

2008 EDITION

100 - 1600 mm

INTERNATIONAL

# RESTRAINED JOINT DUCTILE IRON PIPE AND FITTINGS

TR FLEX® - Anchor Gaskets - HP LOK®



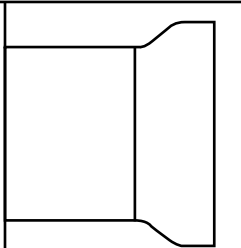
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WATER & WASTEWATER

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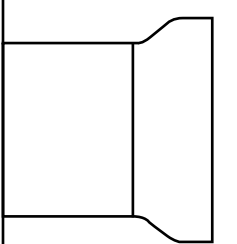
**U.S.  
PIPE**

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| 866.DIP.PIPE |  | <div><div></div><div></div><div></div><div></div></div>                                                        |              |  |     |
|              |                                                                                  | INTERNATIONAL<br><b>RESTRAINED JOINT DUCTILE IRON PIPE AND FITTINGS</b><br>TR FLEX® - Anchor Gaskets - HP LOK® |              |  |     |
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## Introduction

Based in Birmingham, Alabama, U.S. Pipe and Foundry Company, LLC. is America's leading manufacturer of Ductile Iron pipe, joint restraint products and other products for the water and wastewater industry.

U.S. Pipe operates four manufacturing plants and numerous sales locations throughout the country. These domestic sales offices combined with the International Sales office and their worldwide network of sales associates gives U.S. Pipe one of the broadest domestic and international marketing coverages in the industry.

From its beginning in 1899, U.S. Pipe has consistently lead the industry with innovations and product developments.

Centrifugal casting, pioneered by U.S. Pipe, revolutionized the industry. TYTON JOINT® Pipe, using a single rubber gasket, patented by U.S. Pipe and licensed throughout the world, is the most widely used joint for Ductile Iron pipe today.

The company lineage dates back to 1882, when Colonel James Withers Sloss founded Sloss Furnace Company in Birmingham, Sloss Furnace Company became Sloss Iron and Steel Company. After acquiring Sheffield Iron Company, the Sloss-Sheffield Steel and Iron Company was incorporated in 1899.

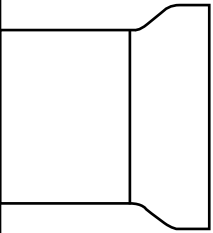
In that same year U.S. Cast Iron Pipe and Foundry Company was incorporated with the consolidation of eleven small cast iron pipe companies located in eight states. Prominent among these was the Bessemer, Alabama plant, one of the three original plants still in operation today.

In 1911, U.S. Pipe purchased the Dimmick Pipe Company, which included a plant in North Birmingham that still operates today.

The name of the company was changed to United States Pipe and Foundry Company in 1929. U.S. Pipe also operates two other pipe plants, one in Burlington, New Jersey, and the other in Union City, California. These plants are located in the northern and western parts of the country to better serve our domestic market.

In 1952, the Sloss-Sheffield Steel and Iron Company was merged into U.S. Pipe, and the General Offices of U.S. Pipe moved from Burlington, New Jersey to Birmingham. The company quickly became a fully integrated producer of cast iron pipe and related products.

While the original plants produced pipe by the so called "pit cast" method, in which molten iron was poured into static, vertical molds lined and cored with sand, today's plants and production bear little resemblance to the old. In 1921, U.S. Pipe revolutionized the production of cast iron pipe when it purchased the rights for the centrifugal casting method, developed by Dimitri Sensaud Delavaud, a French engineer living in Brazil. In this process, the molten iron is poured into a rapidly spinning metal mold. The centrifugal force of the rotating mold distributes the molten iron uniformly around the inner surface of the mold. Upon cooling, extraction and heat treatment, high quality pipe with uniform thickness results.

|                                                                                                           |                                                                                                                                                                     |              |     |
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## Introduction (cont.)

In the early 1960's, U.S. Pipe perfected the production of Ductile Iron pipe, which is superior to gray iron in strength and durability. U.S. Pipe, since 1977, has used Ductile Iron exclusively for all its pressure pipe and fittings, making the company the first in the industry to do so.

Having produced pipe and fittings in imperial (inch) diameter sizes to ANSI/AWWA standards for a number of years, U.S. Pipe, in the 1970's, increased its production and marketing scope to include metric sized pipe and fittings to International Organization for Standardization (ISO) Standards.

Today U.S. Pipe and Foundry Company, a wholly owned subsidiary of Mueller Water Products, Inc., is the largest domestic producer of Ductile Iron pipe in sizes 4 inch through 64 inch. U.S. Pipe perfected the production of Ductile Iron pipe, which is superior in strength to cast iron, and was the first in the industry to use Ductile Iron exclusively for all its pressure pipe and fittings.

This U.S. Pipe International Sales catalog covers DN 100 - 1600 mm ISO Pipe and Fittings. For information on products of ANSI/AWWA imperial (inch) diameter sizes, please contact your U.S. Pipe Sales Representative.

Ductile Iron pipe and fittings of both ANSI/AWWA inch diameter and ISO metric sizes, and other U.S. Pipe products are sold worldwide. U.S. Pipe products have been shipped to Colombia, Ecuador, Egypt, El Salvador, Jamaica, Kuwait, Nigeria, Oman, Paraguay, The Philippines, Saudi Arabia, Canada, Mexico, Qatar, The United Arab Emirates and many, many other countries around the world. Both abroad and in the United States customers and specifiers alike have come to depend upon products and services from the "new ideas" company to keep their work flowing.

