with Underwriters Laboratories Inc. and approved by Factory Mutual Research (FM).
- Standard gland color is Coral Red (RAL 3016).
- May also be used on steel pipe* up to 12" (***transition gasket required on 12" and under**). For 14" and larger steel applications, contact Star Pipe.

SAMPLE SPECIFICATIONS

Restrained adapter flange is to be used to connect plain end ductile iron pipe to a flanged pipe, valve or fitting. The device shall be manufactured of high strength ductile iron in accordance to ASTM A536 Grade 65-45-12 for all sizes. The restrainer portion of the device shall be of wedge type design with torque limiting bolts to insure proper engagement of the wedges.

Applicable dimensions shall conform to ANSI/AWWA C111/A21.15, C110/A21.10 and C153/A21.53. Flange ends to meet ANSI Class 125/150 & ANSI/AWWA C115/A21.15 drill pattern.

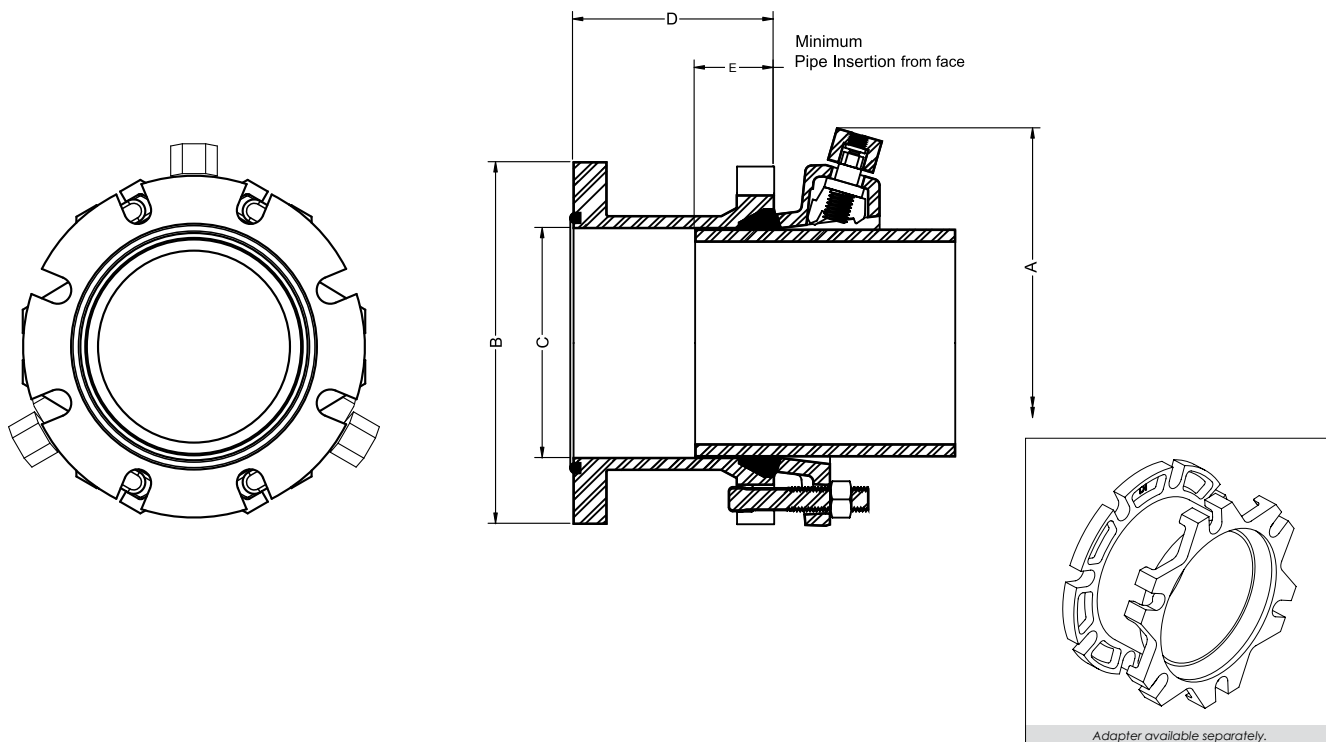
The restrained adapter flange shall have a maximum working pressure of 350 PSI for sizes 3"-16" and 250 PSI for sizes 18"-36". All sizes shall have a minimum safety factor of 2:1 (i.e. twice the maximum rating of the StarFlange™ Series 3200). Restrained flange adapter shall be Star® Pipe Products StarFlange™ Series 3200 or an approved equal.



StarFlange™ series 3200

Restrained Adapter Flange Coupling
for Ductile Iron Pipe

TECHNICAL INFORMATION



STARFLANGE™ 3200 SPECIFICATIONS*

NOM. SIZE	MAX PRESSURE RATING (PSI)	A	A W/NUTS TWISTED OFF	B	C	D	E	1MAX. JOINT DEFLECTION°	APPROX WT. (LBS)
3	350	9.85	8.45	7.50	4.06	3.88	2.13	5°	17
4	350	11.06	9.28	9.00	4.90	4.35	2.13	5°	23
6	350	13.06	11.38	11.00	7.00	5.25	2.50	5°	35
8	350	15.25	13.53	13.50	9.15	5.25	2.50	5°	47
10	350	17.25	15.58	16.00	11.20	5.62	2.50	3°	64
12	350	19.50	12.68	19.00	13.30	5.69	2.50	3°	87
14	350	21.25	19.82	21.00	15.44	6.67	3.00	2°	128
16	350	23.34	21.92	23.50	17.54	6.79	3.00	2°	152
18	250	26.40	24.84	25.00	19.64	7.40	3.00	1.5°	182
20	250	28.56	27.00	27.50	21.74	7.41	3.00	1.5°	204
24	250	33.86	32.30	32.00	25.94	7.90	3.00	1°	300
30	250	40.12	38.56	38.75	32.17	8.50	3.00	1°	520
36	250	46.42	44.86	46.00	38.47	9.00	3.00	1°	688

*All dimensions in inches except where indicated.

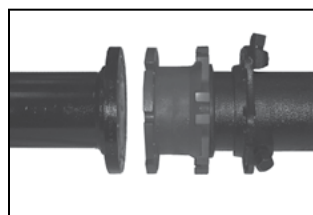
1 - Deflection attained at minimum pipe insertion.



StarFlange™ series 3200

Restrained Adapter Flange Coupling
for Ductile Iron Pipe

INSTALLATION INSTRUCTIONS - SIZES 3" - 36"

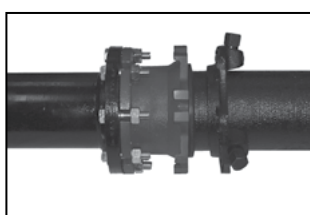


STEP 1

Check the StarFlange™ ensuring that no damage has occurred or parts are missing. Make sure that the O-ring gasket on the flange face of the StarFlange™ is securely in place.

The pipe end must be thoroughly cleaned for a distance of 2" greater than the length of the StarFlange™ body. (see dimension "D")

Slide the Stargrip® Gland on the plain end of the pipe making sure that the lip extension is towards the mechanical joint bell of the StarFlange™. Do not remove rubber washers prior to installation. Washers have been provided for proper wedge placement during shipment and installation.

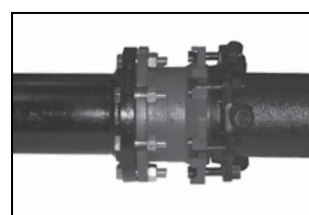


STEP 2

Brush both the gasket and the plain end of the pipe with soapy water or approved pipe lubricant, which meets ANSI/AWWA C111/A21.11. Slide the MJ gasket over the pipe with the beveled edge towards the MJ bell of StarFlange™.

Slide the StarFlange™ on to the pipe with the MJ bell towards the Stargrip® Gland. Pipe must be inserted into the StarFlange™ a minimum of 2.125" on 3"-4", 2.500" on 6"-12" and 3.000" on 14"-36" to attain maximum deflection per table.

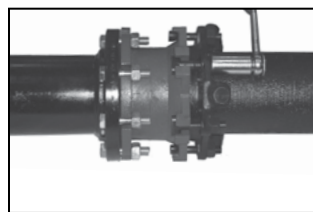
Position the pipe and flanged end of StarFlange™ against the mating flange, making sure that the flange bolt holes line-up. Assemble the flanged joint using flange bolts. **Note: Flange bolts not supplied with StarFlange™.**



STEP 3

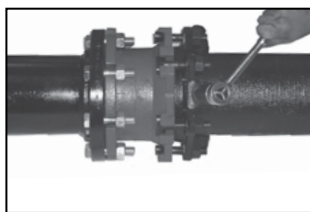
Center the pipe so that the space between the OD of the pipe and the ID of the StarFlange™ is even all around the pipe. Slide the MJ Gasket into the MJ bell recess of the StarFlange™.

Slide the Stargrip® towards the StarFlange™ with the Gland lip against the gasket. Insert T-bolts and hand-tighten nuts.



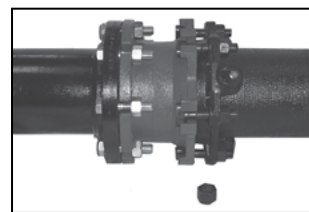
STEP 4

Tighten the T-bolts to normal range of bolt torque (see table below). It is necessary that the gland be brought up toward the bell flange evenly, maintaining approximately the same distance between the gland and the face of the flange at all points around the socket. T-bolts should be tightened alternately on opposite sides (Star Pattern) (See Table A).



STEP 5

Hand tighten the torque limiting twist off nuts in a clockwise direction until all wedges are in firm contact with the pipe surface.



STEP 6

Continue tightening in an alternative manner going on the opposite sides [Star Pattern], until all of the nuts have been twisted off. Never turn a single nut over 180 degrees without alternating to another nut. If removal is necessary, utilize the 5/8" hex head provided. [If reassembly is required, assemble the joint in the same manner as above and tighten the wedge bolts to 90 ft-lbs on sizes 3"-20" and 120 ft-lbs on sizes 24"-36".

(TABLE A) T-HEAD BOLT & NUT DETAILS

PIPE SIZE (IN)	BOLT SIZE (IN)	RANGE ¹ OF TORQUE (FT-LBS)
3	5/8	45-60
4-24	3/4	75-90
30-36	1	100-120

¹These torque ranges are requirements of AWWA C600

Notes:

- Not to be used on plain end fittings or PVC or HDPE pipe.
- If effective sealing is not attained at the maximum torque indicated, then the joint should be disassembled, thoroughly cleaned, and reassembled. **Overstressing the bolts to compensate for poor installation practice is not acceptable.**
- May also be used on steel pipe* up to 12" (*transition gasket required on 12" and under). For 14" and larger steel applications, contact Star Pipe.
- Stargrips® must be adequately wrapped or protected if they are covered by concrete to ensure that concrete does not enter the wedge pocket.
- For applications exceeding the maximum pressure ratings listed, please contact Star Pipe Products for recommendations.
- For applications with vertical offsets please contact Star Pipe Products for technical assistance.
- For applications on existing pipe, the surface of the pipe needs to be sufficient for proper wedge engagement. Please contact Star Pipe Products for technical assistance.

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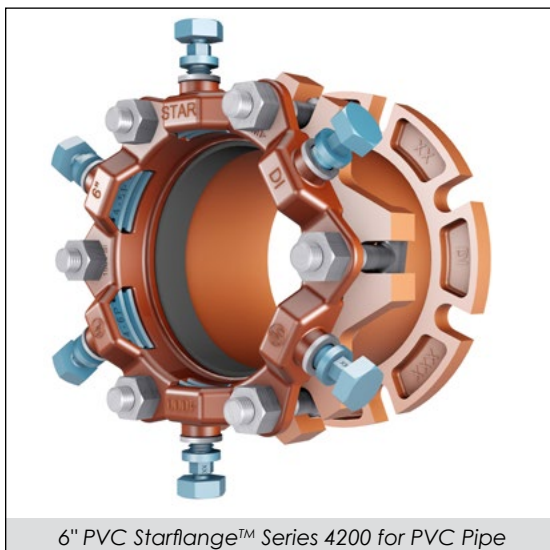
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PVC StarFlange™ series 4200

Restrained Adapter Flange Coupling
for PVC Pipe



6" PVC Starflange™ Series 4200 for PVC Pipe

INFORMATION

PVC StarFlange™ Series 4200 is a restrained adapter flange coupling device designed to connect plain end PVC pipe to a flanged pipe or fitting. A ductile iron flange body provides the flange connection and includes an O-ring gasket that seals with the mating flange. The PVC Stargrip® Series 4000 provides restraint for the plain end PVC pipe.

No Special Tools Required For Installation

FEATURES & ADVANTAGES

- Provides flexibility to accommodate pipe misalignment
- No special tools required for installation
- Fully restrained to pressure rating as listed on next page, with a 2:1 safety factor
- Pipe end does not need to be square cut.
- Flange meets ANSI Class 125/150 and ANSI/AWWA C115/A21.15 drill pattern.
- Can be used on 3" - 12" IPS PVC Pipe (**a transition MJ gasket is required with IPS pipe**)
- StarFlange™ body and PVC Stargrip® are manufactured from high strength Ductile Iron per ASTM A536, Grade 65-45-12.
- MJ gasket and O-ring flange gasket are made from styrene butadiene rubber (SBR) per ANSI / AWWA C111/ A-21.11.
- T-bolts / nuts are produced from high strength low alloy steel per ANSI/AWWA C111/A-21.11
- Includes PVC Stargrip®, Flange Adapter, MJ Gasket, O-Ring gasket and low alloy steel T-bolts
- StarFlange™ size 4"-12" are listed with Underwriters Laboratories Inc. and approved by Factory Mutual Research (FM) for use on DR18 Class 235 C900 PVC pipe at 150 PSI.
- Standard gland color is Coral Red (RAL 3016).

SAMPLE SPECIFICATIONS

Restrained adapter flange is to be used to connect plain end PVC pipe to a flanged pipe, valve or fitting. The device shall be manufactured of high strength ductile iron in accordance to ASTM A536 Grade 65-45-12 for all sizes. The restrainer portion of the device shall be of wedge type design with torque limiting bolts to insure proper engagement of the wedges.

Applicable dimensions shall conform to ANSI/AWWA C111/A21.11, C110/A21.10 and C153/A21.53. Flange ends to meet ANSI Class 125/150 & ANSI/AWWA C115/A21.15 drill pattern.

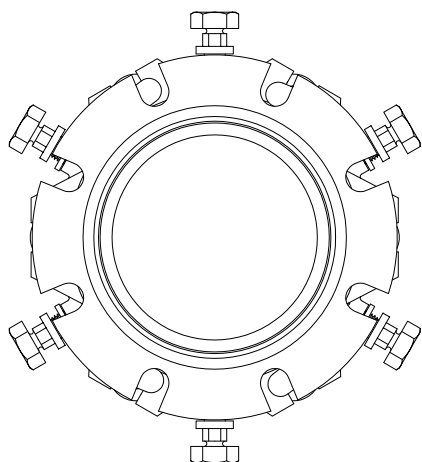
All sizes shall have a minimum safety factor of 2:1 (i.e. twice the pressure rating as stated in most current catalog). Restrained flange adapter shall be Star® Pipe Products StarFlange™ Series 4200 or an approved equal.



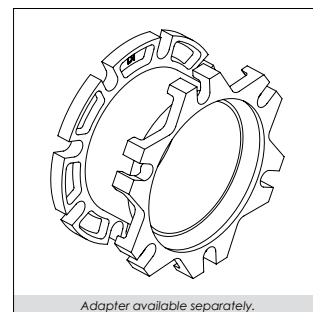
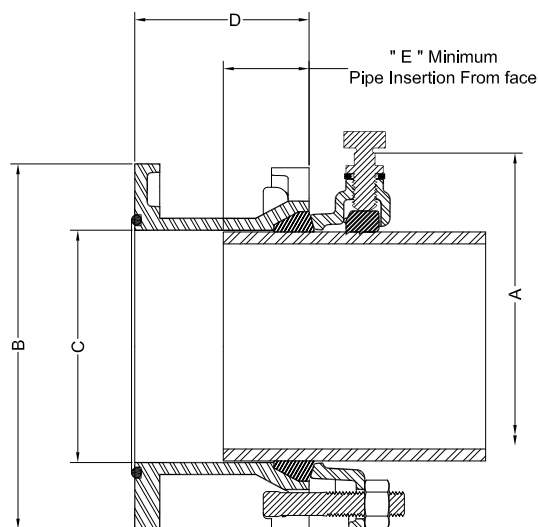
PVC StarFlange™ series 4200

Restrained Adapter Flange Coupling
for PVC Pipe

TECHNICAL INFORMATION



6" PVC Starflange™ Series 4200 for PVC Pipe



PVC STARFLANGE™ 4200 SPECIFICATIONS*

NOM. SIZE	C900/C905 PIPE OD	IPS PIPE OD	A ¹	B	C	D	E	² MAXIMUM JOINT DEFLECTION ¹	APPROX. WT. (LBS)
3	N/A	3.50	8.50	7.50	4.06	3.88	2.13	5°	20
4	4.80	4.50	9.64	9.00	4.90	4.35	2.13	5°	27
6	6.90	6.63	11.72	11.00	7.00	5.25	2.50	5°	39
8	9.05	8.63	13.97	13.50	9.15	5.25	2.50	5°	53
10	11.10	10.75	16.18	16.00	11.20	5.62	2.50	3°	72
12	13.20	12.75	18.23	19.00	13.30	5.69	2.50	3°	92
14	15.30	N/A	20.36	21.00	15.44	6.67	3.00	2°	134
16	17.40	N/A	22.46	23.50	17.54	6.79	3.00	2°	162
18	19.50	N/A	24.56	25.00	19.64	7.40	3.00	1.5°	188
20	21.60	N/A	26.66	27.50	21.74	7.41	3.00	1.5°	220
24	25.80	N/A	30.86	32.00	25.94	7.90	3.00	1°	293
30	32.00	N/A	36.82	38.75	32.17	8.50	3.00	1°	453
36	38.30	N/A	43.12	46.00	38.47	9.00	3.00	1°	623

*All dimensions in inches except where indicated.

1 - Dimension after assembly on pipe.

2 - Deflection attained at minimum pipe insertion.

MAXIMUM WORKING PRESSURE RATING WITH OCCASSIONAL & RECURRING SURGES

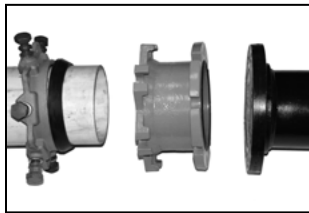
NOM. SIZE (IN)	C900			C905				ASTM D2241		
	DR14	DR18	DR25	DR18	DR21	DR25	DR32.5	SDR17	SDR21	SDR26
3								250	200	160
4	305	235	165					250	200	160
6	305	235	165					250	200	160
8	305	235	165					250	200	160
10	305	235	165					250	200	160
12	305	235	165					250	200	160
14				235	200	165	125			
16				235	200	165	125			
18				235	200	165	125			
20				235	200	165	125			
24				235	200	165	125			
30						165	125			
36						165	125			



PVC StarFlange™ series 4200

Restrained Adapter Flange Coupling
for PVC Pipe

INSTALLATION INSTRUCTIONS - SIZES 3" - 36"

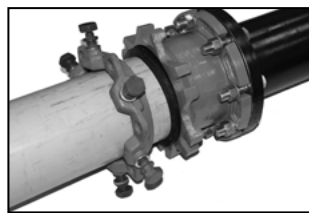


STEP 1

Check the StarFlange™ ensuring that no damage has occurred or parts are missing. Make sure that the ring gasket on the flange face of the StarFlange™ is securely in place.

The pipe end must be thoroughly cleaned for a distance of 2" greater than the length of the StarFlange™ body.

Slide the PVC Stargrip gland on the plain end of the pipe making sure that the lip extension is towards the mechanical joint bell of the StarFlange™.