### Standards

**ISO 2531** Ductile iron pipes, fittings, accessories and their joints for water or gas applications

**ISO 4179** Ductile iron pipes and fittings for pressure and non-pressure pipelines – Cement mortar lining

**ISO 4633** Rubber seals – Joint rings for water supply, drainage and sewerage pipelines – Specification for material

**ISO 8179-1** Ductile iron pipes – External zinc-based coating – Part 1: Metallic zinc with finishing layer

**ISO 8179-2** Ductile iron pipes – External zinc coating – Part 2: Zinc rich paint with finishing layer

**ISO 8180** Ductile iron pipes – Polyethylene sleeving for site application

**ANSI/AWWA C150/A21.50-02** American National Standard for Thickness Design of Ductile-Iron Pipe

**ANSI/AWWA C151/A21.51-02** American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water

**ANSI/AWWA C153/A21.53-06** American National Standard for Ductile-Iron Compact Fittings for Water Service

**ANSI/AWWA C104/A21.4-03** American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water

**ANSI/AWWA C105/A21.5-05** American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems

**ANSI/AWWA C111/A21.11-07** American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

**ANSI/AWWA C110/A21.10-03** American National Standard for Ductile-Iron and Gray-Iron Fittings for Water

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## General Specifications: Dimensions

The following descriptions of dimensions are in accordance with the requirements of **ISO 2531**. Variations from the Standard are so noted.

**a. Thickness** - The standard thicknesses of pipe and fittings are calculated as a function of their nominal diameter by the following formula:

$$e = k (0,5 + 0,001 \text{ DN})$$

where

$e$  = Standard wall thickness (mm)

DN = Nominal Diameter (mm)

$k$  = A coefficient selected from a series of whole numbers...8,9,10,11,12...

The external diameter of the pipe, expressed in millimeters is fixed as a function of the nominal diameter and independent of the pipe wall thickness. Increases or decreases in the pipe wall thickness result in change of the internal diameter.

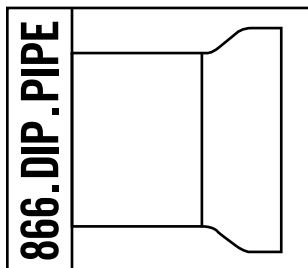
For fittings, both internal and external diameters may be varied to change wall thicknesses. Actual wall thicknesses may be adjusted to accommodate internal stresses for each point of the casting. In bends, for example, the wall thickness at the inner radius may be greater than that at the outer radius. The thickness “ $e$ ” indicated in each table and on the drawings of the fittings is the mean thickness.

**b. Thickness Tolerances** - The tolerances on wall thicknesses are as given in Table 1.

**Table 1.**

| Type of Casting        | Tolerance Dimensions in Millimeters |
|------------------------|-------------------------------------|
| Pipe                   | $-(1,3 + 0,001 \text{ DN})^1$       |
| Fittings & Accessories | $-(2,3 + 0,001 \text{ DN})^1$       |

<sup>1</sup> No Limit for the plus tolerance has been set



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## General Specifications: Dimensions (cont.)

**c. Lengths and Tolerances: Spigot and Socket Pipe** - TR FLEX and HP LOK Pipe are produced to the manufacturing working lengths shown in Table 2.

In accordance with **ISO 2531**, of the total number of spigot and socket pipe to be supplied in each diameter, up to 10% may be supplied in shorter lengths than the working lengths stated in Table 2. The Standard allows a  $\pm 30$  mm tolerance on manufacturing working lengths to allow for variations due to shrinkage and growth, depending on the composition and heat treatment of the Ductile Iron.

**d. Lengths and Tolerances: Fittings** - Fittings were designed using the performance requirements of **ISO 2531** as the minimal requirements. At U.S. Pipe, fitting patterns have the capacity to accept interchangeable end pieces for different jointing systems. This affords a high degree of flexibility in the manufacture of the fittings at a minimal expense to the customer. Fittings constructed by this method may have lengths and masses which differ from those in the above mentioned standard. The lengths and masses for individual fittings are given in the appropriate table in this catalog. Many fittings, sizes and configurations are shown which are not in the **ISO 2531** Standard.

Casting Tolerances on the laying lengths vary by fitting type and are given in the fitting tables.

**e. Tolerance on the Straightness of Centrifugally Cast Pipe** - When pipe are rolled along two gantries separated by approximately two-thirds of the length "L" of the pipe to be checked, the maximum deviation " $f_m$ ", in millimeters, shall not be greater than 1,25 times the length "L", in meters of this pipe:

$$f_m < 1,25L$$

Table 2.

| Nominal Diameters DN | Manufacturing Nominal Working Lengths m |
|----------------------|-----------------------------------------|
| 100 to 1000          | 5,5                                     |
| 1200 to 1600         | 6,0                                     |

*Dimensions in millimeters*

## General Specifications: Mechanical Testing

The following mechanical tests and acceptance values are in accordance with the requirements of **ISO 2531**. At the end of this section additional control tests used by U.S. Pipe during the production of centrifugally cast Ductile Iron pipe, the Ball Impression Test and Charpy Impact Test, are shown. These latter tests are not required by the International Standard.

### a. Tensile Tests - Test Bars:

**Pipe centrifugally cast in metal molds** - The machined test bar for the tensile test is taken from the spigot end of the pipe, at approximately mid-thickness of the wall, with its axis parallel to the axis of the pipe.

The test bar includes a cylindrical part, with a gauge length at least five times its diameter: the latter given in Table 3, according to the thickness of the pipe, “e”.

**Table 3.**

| Thickness of Pipe | Diameter of Test Bar |
|-------------------|----------------------|
| $e < 6$           | 2,5                  |
| $6 < e < 8$       | 3,5                  |
| $8 < e < 12$      | 5                    |
| $12 > e$          | 6                    |

*Dimensions in millimeters*

**Fittings cast in sand molds** - The machined bar for the tensile test is taken from a sample attached to the casting or a sample cast separately from the same iron. Where heat treatment of the fitting or accessory is required, a separately cast sample shall be subjected to the same heat treatment. The thickness of the sample and the diameter of the test bar is given in Table 4 as a function of the mean thickness of the casting. The gauge length of the machined bar is at least five times its diameter.

**Table 4.**

| Mean thickness of casting | Thickness of sample | Diameter of test bar |
|---------------------------|---------------------|----------------------|
| $\leq 12$                 | 12,5                | 6                    |
| $> 12$                    | 25,0                | 12                   |

*Dimensions in millimeters*

## General Specifications: Mechanical Testing (cont.)

**b. Tensile Test: Methods and Results** - These mechanical tests are carried out during the manufacturing process on castings grouped in accordance with the following batch size limitations:

**Pipe centrifugally cast in metal molds**

DN 100 to 300.....200 pipe

DN 350 to 600.....100 pipe

DN 700 to 1000.....50 pipe

DN 1200 to 1600.....25 pipe

**Fittings not centrifugally cast** - Castings made from iron of substantially the same composition and, if necessary, having been subjected to the same heat treatment, shall be considered as one batch.

For one pipe, or from one sample of each batch of fittings, one test bar is taken which shall satisfy the requirements of Table 5.

If a result of this test is below the specified minimum values, two other test bars are taken from the same pipe, or from the same sample in the case of fittings and these must both satisfy the same requirements.

**Table 5.**

| Type of Casting         | Minimum tensile strength $R_m$ | Minimum elongation after fracture A |           |
|-------------------------|--------------------------------|-------------------------------------|-----------|
|                         | N/mm <sup>2</sup>              | %                                   |           |
|                         | DN 100 to 1600                 | DN 100 to 1000                      | DN > 1000 |
| Pipe centrifugally cast | 420                            | 10                                  | 7         |
| Fittings                | 400                            | 5                                   | 5         |

*Dimensions in millimeters*

**NOTE:** By agreement between manufacturer and purchaser, the 0.2% proof test may be used to determine the proof stress (yield strength). It shall not be less than:

-270 MPa when > 12% for DN 100 to 1000  
or A > 10% for DN > 1000

\*300 MPa in other cases.

## General Specifications: Mechanical Testing (cont.)

c. **Internal Pressure Proof Test** - Pipe are subjected to a works hydrostatic test for a minimum duration of 10 seconds and at a pressure based on the formulae and limitations given in Table 6.

Table 6.

| Nominal size<br>DN | Hydrostatic works test pressure<br>for K ≥ 9 pipe |                                |
|--------------------|---------------------------------------------------|--------------------------------|
|                    | Formulae<br>(bar)                                 | Minimum Test<br>Pressure (bar) |
| 100 < DN < 300     | $0,5 (k + 1)^2$                                   | 50                             |
| 350 < DN < 600     | $0,5 k^2$                                         | 40                             |
| 700 < DN < 1000    | $0,5 (k-1)^2$                                     | 32                             |
| 1200 < DN < 1600   | $0,5 (k-2)^2$                                     | 25                             |

*k is the thickness coefficient of the pipe  
Dimensions in millimeters*

Fittings are subjected to a leak-tightness test carried out with water at the test pressures given in Table 7 or with air at a minimum pressure of 1 bar.

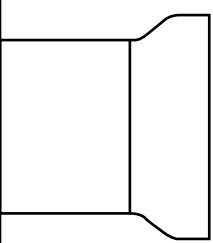
Table 7.

| Nominal size DN | Hydrostatic leak-tightness test pressure<br>for fittings (bar) |
|-----------------|----------------------------------------------------------------|
| 80 < DN < 300   | 25                                                             |
| 350 < DN < 600  | 16                                                             |
| 700 < DN < 1600 | 10                                                             |

*Dimensions in millimeters*

For pipe and fittings, the acceptance criteria are that after completion of the test there shall be no visible leakage, sweating or other fault of any kind.

d. **Other Mechanical Tests** - The following two tests, the Ball Impression Test and the Charpy Test, are quality and process control tests utilized by U.S. Pipe to assure consistent quality of centrifugally cast Ductile Iron pipe. Neither test is a requirement of International Standard. The Ball Impression Test is a proprietary test developed by U.S. Pipe. The Charpy Impact Test is a requirement of **ANSI/AWWA C151/A21.51 American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.**

|                                                                                                                                                                                                                                                                                              |                                                                                   |                                                                                                                                                 |  |      |  |
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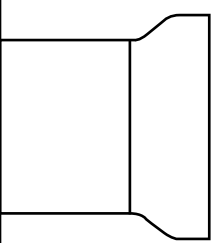
## General Specifications: Mechanical Testing (cont.)

**Ball Impression Test** - Each processed Ductile Iron pipe is subjected to a proof test. The test consists of applying a concentrated load of the magnitude which would rupture the wall of a non-ductile pipe. An acceptable pipe will not split when tested at the designated loading for the applicable pipe wall thickness.

**Charpy Impact Test** - The Charpy Impact Test is a fracture toughness test used to measure the mechanical properties of centrifugally cast Ductile Iron pipe. A notched test specimen of full wall thickness is tested in accordance with the requirements of **ASTM E 23**. The pendulum type test equipment strikes the properly positioned test specimen and measures the energy required to fracture it.

Samples for Charpy testing are selected to represent production through the heat treating operation.

The acceptance value, corrected for actual thickness, is 7 ft-lbs (9.49 J) at 70° (21C). Pipe failing to meet this requirement are subjected to metallurgical evaluation and additional heat treatment or rejection as appropriate.

|                                                                                                           |                                                                                                                                                                     |              |      |
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## General Specifications: Coatings, Linings, and Markings

### COATINGS AND LININGS

Coatings and linings applied to pipe and fittings are as follows:

#### EXTERNAL - COATINGS

##### Pipe and fittings:

Bituminous paint.

When specified, metallic zinc with a bituminous finishing layer in accordance with **ISO 8179-1** and/or **ISO 8179-2 Ductile Iron Pipes - External Zinc Coating**, can be furnished.

Polyethylene encasement as specified in **ISO 8180, Ductile Iron Pipes - Polyethylene Sleeving**, or **ANSI/AWWA C105/A21.5, Polyethylene Encasement for Ductile Iron Pipe**, is available when the soil is corrosive to Ductile Iron and protection against exterior corrosion should be provided.

#### INTERNAL LININGS

##### Pipe:

Cement mortar in accordance with **ISO 4179, ductile iron pipes for pressure and non-pressure pipelines - Centrifugal cement mortar lining - general requirements**.

##### Fittings:

Cement mortar in accordance with the applicable requirements of **ISO 4179**.