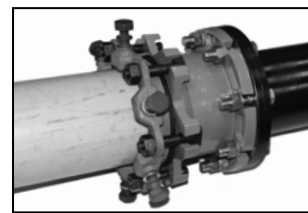


STEP 2

Brush both the gasket & the plain end of the pipe with soapy water or approved pipe lubricant, which meets ANSI/AWWA C111/A21.11. Slide the MJ gasket over the pipe with the beveled edge towards the MJ bell of StarFlange™.

Slide the StarFlange™ on to the pipe with the MJ bell towards the PVC Stargrip gland. Pipe must be inserted into the StarFlange™ a minimum length as indicated in the table to attain maximum deflection.

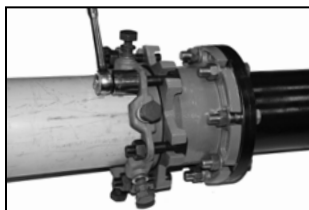
Position the pipe and flanged end of the StarFlange™ against the mating flange, making sure that the flange bolt holes line-up. Assemble the flanged joint using flange bolts. **Note: Flange bolts not supplied with StarFlange™.**



STEP 3

Center the pipe so that the space between the OD of the pipe and the ID of the StarFlange™ is even all around the pipe.

Slide the MJ gasket into the MJ bell recess of the StarFlange™. Slide the PVC Stargrip towards the StarFlange™ with the gland lip against the gasket. Insert T-bolts and hand-tighten nuts.



STEP 4

In order to keep the spigot fully homed in the MJ bell, the joint will need to be kept in compression until the completion of step 6. Tighten the T-bolts to the normal range of bolt torque (see table).

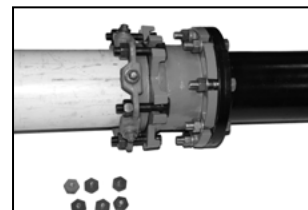
This may require multiple rounds. It is necessary that the gland be brought up toward the bell flange evenly, maintaining approximately the same distance between the gland and the face of the flange at all points around the socket. It is recommended to follow alternating star pattern while tightening T-bolts.



STEP 5

Tighten the torque limiting twist off bolts in a clockwise direction until all the wedges are in firm contact with the pipe surface.

Note: When installing sizes 4" – 12" on IPS PVC pipe, the spacer washers must be removed from the torque limiting bolts.



STEP 6

Continue tightening in an alternating manner until all of the Torque-limiting twist-off bolt heads have been twisted off.

If removal is necessary, utilize the 5/8" hex head provided. If reassembly is required, assemble the joint in the same manner as above and tighten the wedge bolt to 90 ft-lbs.

(TABLE A) T-HEAD BOLT & NUT DETAILS

PIPE SIZE (IN)	BOLT SIZE (IN)	RANGE ¹ OF TORQUE (FT-LBS)
3	5/8	45-60
4-24	3/4	75-90
30-36	1	100-120

¹These torque ranges are requirements of AWWA C600

Notes:

- If effective sealing is not attained at the maximum torque indicated, then the joint should be disassembled, thoroughly cleaned, and reassembled. **Overstressing the bolts to compensate for poor installation practice is not acceptable.**
- For use on IPS PVC pipe, Transition MJ gasket must be used & removal of spacer washers from the torque limiting bolts must be ensured.
- Not to be used on DI or steel pipe.

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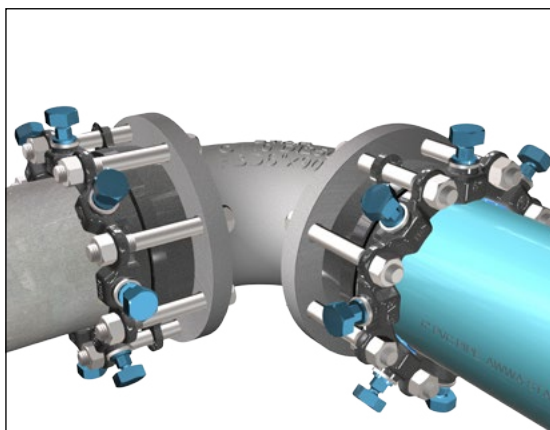
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Super Flange® series 7200

Designed for use on Ductile Iron, Steel, PVC, PVCO and HDPE Pipes

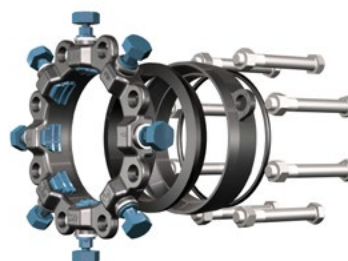


Super Flange® Series 7200 for
Ductile Iron, Steel, PVC, PVCO and HDPE Pipe

INFORMATION

The Series 7200 Super Flange® is a restrained flange adapter designed to connect plain end pipe to a flange end component. May be installed on ductile iron, steel, PVC, PVCO and HDPE pipe.

Restrains and Adapts Plain End Pipe to Flanged Components



FEATURES & ADVANTAGES

- Versatile product designed for adapting metal and plastic pipe to flange connections.
- Designed for use on ductile iron pipe for 3" to 48" with pressure ratings up to 350 psi.
- Rated to 350 psi on steel pipe for 3" to 12". A transition gasket is required.
- Approved on AWWA C900 PVC pipe, AWWA C905 PVC pipe, IPS PVC pipe, AWWA C909 PVCO pipe, and HDPE pipe. See pressure rating table for approved DRs and sizes. Plastic pressure pipes manufactured to an IPS diameter regimen will require a transition gasket.
- Joint deflection up to 5° maximum
- Allows for field flanged ends on plain end pipe
- Flange meets ANSI Class 125/150 and ANSI/AWWA C115/A21.15 drill pattern.
- MJ gasket and O-ring flange gasket are made from styrene butadiene rubber (SBR) per ANSI/AWWAC111/A-21.11.
- Includes restraint gland, flange adapter ring, gaskets and hex head bolts/nuts
- Restraint gland is coated with StarBond™ (polyester).
- Flange adapter ring coated with fusion bonded epoxy.
- Super Flange® sizes 3"-12" are listed with Underwriters Laboratories Inc. and Underwriters Laboratories of Canada for ductile iron and steel pipe at 350 psi.
- Super Flange® sizes 4" – 12" are approved by Factory Mutual Research for use on DR18 AWWA C900 PVC pipe and sizes 4"-10" on DR14.
- Wedges are heat treated to a minimum 370 BHN
- When installed on IPS pipe in sizes 4" to 12", the spacers must be removed.

SAMPLE SPECIFICATIONS

Restrainer mechanism shall be integrated into the design of the restraint gland. As the mechanism is activated, multiple wedging action shall be imparted against the pipe increasing its resistance as internal pressure increases. After burial of the restraining mechanism, joint flexibility shall be maintained.

The actuating bolt shall be threaded into the gland and have a 1-1/4" hex operating nut. The actuating bolt system shall have a torque-limiting head designed to break off at preset torque levels, thus insuring proper action of the restraining device. After removal of the torque-limiting head, a 5/8" hex head shall remain to facilitate the removal and re-assembly of the gland. Glands, bolts and wedges shall be manufactured of high strength ductile iron in accordance with ASTM A536 Grade 65-45-12 requirements. Wedges shall be heat treated to a minimum hardness of 370 BHN.

All internal and external surfaces of flange adapter ring will have fusion bonded epoxy per requirements of ANSI/AWWA C116/A 21.16. Coatings and gaskets to meet ANSI/NSF-61. The restraint mechanism shall have a 2:1 safety factor for pressure rating as stated in the most recent catalog.

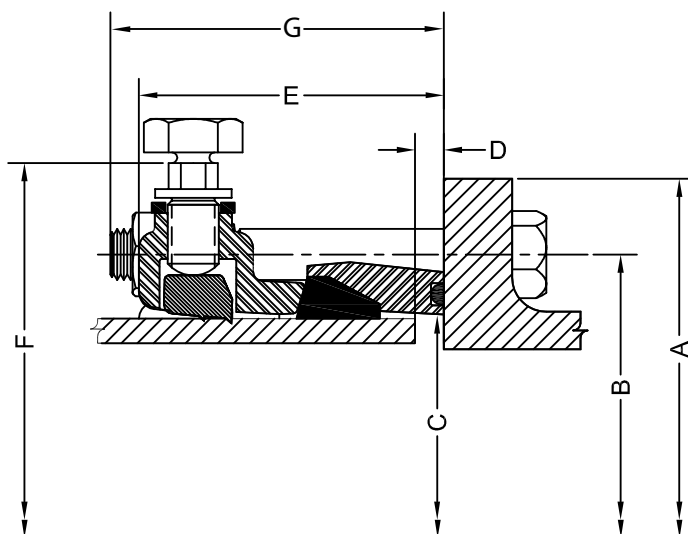
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Super Flange® series 7200

Designed for use on Ductile Iron, Steel, PVC, PVCO and HDPE Pipes

TECHNICAL INFORMATION



SUPER FLANGE® 7200 SPECIFICATIONS*

NOM. SIZE	A	B	C	D MAX.	E	F	G	BOLTS		MAXIMUM JOINT DEFLECTION°	APPROX. WT. (LBS)
								SIZE	QTY.		
3	7.50	6.00	4.09	0.70	4.06	7.95	4.75	5/8 X 5 1/2	4	5.0°	13
4	9.00	7.50	4.93	0.60	4.18	9.22	4.56	5/8 X 5 1/2	8	5.0°	20
6	11.00	9.50	7.03	0.80	4.43	11.32	5.00	3/4 X 6	8	5.0°	29
8	13.50	11.75	9.18	0.90	4.60	13.29	4.88	3/4 X 6	8	5.0°	35
10	16.00	14.25	11.23	1.00	4.62	15.50	6.31	7/8 X 7 1/2	12	3.0°	60
12	19.00	17.00	13.33	1.00	4.75	17.50	6.25	7/8 X 7 1/2	12	3.0°	72
14	21.00	18.75	15.45	1.30	5.13	19.54	6.62	1 X 8	12	2.0°	89
16	23.50	21.25	17.55	1.30	5.18	21.64	6.56	1 X 8	16	2.0°	110
18	25.00	22.75	19.65	1.30	5.23	23.74	6.94	1 1/8 X 8 1/2	16	1.5°	140
20	27.50	25.00	21.75	1.30	5.24	25.84	6.81	1 1/8 X 8 1/2	20	1.5°	165
24	32.00	29.50	25.95	1.30	5.28	30.04	6.62	1 1/4 X 8 1/2	20	1.0°	198
30	38.75	36.00	32.18	2.00	6.00	36.58	7.88	1 1/4 X 10	28	1.0°	362
36	46.00	42.75	38.48	2.00	6.00	42.88	8.12	1 1/2 X 10 1/2	32	1.0°	541
** 42	53.00	49.50	44.68	2.00	8.00	50.80	9.38	1 1/2 X 12	36	1.0°	---
** 48	59.50	56.00	50.98	2.00	8.00	57.10	9.25	1 1/2 X 12	44	1.0°	---

* All dimensions in inches except where indicated.