When specified, cement mortar linings can be furnished made with **ASTM C150 Type V** sulfate resisting Portland cement. Pipe and fittings can be furnished with or without a bitumen seal-coat on the cement mortar lining. Sealcoating furnished meets the health effects requirements of **ANSI/NSF 61, Drinking Water System Components-Health Effects**.

#### CAST-ON OR COLD STAMPED MARKINGS

All pipe and fittings shall be marked as follows:

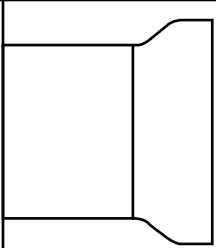
- identification of the manufacturer
- identification of the year of manufacture
- DN
- identification of Ductile Iron
- PN of flanges where applicable

Other markings, painted or attached via a label, as appropriate:

- length, etc.
- identification of third party certification
- special markings



**NOTE:** The above standard coatings and linings are suitable for the majority of soil conditions and raw or potable waters to be conveyed. Should supplementary protection be required for aggressive soils or waters carried by the pipeline, contact International Sales for additional methods of protection.

|                                                                                                           |                                                                                                                                                                     |              |      |
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## Restrained Joint Pipe and Fittings

TR FLEX Restrained Joint Pipe and Fittings provide flexible restrained push-on joints for DN 100 mm through DN 1 600 mm Ductile Iron pipe and fittings.\* The joints are suitable for 25 bars working pressures for pipe and fittings of sizes DN 100 mm through DN 600 mm and 17 bars for sizes DN 700 mm through DN 1200 mm. Pipe and fittings, sizes DN 1400 mm, 1500 mm, and 1600 mm, are rated for 24 bars working pressure.†

Ductile Iron locking segments, inserted through a slot (or slots) in the bell face, provide a positive axial lock between the bell interior surface and a retainer weldment on the spigot end of the pipe.

TR FLEX Pipe utilizes the conventional TYTON® Gasket for DN 400 mm through DN 900 mm sizes. TR FLEX® Gaskets are furnished for DN 1000 mm and 1200 mm TR FLEX Pipe and Fittings. Conventional TYTON Gaskets are used for 1400, 1500 and 1600 mm TR FLEX Pipe and Fittings. Gaskets are not interchangeable with gaskets used in TYTON JOINT® Pipe bells of these sizes.

TR FLEX Pipe and Fittings are furnished in Ductile Iron only and conform to applicable requirements of ISO 2531 “Ductile-iron pipes, fittings, accessories and their joints for water or gas applications.”

Cement lining in accordance with ISO 4179 “Ductile iron pipes for pressure and non-pressure pipelines - Centrifugal Cement Mortar Lining - General Requirements” or ANSI/AWWA C104/A21.4 “Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water” is available. Asphaltic outside coating is in accordance with ANSI/AWWA C151/A21.51 “Ductile-Iron Pipe, Centrifugally Cast, for Water” for pipe and ANSI/AWWA C110/A21.10 “DUCTILE-IRON AND GRAY-IRON FITTINGS, 3 IN. THROUGH 48 IN. (75 mm THROUGH 1200 mm), FOR WATER” or ANSI/AWWA C153/A21.53 “DUCTILE-IRON COMPACT FITTINGS, 3 IN. THROUGH 24 IN. (76 mm THROUGH 610 mm) AND 54 IN. THROUGH 64 IN. (1,400 mm THROUGH 1,600 mm), FOR WATER SERVICE”. Asphaltic seal-coat on cement mortar lining and special linings and/or coatings, including metallic zinc spray per ISO 8179, can be furnished for specific conditions.

**NOTE:** \*Check with your U.S. Pipe Sales Representative for higher pressure ratings.

†For a suggested design procedure for the restraint of thrust forces in pressurized, buried Ductile Iron piping systems, the design engineer should refer to the current DIPRA publication “THRUST RESTRAINT DESIGN FOR DUCTILE IRON PIPE”.

If specifiers and users believe that corrosive soils will be encountered where our products are to be installed, please refer to ANSI/AWWA C105/A21.5 “Polyethylene Encasement for Ductile-Iron Pipe Systems” for proper protection procedures.

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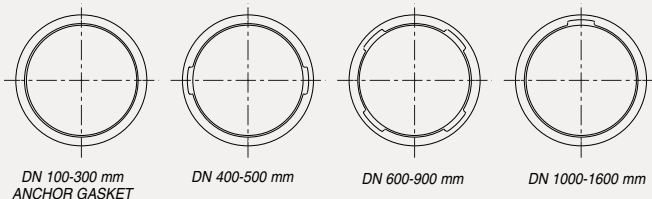
# Restrained Joint Ductile Iron Pipe and Fittings Assembly

**CAUTION:** Gasket-seat in the socket must be cleaned of all excess paint and foreign matter prior to installation of the gasket. Joints are only as watertight as they are clean. If the joint is somewhat difficult to assemble, inspect for proper gasket positioning, adequate lubrication, and removal of foreign matter in the joint.

**Figure 1. Insertion Slot Orientation**

Orientation of the segment insertion slots located in the face of the TR FLEX Pipe bell, is important for ease of assembly; therefore particular attention should be paid to that portion of the assembly instructions. Clean the sockets of all dirt, sand, gravel, or other foreign matter.

**Figure 1.**



**Figure 2. Gasket Installation**

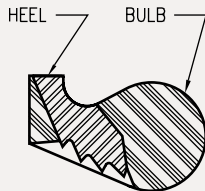
Clean the gasket. Loop it as shown in one of the two following illustrations and place it into the socket with the rounded bulb entering first.

Smaller sized gaskets (DN 100 through 500 mm) require only one loop. With larger sized gaskets (DN 600 - 1600 mm) it will be helpful to loop the gasket at two or more locations.

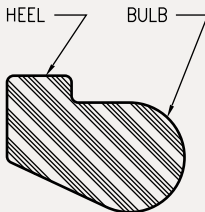
After the gasket has been inserted into the gasket seat, making sure the gasket is uniformly seated inside the socket, apply a thin film of TYTON® Lubricant to the exposed surface of the gasket.