** Contact Star Pipe Products for price and availability.



Super Flange® series 7200

Designed for use on Ductile Iron, Steel and PVC Pipes

TECHNICAL INFORMATION

TABLE A. Maximum Working Pressure Rating with Occasional or Recurring Surges in PSI for Pipes Made to a CIOD Diameter Regimen

NOM. SIZE (IN)	ACTUAL PLASTIC PIPE OD	DUCTILE IRON	AWWA C900/C905 PVC					AWWA C909 PVCO	AWWA C906 HDPE*					
			DR14	DR18	DR21	DR25	DR32.5		DR 7.3	DR 9	DR 9.3	DR 11	DR13.5	DR17
3	3.96	350	-	-		-	-							
4	4.80	350	305	235		165	-	235	254	200	193	160	130	100
6	6.90	350	305	235		165	-	235	254	200	193	160	130	100
8	9.05	350	305	235		165	-	235	254	200	193	160	130	100
10	11.10	350	305	235		165	-	***	254	200	193	160	130	100
12	13.20	350	305	235		165	-	200	254	200	193	160	130	100
14	15.30	350	305	235	200	165	125	165		200	193	160	130	100
16	17.40	350	305	235	200	165	125	165				160		
18	19.50	300	-	235	200	165	125	150				160		
20	21.60	250	-	235	200	165	125							
24	25.80	200	-	-	200	165	125							
30	32.00	150	-	-		-	-							
36	38.30	150	-	-		-	-							
** 42	44.50	-	-	-		-	-							
** 48	50.80	-	-	-		-	-							

* A stainless steel pipe stiffener (provided by others) is required for the Series 7200 to be installed on HDPE pressure pipe. The stiffener must be installed in the HDPE pipe before installing the Series 7200. The stainless steel pipe stiffener must be of sufficient length to support the full bearing length of the restrainer.

** Contact Star Pipe Products for price and availability.

*** The Series 7200 is not recommended for 10-inch AWWA C909 PVCO pressure pipe.

TABLE B. Maximum Working Pressure Rating with Occasional or Recurring Surges in PSI for Pipes Made to an IPS Diameter Regimen

NOM. SIZE (IN)	ACTUAL PLASTIC PIPE OD*	STEEL PIPE	ASTM D2241 PVC			AWWA C901 and AWWA C906 HDPE**					
			SDR17	SDR21	SDR26	DR 7.3	DR 9	DR 9.3	DR 11	DR 13.5	DR 17
3	3.50	350	250	200	160	254	200		160	130	100
4	4.50	350	250	200	160	254	200	193	160	130	100
6	6.63	350	250	200	160	254	200	193	160	130	100
8	8.63	350	250	200	160	254	200	193	160	130	100
10	10.75	350	250	200	160	254	200	193	160	130	100
12	12.75	350	250	200	160	254	200	193	160	130	100

* A transition gasket is required for use with pipes made to an IPS diameter regimen.

** A stainless steel pipe stiffener (provided by others) is required for the Series 7200 to be installed on HDPE pressure pipe. The stiffener must be installed in the HDPE pipe before installing the Series 7200. The stainless steel pipe stiffener must be of sufficient length to support the full bearing length of the restrainer.

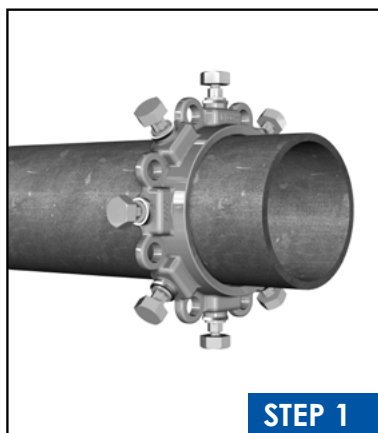
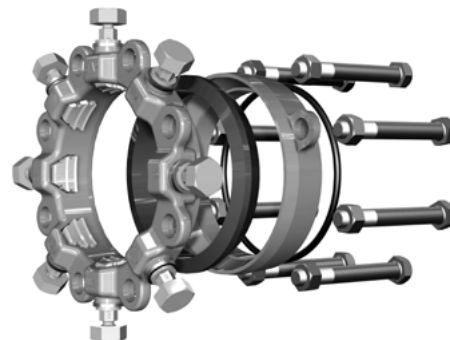


Super Flange® series 7200

Designed for use on Ductile Iron, Steel and PVC Pipes

INSTALLATION INSTRUCTIONS - SIZES 3" - 48"

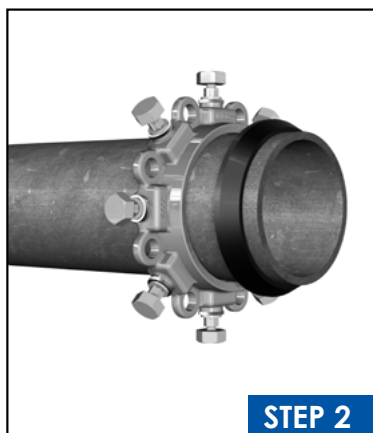
SIZE (IN)	INFORMATION
3	Designed for use on Ductile Iron, Steel Pipe, IPS OD PVC pressure pipe, and IPS OD HDPE pressure pipe. Spacers are not provided on this size.
4 - 12	Designed for use on Ductile Iron, Steel Pipe, PVC Pressure Pipe, PVCO Pressure Pipe, and HDPE Pressure Pipe. 1. For Ductile Iron, AWWA C900 PVC Pressure Pipe, AWWA C909 PVCO Pressure Pipe, and CIOD HDPE Pressure Pipe, DO NOT REMOVE spacers. 2. For Steel, IPS PVC Pressure Pipe, and IPS HDPE Pressure pipe, spacers MUST BE REMOVED.
14 - 24	Spacers are not provided in these sizes. 1. For Ductile Iron in all of these sizes. 2. For AWWA C905 PVC pressure pipe in all these sizes. 3. For AWWA C909 PVCO pressure pipe in 14" to 18". 4. For AWWA C906 HDPE pressure pipe with a CIOD in 14" to 18".
30 - 48	Spacers are not provided in these sizes. Designed for Ductile Iron pipe only in these sizes.



STEP 1

Pipe to be cut to required length and surface to be clean. Insert 7200 gland assembly with lip of the gland facing the plain end of pipe.

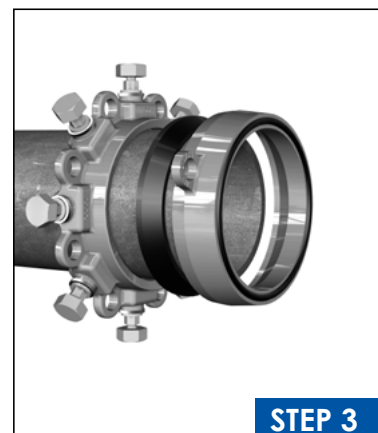
NOTE: If installing the Series 7200 on HDPE pressure pipe, a stainless steel pipe stiffener (provided by others) is required. The stiffener must be installed in the HDPE pipe before installing the Series 7200. The stainless steel pipe stiffener must be of sufficient length to support the full bearing length of the unit.



STEP 2

Brush both the gasket and the plain end of pipe with soapy water or approved pipe lubricant, which meets ANSI/AWWA C111/A21.11. Slide the MJ gasket over the pipe with beveled edge towards the pipe end.

IMPORTANT: When used on IPS pressure pipe, a transition MJ gasket must be used.



STEP 3

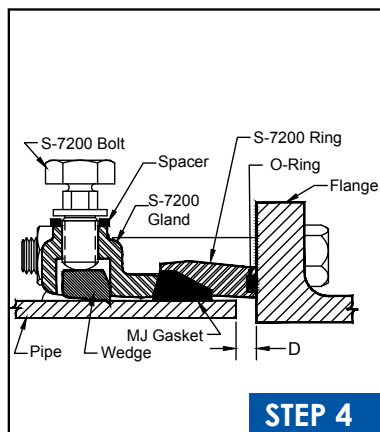
Insert 7200 ring onto the pipe with O-Ring facing the flange component. O-Ring has been glued in place at the factory.



Super Flange® series 7200

Designed for use on Ductile Iron, Steel and PVC Pipes

INSTALLATION INSTRUCTIONS - SIZES 3" - 48" (Continued)



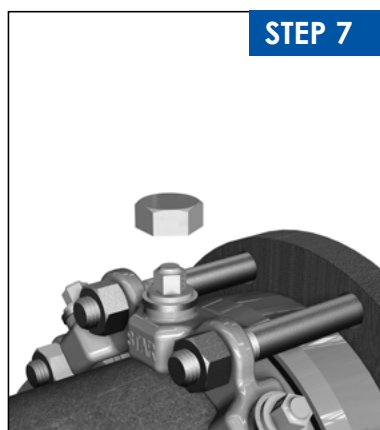
Move the pipe towards the flange face bringing it within max. allowable distance "D" from flange face. Refer to Table A for max. allowable distance "D" and Max. allowable deflection of pipe.



Assemble the joint using supplied flange bolts. Torque all flange bolts in alternating manner as per the torque values given in the table. Make joint deflection if required before actuating torque off bolts. Joint deflection must not exceed the given values and must not make the separation any more than max. allowable distance "D."



Tighten torque off bolts in an alternate manner such that all wedges touch the pipe. Never turn a single bolt over 180 degrees without alternating to another bolt.



Continue tightening the bolts in an alternate manner until torque off bolt heads twist off. If removal is necessary, use 5/8 inch hex head provided. If reassembly is required, assemble the joint in the same manner following steps 1 to 6 and tighten wedge bolts to 90 ft-lbs.

TABLE A			
SIZE (IN)	MAX. ALLOWABLE DISTANCE "D" (IN)	MAX. ALLOWABLE DEFLECTION	FLANGE BOLT TORQUE (FT-LBS)
3	0.7	5°	45 - 60
4	0.6	5°	75 - 90
6	0.8	5°	75 - 90
8	0.9	5°	90 - 110
10 - 12	1.0	3°	90 - 110
14 - 16	1.3	2°	90 - 110
18 - 20	1.3	1.5°	90 - 110
24	1.3	1.0°	90 - 110
30 - 48	2.0	1.0°	110 - 130

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MJ x MJ Adapter series 100

For MJ Bell Connections



MJ x MJ Adapter Series 100 for
MJ bell connections

INFORMATION

The Series 100 MJ x MJ Adapter provides a compact, bolt-through restraint option for MJ bell connections when space is limited.

Compact Design



NOTE: Product is supplied with MJ x MJ adapter; 2 MJ gaskets, bolts, nuts and spacers.

FEATURES & ADVANTAGES

- Provides restraint between MJ valves and MJ fittings or between MJ fittings through the use of our bolt-through design MJ x MJ Adapter.
- Compact design allows connection of two MJ bells with minimum spacing.
- Approximate distance between MJ connections is 1 ¼ inches for 3"-10" and 1 ¾ inches for 12"-36".
- Maximum working pressure 350 PSI for 3"-24" and 250 PSI for 30"-36".
- Product is supplied with MJ x MJ adapter, 2 MJ gaskets, bolts, nuts and spacers.
- MJ x MJ adapter and spacers manufactured from high strength ductile iron in accordance with ASTM A536 Grade 65-45-12.
- T-Head bolts, and pigtail bolts made from low alloy high strength steel per ANSI/AWWA C111/A21.11.
- Standard MJ gaskets are made from styrene butadiene rubber (SBR) per ANSI/AWWA C111/A21.11.
- Sizes 3"-12" asphaltic coating and standard hardware is standard.
- Sizes 14"-36" fusion bonded epoxy (FBE) and Star-Blue hardware is standard.
- Special long hardware kits are available for full body applications.

SAMPLE SPECIFICATIONS

A positive, bolt-through restraint mechanism shall be used to connect mechanical joint valves and fittings without the use of pipe. The MJ x MJ Adapter will incorporate a bolt-through restraint mechanism design that allows for connection of MJ x MJ bells of valves and fittings with T-head bolts and pigtail bolts. The MJ x MJ Adapter and spacers shall be manufactured from high strength ductile iron in accordance with ASTM A536, Grade 65-45-12. Supplied with standard NSF-61 Approved asphaltic seal coat that conforms to ANSI/AWWA C104/A21.4 or NSF-61 approved FBE coating that conforms to ANSI/AWWA C116/A21.6.

The MJ x MJ Adapter kit shall come complete with one MJ x MJ adapter; two standard SBR (styrene butadiene rubber) mechanical joint gaskets, and all required T-head bolts and pigtail bolts. Standard MJ gaskets, T-head bolts and pigtail bolts shall conform to ANSI/AWWA C111/A21.11. Nuts for 3" and 14"-36" shall be heavy hex HSLA steel conforming to ANSI/AWWA C111/A21.11. Nuts for 4"-12" shall be standard hex conforming to SAE J995 grade 2 with zinc plating.

The MJ x MJ Adapter shall have a maximum water working pressure of 350 PSI for sizes 3"-24", 250 PSI for sizes 30"-36" and shall be used with standard Mechanical Joint fittings and valves. The MJ x MJ Adapter shall be Star® Pipe Products Series 100 or an approved equal.

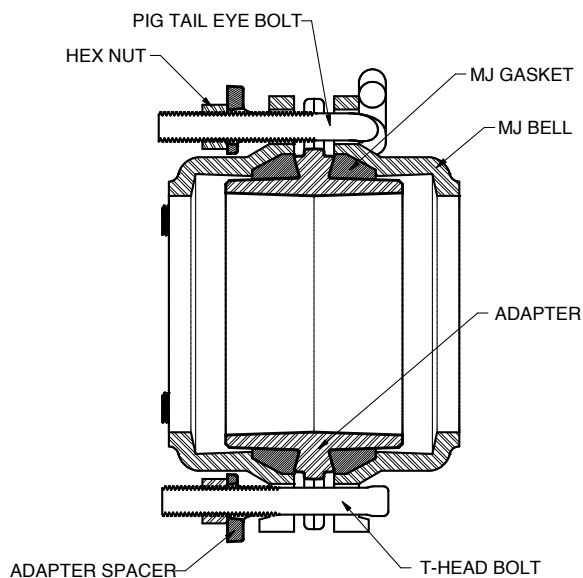
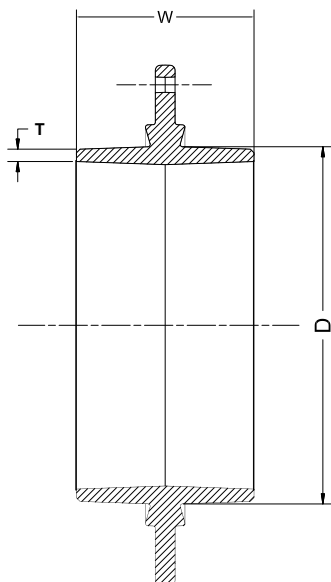
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MJ x MJ Adapter series 100

For MJ Bell Connections

TECHNICAL INFORMATION



MJ x MJ ADAPTER SPECIFICATIONS*

NOM. SIZE	T-HEAD BOLT QTY.	PIG TAIL EYE BOLT QTY.	ADAPTER SPACERS QTY.	W	D	T	WT. WITH ACCESSORIES (LBS.)
3	4	N/A	4	4.50	3.96	0.29	10
4	4	N/A	4	4.50	4.80	0.31	16
6	4	2	6	4.50	6.90	0.31	23
8	4	2	6	4.50	9.05	0.31	29
10	4	4	8	4.60	11.10	0.34	41
12	4	4	8	4.60	13.20	0.34	45
14	10	N/A	10	6.00	15.30	0.36	69
16	12	N/A	12	6.00	17.40	0.37	80
18	12	N/A	12	6.75	19.50	0.38	98
20	14	N/A	14	6.75	21.60	0.39	111
24	16	N/A	16	6.75	25.80	0.44	130
30	20	N/A	20	7.50	32.00	0.51	229
36	24	N/A	24	7.50	38.30	0.58	289

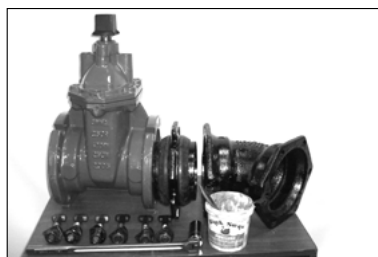
*All dimensions in inches except where indicated.



MJ x MJ Adapter series 100

For MJ Bell Connections

INSTALLATION INSTRUCTIONS - SIZES 3" - 36"



STEP 1

To ensure that the rubber gasket will seal effectively, clean and remove all loose material and rust from the mating surfaces. Lubricate the gasket and plain end by brushing soapy water or pipe lubricant.



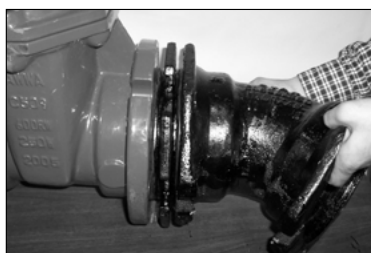
STEP 2

Slide the MJ gasket onto each end of the MJ adapter, such that the flat section of the gasket is towards the center. Ensure that the gaskets are completely against the center shoulder.



STEP 3

Insert the MJ adapter along with the gaskets into the first MJ bell.



STEP 4

Insert the second MJ bell onto adapter. Align adapter such that fins do not obstruct MJ bolt holes.



STEP 5

Insert bolts through the assembly then slide the spacers provided on bolts such that the wider flat side faces the nut.



STEP 6

Assemble nuts onto the bolts using the appropriate wrench/socket. Tighten in an alternative pattern (star pattern) until they are within 45-60 ft-lb torque for 3", 75-90 ft-lb torque for sizes 4"-24" and 100-120 ft-lb torque for 30"-36".