In subfreezing weather the gaskets should be kept at temperatures above 4° C (39° F), to ensure resiliency during installation. Examples of suitable means of keeping the gaskets warm are: storing the gaskets in a heated area or keeping the gaskets immersed in a tank of warm water. If the gaskets are kept in warm water, they should be dried before they are installed into the socket.

**Figure 2.**

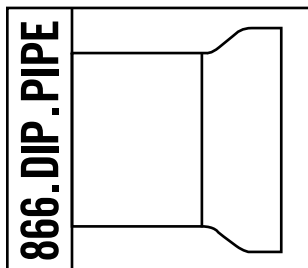


**DN 100 - 300 mm  
Anchor Gasket**



**DN 400 - 1600 mm  
Gasket**





INTERNATIONAL

# RESTRAINED JOINT DUCTILE IRON PIPE AND FITTINGS

TR FLEX® - Anchor Gaskets - HP LOK®



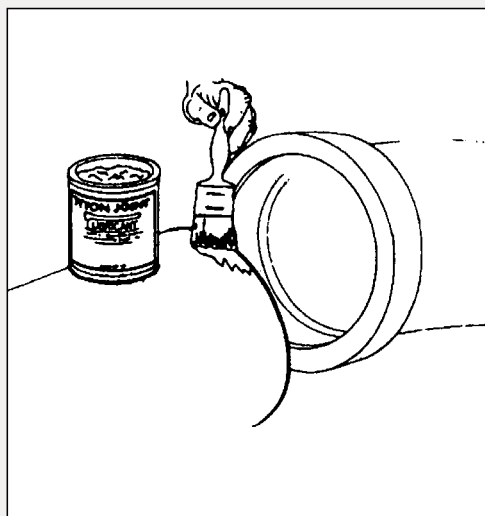
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## TR FLEX Joint Ductile Iron Pipe Assembly (cont.)

### Lubrication

Clean the spigot end of the pipe back to the assembly stripes. Apply a thin film of TYTON® Lubricant. In warm, dry weather conditions, the lubricant can dry out, especially when applied to warm or hot pipe, it will be necessary to add a small amount of water to hydrate the lubricant. Only TYTON JOINT Lubricant should be used. Do not allow the lubricated plain end to touch the ground or trench sides. For under-water installations, a special lubricant is available from U.S. Pipe.



### Final Assembly

Keep the pipe in axial alignment during assembly. Insert the spigot end until the first assembly stripe is in the socket.

The locking segments should then be inserted. Both left hand and right locking segments are required for DN 400 through 900 mm sizes. The rubber locking segment retainer(s) should be wedged between the inserted locking segments. The pipe may then be retracted until the locking segments are seated. (See section of this brochure titled TR FLEX Pipe and Fitting Socket Pull Out, Page 21.) Lastly, deflection may be set observing the deflection limits in Table 8.

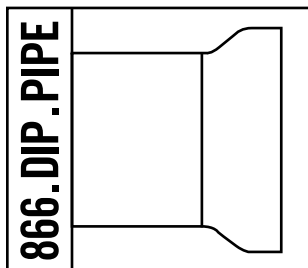
Table 8.

Maximum Deflection of TR FLEX Pipe and Fittings\*

| Size DN | Max. Deflection |
|---------|-----------------|
| 100     | 5°              |
| 150     | 5°              |
| 200     | 5°              |
| 250     | 5°              |
| 300     | 5°              |
| 400     | 3 1/4°          |
| 450     | 3°              |
| 500     | 2 3/4°          |
| 600     | 2 1/4°          |
| 700     | 2 1/4°          |
| 800     | 1 3/4°          |
| 900     | 1 1/2°          |
| 1000    | 1/2°            |
| 1200    | 1/2°            |
| 1400    | 1/2°            |
| 1500    | 1/2°            |
| 1600    | 1/2°            |

*Dimensions in millimeters*

**\*NOTE:** These deflections are based on nominal dimensions. Slightly higher or lesser deflections may be obtained in the field.



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# RESTRAINED JOINT DUCTILE IRON PIPE AND FITTINGS

TR FLEX® - Anchor Gaskets - HP LOK®



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## Anchor Gaskets (100-300 mm)

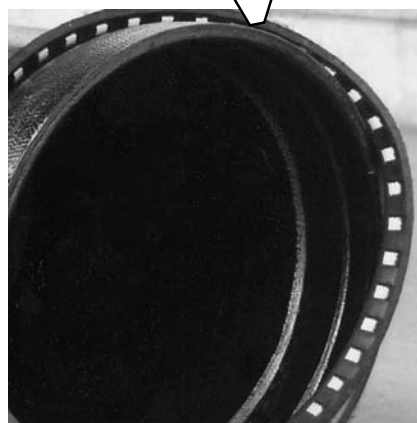
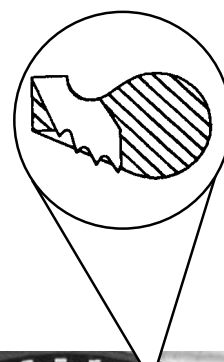
Restrained joint pipe and fittings are used in pressurized Ductile Iron pipelines to prevent the joints of the line from separating due to thrust forces. Thrust forces generally occur at changes of direction in the line. Usually, a calculated length of pipeline extending from the location of the thrust force is restrained in the joints so that this force can be transmitted to the soil surrounding the line. The entire pipeline is often restrained for installations in poor soil or for critical lines.

U.S. Pipe's Anchor Gasket has proven to be an extremely successful, trouble-free means of joint restraint for well over one million Ductile Iron pipe and fitting joint assemblies. By simply inserting a Anchor Gasket into the socket of a TYTON JOINT® Pipe, Fitting or Valve, restraint is instantly achieved when the joint is assembled. Stainless steel locking segments vulcanized into the Anchor Gasket grip the pipe to prevent joint separation.

Anchor Gaskets, utilizing patented improvements, are rated by U.S. Pipe for operating pressures up to 24 bars.

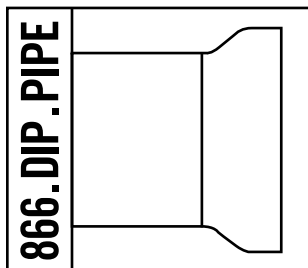
With the use of the Anchor Gasket, push-on joint Ductile Iron TYTON JOINT Pipe or Fittings can be quickly and securely restrained as the joint is assembled. Field cut pipe are no longer a problem to restrain. No pipe surface preparation\* or grooving is required for field cut pipe other than the cut end needing to be beveled as required for any push-on joint spigot end. With the Anchor Gasket in place, the joints are restrained without thrust blocks, bolts, grooves, rods, clamps or retainer glands, resulting in savings of labor, material and time.

**CAUTION:** U.S. Pipe does not recommend Anchor Gaskets for use above ground. The long-term effect of cyclical movements can be gradual joint separation to the point that the seal on the gasket bulb is compromised. Sources of cyclical movements include vibration as may be found on bridge crossings, and thermal expansion and contraction resulting from atmospheric temperature changes. These conditions are not experienced with buried pipe lines.



**NOTE:** If specifiers and users believe that corrosive soils will be encountered where products are to be installed, please refer to ISO 8180 Ductile iron pipes - Polyethylene sleeving for site application.

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INTERNATIONAL

# RESTRAINED JOINT DUCTILE IRON PIPE AND FITTINGS

TR FLEX® - Anchor Gaskets - HP LOK®



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## Instructions for DN 400 - 500 mm TR FLEX Pipe and Fittings - Two Bell Slots

1. Lay pipe or fitting such that both of the bell slots are accessible (in the horizontal position if possible).
2. Clean the socket and insert a TYTON® Gasket.
3. Clean the pipe spigot end back to the assembly stripes.
4. Lubricate the exposed surface of the gasket and the pipe spigot end back to the weld bead.
5. Make a conventional push-on joint assembly, fully homing the pipe until the first assembly stripe is in the bell socket. Keep the joint in straight alignment during assembly.
6. Insert lower locking segment into a bell slot and slide the segment around the pipe.
7. Insert upper locking segment into the same bell slot and rotate around the pipe.
8. Hold the upper segment in place and wedge the rubber retainer into the slot between the two locking segments.
9. Repeat steps 6-8 for other slot. Make sure that all 4 locking segments and 2 rubber retainers are securely in place.
10. Extend the joint to remove the slack in the locking segment cavity. Joint extension is necessary to attain the marked laying length of the pipe and to minimize growth or extension of the line as it is pressurized. (Refer to the section entitled TR FLEX Pipe and Fitting Socket Pullout, Page 21)
11. Set the joint deflection as required. (See Table 8, Page 14)

### Components required for each joint:

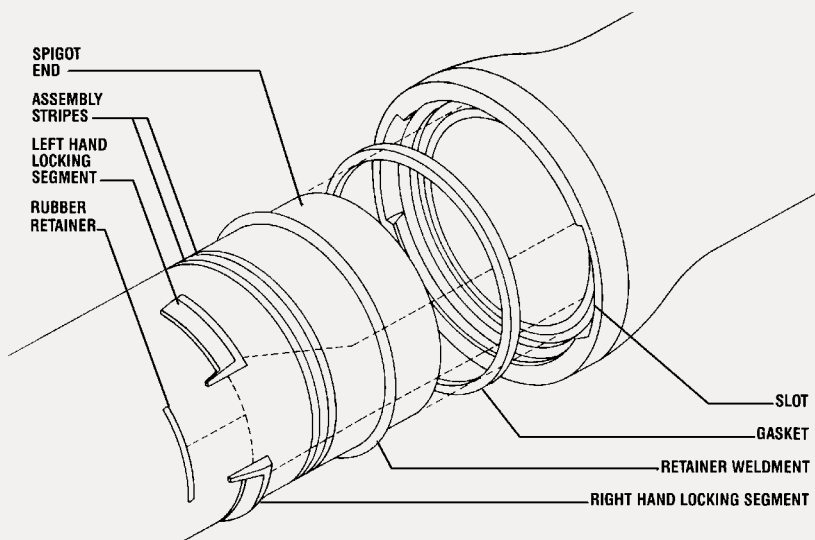
2 right-hand locking segments (painted red, marked RH)

2 left-hand locking segments (painted black, marked LH)

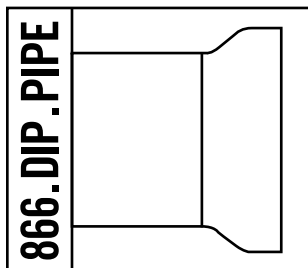
2 rubber retainers

1 TYTON® Gasket

TYTON® Lubricant



Dimensions in millimeters



INTERNATIONAL

# RESTRAINED JOINT DUCTILE IRON PIPE AND FITTINGS

TR FLEX® - Anchor Gaskets - HP LOK®



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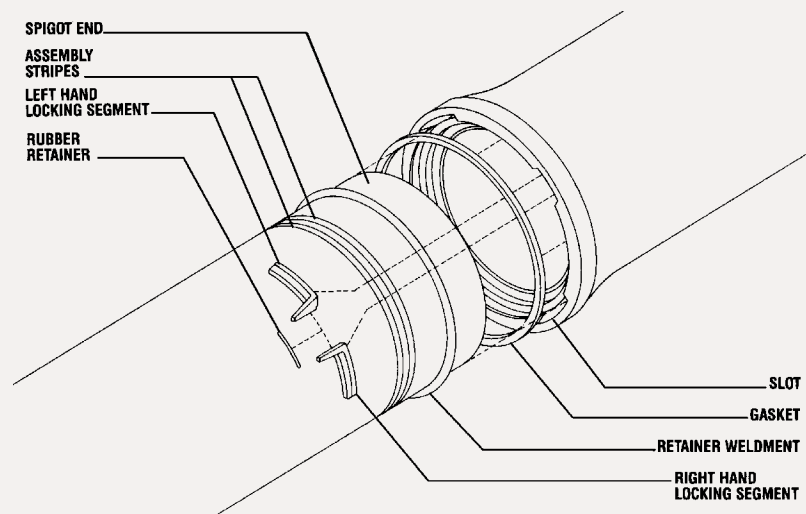
P 17