BOLTS IN C153 ACCESSORY PACK					
SIZE (IN)	T-HEAD BOLT (IN)	QTY	PIGTAIL EYE BOLT (IN)	QTY	WRENCH / SOCKET SIZE
3	5/8 x 4	4	N/A	N/A	1 1/16"
4	3/4 x 4 1/2	4	N/A	N/A	1 1/8"
6	3/4 x 4 1/2	4	3/4 x 4 1/2	2	1 1/8"
8	3/4 x 4 1/2	4	3/4 x 4 1/2	2	1 1/8"
10	3/4 x 5	4	3/4 x 5	4	1 1/8"
12	3/4 x 5	4	3/4 x 5	4	1 1/8"
14	3/4 x 5 1/2	10	N/A	N/A	1 1/4"
16	3/4 x 5 1/2	12	N/A	N/A	1 1/4"
18	3/4 x 6	12	N/A	N/A	1 1/4"
20	3/4 x 6	14	N/A	N/A	1 1/4"
24	3/4 x 6	16	N/A	N/A	1 1/4"
30	1 x 7 1/2	20	N/A	N/A	1 5/8"
36	1 x 7 1/2	24	N/A	N/A	1 5/8"

BOLTS IN C110 ACCESSORY PACK					
SIZE (IN)	T-HEAD BOLT (IN)	QTY	PIGTAIL EYE BOLT (IN)	QTY	WRENCH / SOCKET SIZE
3	5/8 x 5	4	N/A	N/A	1 1/16"
4	3/4 x 5 1/2	4	N/A	N/A	1 1/8"
6	3/4 x 5 1/2	4	3/4 x 5 1/2	2	1 1/8"
8	3/4 x 5 1/2	4	3/4 x 5 1/2	2	1 1/8"
10	3/4 x 5 1/2	4	3/4 x 5 1/2	4	1 1/8"
12	3/4 x 5 1/2	4	3/4 x 5 1/2	4	1 1/8"
14	3/4 x 7	10	N/A	N/A	1 1/4"
16	3/4 x 7	12	N/A	N/A	1 1/4"
18	3/4 x 7 1/2	12	N/A	N/A	1 1/4"
20	3/4 x 7 1/2	14	N/A	N/A	1 1/4"
24	3/4 x 7 1/2	16	N/A	N/A	1 1/4"
30	1 x 9	20	N/A	N/A	1 5/8"
36	1 x 9	24	N/A	N/A	1 5/8"

Notes:

- For certain valves it may be easier to insert pigtail eye bolts on the sides of the valve or in slotted holes.
- When installing fitting to fitting, pigtail eye bolts may be inserted into any bolt hole.
- The MJ x MJ adapter may not fit on BOTH branch and run of tees and crosses and on both ends of some bends because of long bolts and spacers.

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Flange Adapters series 200

For Steel (3"-12") and Ductile Iron (3"-12") Pipe - Flange Drilling ANSI B16.1 125 lbs
Working Pressure: 3"-8" 200 PSI, 10"-12" 175 PSI



Flange Adapter Series 200 for
Steel and Ductile Iron Pipe

INFORMATION

The Series 200 Flange Adapter provides restraint by utilizing set screws in a locking device similar to the mechanical joint retainer glands. This adapter eliminates the need for thrust blocks and other restraining devices and has been used throughout the world for more than 40 years.

Proven Design

FEATURES & ADVANTAGES

- Flange adapters are made of Ductile Iron - ASTM A536 Grade 65-45-12.
- Sizes 3"-12" are Underwriters Laboratories Inc. Listed at 200 PSI for 3"-8" sizes and 175 PSI for 10"-12" sizes. For use on PC350 ductile iron and SCH40 steel pipe.
- Bolt hole drilling is to ANSI B16.1 class 125.
- Uses standard mechanical joint gasket for seal on DI Pipe and Transition Gasket on steel pipe.
- Pipe fabrication can be done on site, using plain end pipe.
- Flange Adapters are ideal for jobs involving retro-fitting.
- Can be used on Ductile Iron (3"-12") and Steel (3"-12") Pipe -- steel pipe sizes require a transition gasket.
- Can be used in above or below ground applications
- If future maintenance is required, Flange Adapters can be easily disassembled.
- Standard gland color is Coral Red (RAL 3016).

Note: See page 80 for Technical information and page 82 for installation instructions.

SAMPLE SPECIFICATIONS

Flange Adapter for use on iron or steel pipe shall be manufactured of high strength ductile iron in accordance to ASTM A536 Grade 65-45-12 for all sizes. Applicable dimensions shall conform to ANSI/AWWA C111/A21.11, C110/A21.10 and C153/A21.53. Flange ends to meet ANSI B16.1 Class 125 & ANSI/AWWA C115/A21.15.

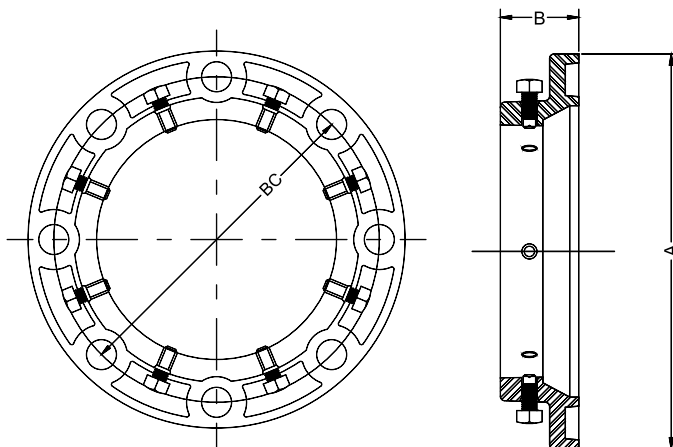
The device shall be Underwriters Laboratories Listed for sizes 3"-12". Flange Adapter shall have a working pressure rating of 200 PSI for sizes 3"-8" and 175 PSI for 10"-12". Flange adapters shall be Star® Pipe Products Flange adapter Series 200 or an approved equal.



Flange Adapters series 200/400

For Steel (3"-12") and Ductile Iron (3"-36") Pipe - Flange Drilling ANSI B16.1 125 lbs

TECHNICAL INFORMATION



FLANGE ADAPTER 200 SPECIFICATIONS*

NOM. SIZE	DUCTILE PIPE O.D.	STEEL PIPE O.D.	APPROX. WT. (LBS)	A	B	BC	BOLT HOLE DIA.	SET SCREWS	
								QTY	SIZE
3	3.96	3.50	5.84	7.50	2.00	6.00	3/4	4	1/2 x 1 1/4
4	4.80	4.50	8.12	9.00	2.07	7.50	3/4	4	1/2 x 1 1/4
6	6.90	6.63	11.05	11.00	2.19	9.50	7/8	8	1/2 x 1 1/4
8	9.05	8.63	17.13	13.50	2.31	11.75	7/8	8	5/8 x 1 1/2
10	11.10	10.75	25.15	16.00	2.50	14.25	1	12	5/8 x 1 1/2
12	13.20	12.75	34.38	19.00	2.50	17.00	1	12	5/8 x 1 1/2

*All dimensions in inches except where indicated. See page 62 for installation instructions.

FLANGE ADAPTER 400 SPECIFICATIONS*

NOM. SIZE	DUCTILE PIPE O.D.	STEEL PIPE O.D.	APPROX. WT. (LBS)	A	B	BC	BOLT HOLE DIA.	SET SCREWS	
								QTY	SIZE
3	3.96	3.50	5.84	7.50	2.00	6.00	3/4	4	1/2 x 1 1/4
4	4.80	4.50	8.12	9.00	2.07	7.50	3/4	4	1/2 x 1 1/4
6	6.90	6.63	11.05	11.00	2.19	9.50	7/8	8	1/2 x 1 1/4
8	9.05	8.63	17.13	13.50	2.31	11.75	7/8	8	5/8 x 1 1/2
10	11.10	10.75	25.15	16.00	2.50	14.25	1	12	5/8 x 1 1/2
12	13.20	12.75	34.38	19.00	2.50	17.00	1	12	5/8 x 1 1/2
14	15.30	N/A	53.00	21.00	2.75	18.75	1 1/8	12	5/8 x 1 1/2
16	17.40	N/A	69.00	23.50	2.75	21.25	1 1/8	16	5/8 x 1 1/2
18	19.50	N/A	76.00	25.00	3.25	22.75	1 1/4	16	3/4 x 2
20	21.60	N/A	95.00	27.50	3.25	25.00	1 1/4	20	3/4 x 2
24	25.80	N/A	131.00	32.00	3.69	29.50	1 3/8	20	3/4 x 2
30	32.00	N/A	206.00	38.75	4.25	36.00	1 3/8	28	1 x 2 1/4
36	38.30	N/A	300.00	46.00	4.38	42.75	1 5/8	32	1 x 2 1/4

*All dimensions in inches except where indicated. See page 61 for features & advantages and page 62 for installation instructions.

Notes:

+ Transition gasket required on steel pipe.



Flange Adapters series 400

For Steel (3"-12") and Ductile Iron (3"-36") Pipe - Flange Drilling ANSI B16.1 125 lbs
Working Pressure: 3"-12" 250 PSI, 14"-24" 150 PSI, 30"-36" 100 PSI



Flange Adapter Series 400 for
Steel and Ductile Iron Pipe

INFORMATION

Flange adapters can be used to restrain plain end pipe to flange fittings instead of using threaded or welded flanges on plain end pipe. Flange adapters provide restraint by use of a set screw locking device similar to that used in mechanical joint retainer gland. This type adapter flange eliminates the need for thrust blocks and other restraining devices and has been used throughout the world for more than forty years.

Proven Design

FEATURES & ADVANTAGES

- Flange adapters are made of Ductile Iron - ASTM A536 Grade 65-45-12.
- Sizes 3"-12" are Underwriters Laboratories Inc. Listed at 200 PSI for 3"-8" sizes and 175 PSI for 10"-12" sizes. For use on PC350 ductile iron and SCH40 steel pipe.
- Bolt hole drilling is to ANSI B16.1 class 125.
- Uses standard mechanical joint gasket for seal on DI Pipe and Transition Gasket on steel pipe.
- Pipe fabrication can be done on site, using plain end pipe.
- Flange Adapters are ideal for jobs involving retro-fitting.
- Can be used on Ductile Iron (3"-36") and Steel (3"-12") Pipe -- steel pipe sizes require a transition gasket.
- Can be used in above or below ground applications
- If future maintenance is required, Flange Adapters can be easily disassembled.
- Standard gland color is Coral Red (RAL 3016).

Note: See page 80 for Technical information and page 82 for installation instructions.

SAMPLE SPECIFICATIONS

Flange Adapter for use on iron or steel pipe shall be manufactured of high strength ductile iron in accordance to ASTM A536 Grade 65-45-12 for all sizes. Applicable dimensions shall conform to ANSI/AWWA C111/A21.11, C110/A21.10 and C153/A21.53. Flange ends to meet ANSI B16.1 Class 125 & ANSI/AWWA C115/A21.15.

Flange Adapter shall have a working pressure rating of 250 PSI for sizes 3"-12", 150 PSI for sizes 14"-24" and 100 PSI for 30"-36".