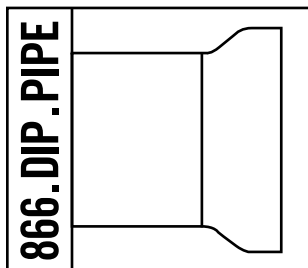
## Instructions for DN 600 - 900 mm TR FLEX Pipe and Fittings - Four Bell Slots

1. Lay pipe or fitting such that all four of the bell slots are accessible (in the diagonal position if possible).
2. Clean the socket and insert a TYTON® Gasket.
3. Clean the pipe spigot end back to the assembly stripes.
4. Lubricate the exposed surface of the gasket and the pipe spigot end back to the weld bead.
5. Make a conventional push-on joint assembly, fully homing the pipe until the first assembly stripe is in the bell socket. Keep the joint in straight alignment during assembly.
6. Insert lower locking segment into a bell slot and slide the segment around the pipe.
7. Insert upper locking segment into the same bell slot and rotate around the pipe.
8. Hold the upper segment in place and wedge the rubber retainer into the slot between the two locking segments.
9. Repeat steps 6-8 for other slots. Make sure that all 8 locking segments and 4 rubber retainers are securely in place.
10. Extend the joint to remove the slack in the locking segment cavity. Joint extension is necessary to attain the marked laying length of the pipe and to minimize growth or extension of the line as it is pressurized. (Refer to the section entitled TR FLEX Pipe and Fitting Socket Pullout, Page 21)
11. Set the joint deflection as required. (See Table 8, Page 14)

### Components required for each joint:

4 right-hand locking segments (painted red, marked RH)  
 4 left-hand locking segments (painted black, marked LH)  
 4 rubber retainers  
 1 TYTON® Gasket  
 TYTON® Lubricant





INTERNATIONAL

# RESTRAINED JOINT DUCTILE IRON PIPE AND FITTINGS

TR FLEX® - Anchor Gaskets - HP LOK®



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## Instructions for DN 1 000 - 1 200 mm TR FLEX Pipe and Fittings - One Bell Slot

1. Lay pipe or fitting such that the bell slot is accessible (in the 12 o'clock position if possible).
2. Clean the socket and insert a TR FLEX Gasket.
3. Clean the pipe spigot end back to the assembly stripes.
4. Lubricate the exposed surface of the gasket and the pipe spigot end back to the weld bead.
5. Make a conventional push-on joint assembly, fully homing the pipe until the first assembly stripe is in the bell socket. Keep the joint in straight alignment during assembly.
6. Insert 11 locking segments one at a time into the bell slot and slide the segments alternately to the left and to the right around the pipe.
7. Wedge the rubber retainer into the slot between the last two locking segments.
8. Make sure that all 11 locking segments and the rubber retainer are securely in place.
9. Extend the joint to remove the slack in the locking segment cavity. Make sure that the segments are evenly extended around the socket and are not over the weld bead. Joint extension is necessary to attain the marked laying length of the pipe and to minimize growth or extension of the line as it is pressurized. (Refer to the section entitled TR FLEX Pipe and Fitting Socket Pullout, Page 21)
11. Set the joint deflection as required. (See TABLE 8, Page 14)

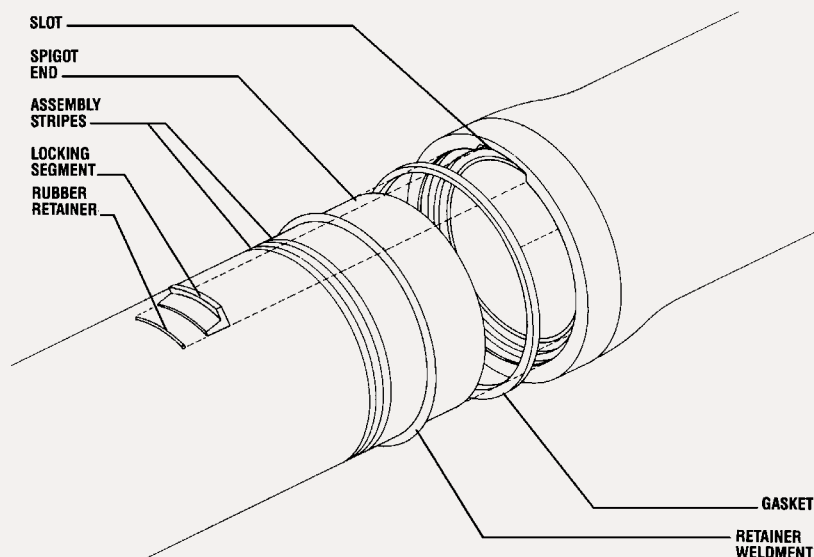
### Components required for each joint:

11 locking segments

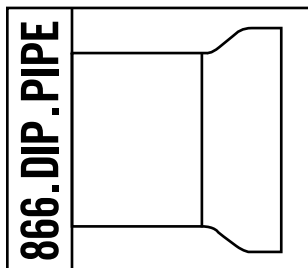
1 rubber retainer

1 gasket - Note: A TR FLEX® Gasket is used in these sizes.