The device shall be Underwriters Laboratories Inc. listed at 200 PSI for 3"-8" sizes and at 175 PSI for 10"-12" sizes for use on ductile iron and steel pipe.

Flange adapters shall be Star® Pipe Products Flange adapter Series 400 or an approved equal.



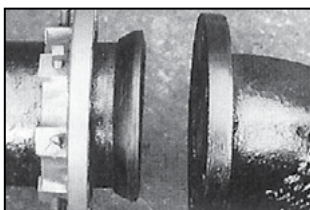
Flange Adapters series 200/400

For Steel (3"-12") and Ductile Iron (3"-36") Pipe-Flange Drilling ANSI B16.1 125 lbs

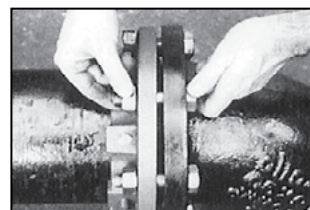
INSTALLATION INSTRUCTIONS - SIZES 3" - 36"

**STEP 1**

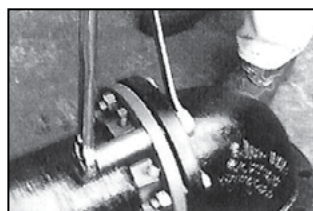
Pipe should be cut square and be free of burrs. Series 200/400 adapter flanges should not be used on beveled end of pipe. Clean the plain end of the pipe. Thoroughly lubricate the pipe and gasket with soap based lubricant. Slide the flange onto the pipe with the gasket cavity facing the end of the pipe. Slide the lubricated gasket over the pipe end, with the taper end facing the gasket cavity in the flange.

**STEP 2**

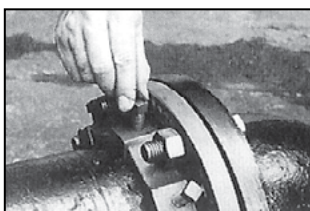
Slide the flange forward until the gasket is evenly seated in the flange cavity, with the leading edge of the gasket flush with the end of the pipe. Butt the end of the pipe against the facing flange.

**STEP 3**

Using conventional flange bolts, mate the Flange Adapter to the standard flange.

**STEP 4**

Be sure to evenly tighten the bolts alternately on opposite sides. Do not over tighten the flange bolts. It is not necessary to bring the Flange Adapter to a face to face contact with the standard flange. A gap of approximately 1/8" between flanges is normal.

**STEP 5**

Hand tighten all set screws until they come in contact with the pipe.

**STEP 6**

Tighten in an alternating manner going on opposite sides (star method) to the torque values shown on the chart below.

Note: Not to be used on plain end fittings or PVC and HDPE pipe.

RECOMMENDED SET SCREW TORQUE VALUES

FLANGE SIZE	SET SCREW SIZE	RECOMMENDED SET SCREW TORQUE VALUE (FT-LBS)								
		DUCTILE IRON PIPE (CLASS)					STEEL PIPE (SCHEDULE)			
		50	51	52	53+	PC350	10	20	30	40+
3"	1/2" x 1 1/4"	-	50	70	70	50	30	-	-	70
4"	1/2" x 1 1/4"	-	50	70	70	50	30	-	-	70
6"	1/2" x 1 1/4"	50	60	80	90	50	30	-	-	90
8"	5/8" x 1 1/2"	75	75	80	90	75	30	50	50	90
10"	5/8" x 1 1/2"	75	75	80	90	75	40	50	50	90
12"	5/8" x 1 1/2"	75	75	80	90	75	40	50	60	90
14"	5/8" x 1 1/2"	75	75	90	90	75	N/A	N/A	N/A	N/A
16"	5/8" x 1 1/2"	75	75	90	90	75	N/A	N/A	N/A	N/A
18"	3/4" x 2"	75	80	115	115	75	N/A	N/A	N/A	N/A
20"	3/4" x 2"	75	80	115	115	75	N/A	N/A	N/A	N/A
24"	3/4" x 2"	75	80	115	115	80	N/A	N/A	N/A	N/A
30"	1" x 2 1/4"	90	110	125	125	125	N/A	N/A	N/A	N/A
36"	1" x 2 1/4"	90	110	125	125	125	N/A	N/A	N/A	N/A



Heavy Duty Retainer Gland series 600

For Mechanical Joints



Heavy Duty Retainer Gland - Series 600

INFORMATION

Heavy Duty Retainer Glands provide reliable restraint for ductile iron and steel pipe, valves and fittings. This simple design has been in service for over 30 years. Retainer glands install in minutes, in any type of soil condition and offer guaranteed restraint. Eliminating expensive time-consuming concrete thrust blocks.

Proven Success for Over 30 Years

FEATURES & ADVANTAGES

- Gland is made of Ductile Iron, ASTM A536 Grade 65-45-12
- Offers a full 5° deflection through 12" size, 3° on 14"-20" & 2° on 24"-36"
- Sizes 3" through 12" are Underwriters Laboratories Listed for use on Ductile Iron, Thickness Class 51 and Pressure Class 350 at 350 psi and on Steel Pipe, Schedule 40, 3" to 10" is rated at 350 psi & 12" at 250 psi.
- Safety factor is twice (2:1) the standardized pressure rating listed in **Table A**.
- Intended for use on Ductile Iron or Steel Pipe as listed in **Table A**.
- Use on Steel Pipe, sizes 3"-12" requires a transition gasket.
- Retainer Glands eliminate tie rods and thrust blocks.
- Standard gland color is Graphite Black (RAL 9011).

Table A

Nominal Size	Maximum Working Pressure Rating					
	TC Ductile Iron Pipe		PC Ductile Iron Pipe			Steel Pipe
	50	51+	PC250	PC300	PC350	SCH40+
3	N/A	350	N/A	N/A	350	350
4	N/A	350	N/A	N/A	350	350
6	350	350	N/A	N/A	350	350
8	350	350	N/A	N/A	350	350
10	350	350	N/A	N/A	350	350
12	350	350	N/A	N/A	350	250
14	250	250	250	250	250	N/A
16	250	250	250	250	250	N/A
18	150	150	150	150	150	N/A
20	150	150	150	150	150	N/A
24	150	150	150	150	150	N/A
30	N/A	100	100	100	100	N/A
36	N/A	100	100	100	100	N/A

SAMPLE SPECIFICATIONS

Restrainer mechanism dimensions shall be in accordance with ANSI/AWWA C111/A21.11. This mechanism shall be designed to fit standard mechanical joint bells with standard T-Bolts.

The mechanical joint restrainer glands shall be manufactured of ductile iron Grade 65-45-12 Conforming to ASTM A536. Set screws are to be of high strength low alloy steel in accordance with ANSI 4140 and heat-treated to Rockwell C45-53 with cup points. Restrainer mechanism sizes 3"-12" shall be Underwriters Laboratories Listed.

Restrainer mechanism shall possess specified pressure rating and carry a minimum safety factor of 2:1. Restrainer mechanism shall be Star® Pipe Products, Series 600 or an approved equal.

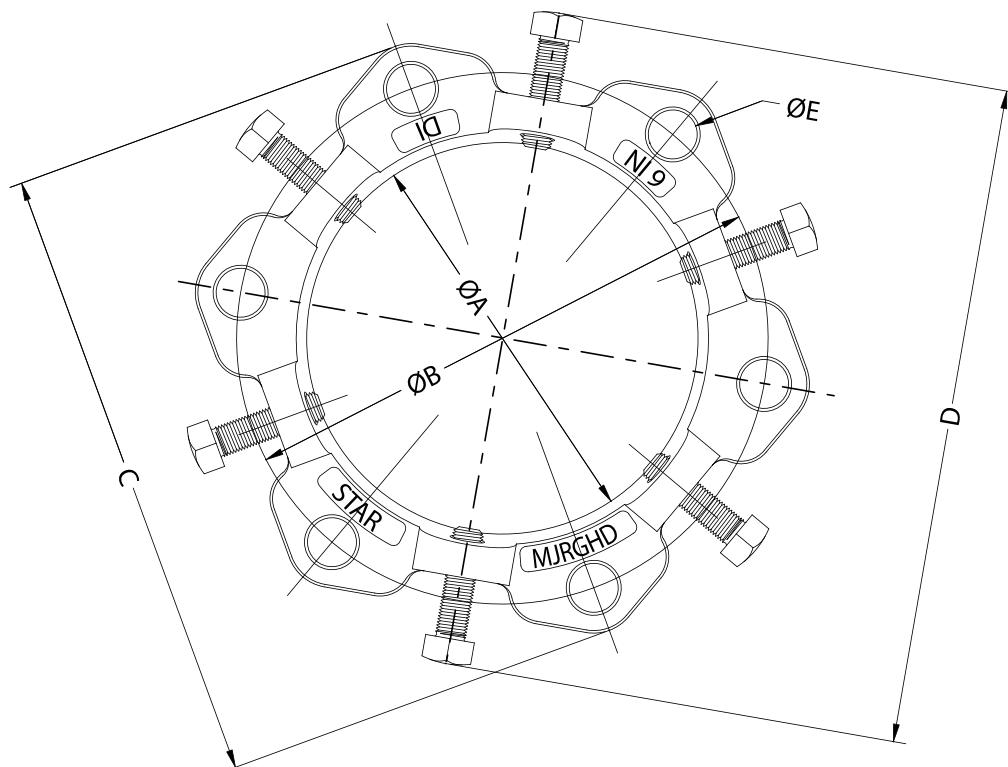
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Heavy Duty Retainer Gland series 600

For Ductile Iron Mechanical Joints

TECHNICAL INFORMATION

**HEAVY DUTY RETAINER GLAND 600 SPECIFICATIONS***

NOM. SIZE	DI PIPE OD	STEEL PIPE* OD	ØA	ØB	C	D	ØE	SET SCREWS SIZE (QTY)	SET SCREW TORQUE (FT-LBS)	APPROX WT. (LBS)
3	3.96	3.50	4.06	6.19	7.69	8.87	3/4	5/8x2 (4)	85	5
4	4.80	4.50	4.90	7.50	9.12	9.72	7/8	5/8x2 (4)	85	7
6	6.90	6.63	7.00	9.50	11.12	11.82	7/8	5/8x2 (6)	85	11
8	9.05	8.63	9.15	11.75	13.37	13.95	7/8	5/8x2 (9)	85	15
10	11.10	10.75	11.20	14.00	15.62	16.00	7/8	5/8x2 (16)	85	22
12	13.20	12.75	13.30	16.25	17.88	18.12	7/8	5/8x2 (16)	85	27
14	15.30	N/A	15.44	18.75	20.25	20.20	7/8	5/8x2 (20)	90	44
16	17.40	N/A	17.54	21.00	22.50	22.30	7/8	5/8x2 (24)	90	55
18	19.50	N/A	19.64	23.25	24.75	24.40	7/8	5/8x2 (24)	90	60
20	21.60	N/A	21.74	25.50	27.00	26.50	7/8	5/8x2 (28)	90	73
24	25.80	N/A	25.94	30.00	31.50	30.70	7/8	5/8x2 (32)	90	92
30	32.00	N/A	32.17	36.88	39.12	39.13	1-1/8	3/4x3 (40)	90	169
36	38.30	N/A	38.47	43.75	46.00	45.43	1-1/8	3/4x3 (48)	90	213

*All dimensions in inches except where indicated.

Notes:

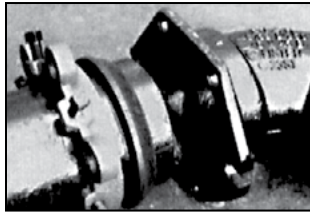
* Transition gasket required on steel pipe.



Heavy Duty Retainer Gland series 600

For Ductile Iron Mechanical Joints

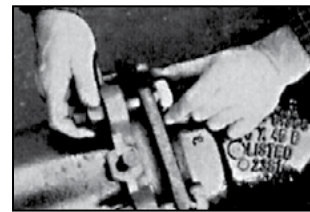
INSTALLATION INSTRUCTIONS - SIZES 3" - 36"

**STEP 1**

Wash socket and plain end pipe with soapy water. Ensure that the set screws are retracted to clear the pipe OD. Slip gland and gasket over plain end pipe with small side of gasket and lip side of gland facing socket.

**STEP 2**

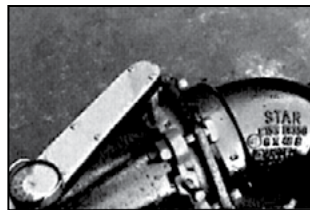
Slip plain end pipe into socket. Lubricate gasket with soapy water to allow it to slip easily into place. Push gasket into socket making sure it is evenly seated.

**STEP 3**

Slide gland into position against gasket. Align bolt holes and insert T-bolts. Tighten nuts by hand. Note: deflection of joint must be made prior to tightening of T-bolts and set screws. The max deflection is 5° for 3"-12", 3° for 14"-20" and 2° for 24"-36".

**STEP 4**

T-bolts should be tightened alternately on opposite sides (Star Pattern), to the torque recommended by AWWA (see table A), and hand tighten set screws until tips evenly touch pipe, assuring concentricity.

**STEP 5**

Then tighten set screws alternately on opposite sides to approximate 50 ft-lbs of torque. Finally, in the same sequence, tighten set screws to recommended torque DO NOT RE-TORQUE. (see table B)

Note: Not to be used on plain end fittings, PVC or HDPE pipe.

(TABLE A) T-HEAD BOLT & NUT DETAILS

PIPE SIZE (IN)	BOLT SIZE (IN)	RANGE ¹ OF TORQUE (FT-LBS)
3	5/8	45-60
4-24	3/4	75-90
30-36	1	100-120

¹These torque ranges are requirements of AWWA C600

(TABLE B) SET SCREW TORQUE

PIPE SIZE (IN)	BOLT SIZE (IN)	RANGE OF TORQUE (FT-LBS)
3-12	5/8 x 2	85
14-24	5/8 x 2	90
30-36	3/4 x 3	90

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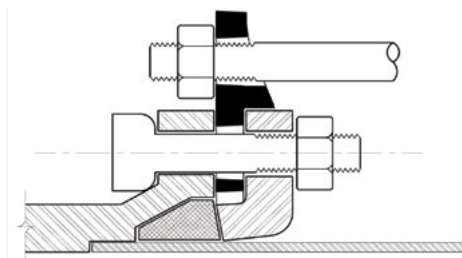
Joint Restraint Hardware



INFORMATION

- Designed to assist in restraining of mechanical joint fittings, valves, hydrants and pipes by threaded rods
- Manufactured with high strength ductile iron per ASTM A 536, Grade 65-45-12
- Designed for use on sizes 4" through 16"
- Installed between MJ Bell and MJ Gland

TECHNICAL INFORMATION



Please refer to the chart below for determining the number of Starlugs to be used depending on the pipe size and pipe line working pressure.

Packaging: Boxes of 50 each

MINIMUM NUMBER OF STARLUGS REQUIRED FOR EACH MJ BELL									
NOM. PIPE SIZE	WORKING PRESSURE (PSI)*								
	100	125	150	200	225	250	300	325	350
4"	2	2	2	2	2	2	2	2	2
6"	2	2	2	2	3	3	3	4	4
8"	2	2	3	4	4	4	6	6	6
10"	4	4	4	6	6	8	8	8	NR
12"	4	4	6	8	8	8	NR	NR	NR
14"	5	6	8	10	NR	NR	NR	NR	NR
16"	6	8	10	12	NR	NR	NR	NR	NR

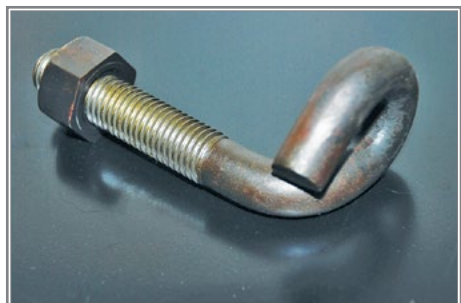
*Pressure ratings include a nominal 2:1 safety factor.

NR - Not Recommended



MJ Eye Bolt (Pigtail)

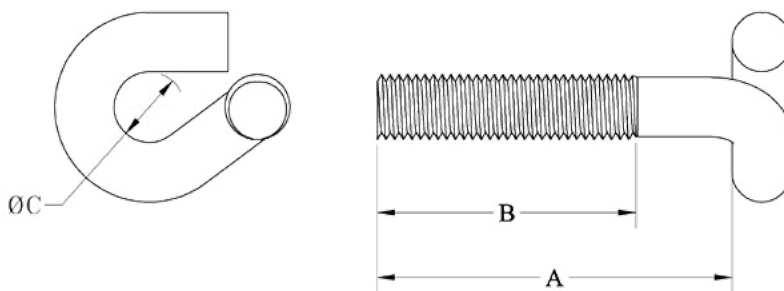
Joint Restraint Hardware



INFORMATION

- Low alloy steel per ANSI/AWWA C111/121.11
- UNC 2A Rolled Threads per ASME B1.1
- Eye bolts can be used in place of T-Head bolts
- Used on sizes 4" through 36"
- Max. Load (per bolt): 7,500 lbs

TECHNICAL INFORMATION



SIZE	A	B	ØC
¾ x 3 ½	3.50	2.50	0.81
¾ x 4	4.00	3.00	0.81
¾ x 4 ½	4.50	3.50	0.81
¾ x 5	5.00	4.00	0.81
¾ x 5 ½	5.50	4.50	0.81
1 x 6	6.00	5.00	1.06

All dimensions in inches.



Zinc Cap

Joint Restraint Hardware



INFORMATION

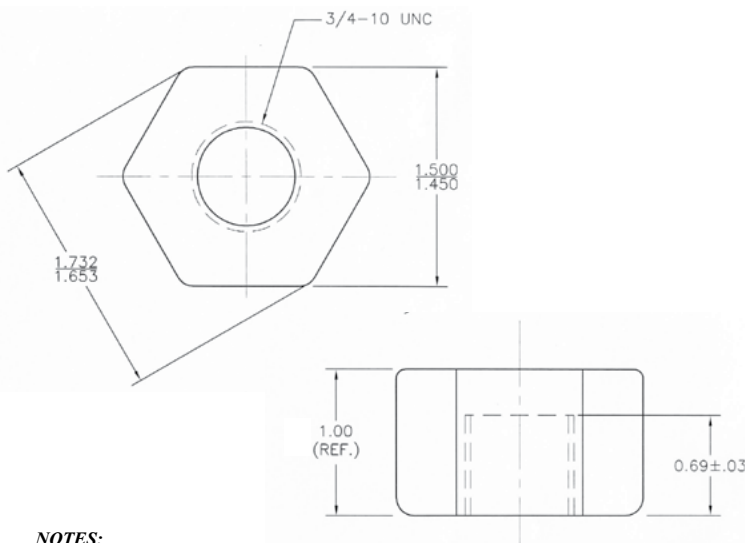
Star Zinc caps are a low cost approach to corrosion protection. Science proves that metals corrode at different rates during electrochemical activity/galvanic action. Because Zinc has the higher electrical potential, the caps act as a sacrificial anode and protect other metals having a lower electrical potential.

A Low Cost Approach to Corrosion Protection

FEATURES & ADVANTAGES

- Star Zinc Caps meet MIL-A-18001J and ASTM B418 Type I specifications.
- Helps to prevent corrosion on T-bolts

TECHNICAL INFORMATION



NOTES:

1. THREADS: 3/4-10 UNC 2B PER ANSI/ASME B1.1

ZINC CAP

COMPOSITION BY ELEMENT¹

ELEMENT	WT%
Cu (Copper)	0.005 Max.
Al (Aluminum)	0.10-0.50
Fe (Iron)	0.005 Max.
Cd (Cadmium)	0.025-0.070
Pb (Lead)	0.006 Max.
Other	0.10 Max.
Zn (Zinc)	Remaining

¹As required by MIL-A-18001J and ASTM B418 Type I

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