TYTON® Lubricant



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# RESTRAINED JOINT DUCTILE IRON PIPE AND FITTINGS

TR FLEX® - Anchor Gaskets - HP LOK®



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## Instructions for Assembling HP LOK Pipe and Fittings (DN 1400 - 1600 mm)

1. The gasket seat must be clean and free of debris or any foreign matter.\*
2. Install the gasket in the bell. Do not lubricate gasket prior to installing bell.\*
3. Lubricate the gasket and spigot of the mating pipe with TYTON® Joint lubricant.\*
4. The spigot of the mating pipe may now be inserted into the bell. The installer must make sure that the spigot is fully homed in the bell and not deflected. The HP LOK® Ring can be slid back and forth when the spigot is inserted correctly and not deflected.
5. The jack bolt should now be removed and discarded.
6. The clamp bolt can now be snugged down so that the HP LOK Ring contacts the pipe surface. Use only enough bolt torque to make sure the HP LOK Ring is in contact with the mating spigot and to prevent the HP LOK Ring from spreading.
7. Inspect the full circumference of the HP LOK Ring to make sure it is in contact with the spigot of the pipe and not resting on the weld bead. If the HP LOK Ring is sitting on the weld bead, the spigot is not fully homed in the bell or the joint is excessively deflected for installation.
8. When it is certain that the HP LOK Ring is fully contacting the spigot, extend the joint (remove slack in the joint) by pulling on the assembled pipe joints. Do not use excessive force. The spigot should slide easily under the HP LOK Ring.
9. Tighten the clamp bolt to approximately 10 to 20 ft-lb of torque. Do not over tighten.
10. Deflect the joint as desired, not to exceed 1/2 degree.
11. The joint is now completely assembled.

### Components required for each joint:

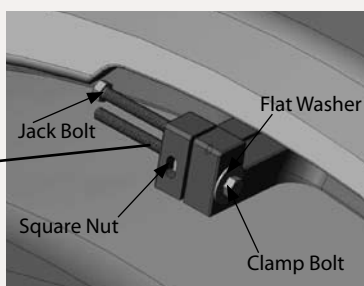
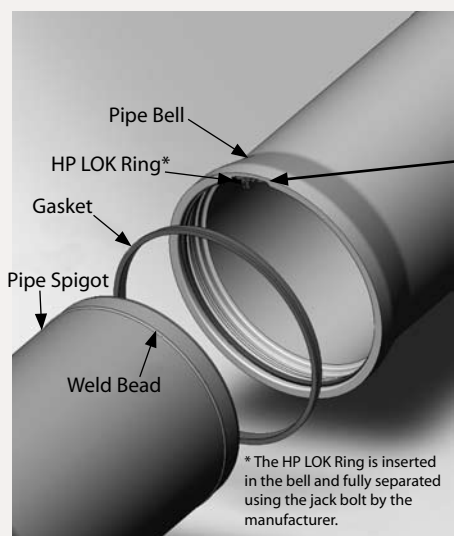
1 HP LOK® Ring (factory installed)

1 TYTON® Gasket

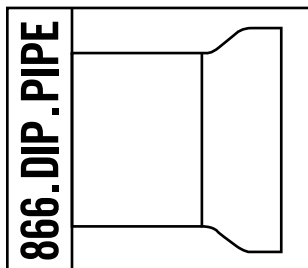
TYTON® Lubricant

1 jack bolt (factory installed)

1 clamp bolt (factory installed)



**NOTE:** HP LOK Ring shown in full closed position.



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# RESTRAINED JOINT DUCTILE IRON PIPE AND FITTINGS

TR FLEX® - Anchor Gaskets - HP LOK®



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## TR FLEX® Ductile Iron Pipe and Fittings Assembly

### TR FLEX Pipe and Fittings

#### Socket Pull Out

(Linear Expansion Within the Socket)

In TR FLEX Pipe and Fitting sockets, a small amount of pull out is available at each joint (Refer to Table 9). This pull out or expansion capability is the result of clearance inside the socket required for the insertion of the locking segments. This expansion can be minimized by extending the joint after installing the locking segments and prior to setting the joint deflection. The expansion may be beneficial when utilized in underground installations. The movement of the pipe and fittings increases the passive resistance of the soil when thrust forces are encountered.

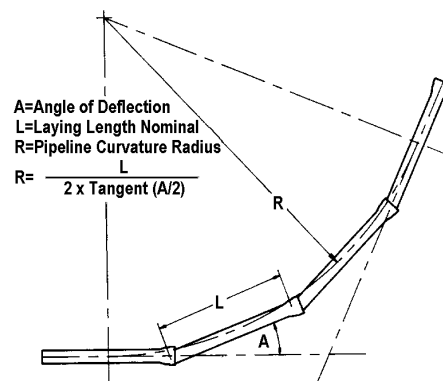
The expansion capability of the TR FLEX Pipe and Fitting socket must be considered, particularly in the following cases:

- When TR FLEX Pipe are used above ground (bridge crossings, on piers, etc.),
- When TR FLEX Pipe are used in poor soil conditions (swamps, marshes, etc.),
- When extremely long lengths of TR FLEX Pipe are required for restraint due to high operating pressures and/or unfavorable soil parameters, and
- Where TR FLEX Pipe are used inside casing pipe.
- When pipeline terminates in a building.
- Where TR FLEX Pipe and Fittings are in vertical alignment.

In cases, such as the above, the TR FLEX Joint should be fully extended after installation of the segments. When TR FLEX Pipe are used inside a casing pipe, it is recommended that the assembled pipe be pulled through the casing. Additional security may be required to ensure that the locking segments are adequately retained in the socket during such installations.

If the joint is not extended, during assembly, the expansion per joint will increase the length of a 300 Meter long bridge crossing installation between 0.6 to 1.5 Meters depending upon pipe size when the pipeline is pressurized (Table 9).

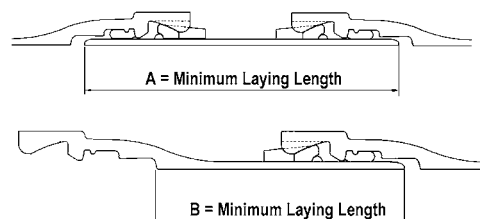
### Pipeline Curve Geometry



## TR FLEX® Ductile Iron Pipe and Fittings Assembly (cont.)

### Minimum Laying Lengths For TR FLEX Pipe

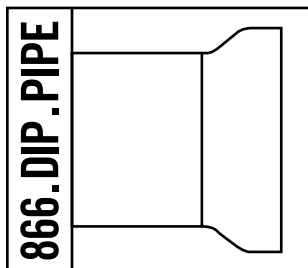
The following drawings and TABLE 9 define the minimum lengths for TR FLEX Pipe when furnished in either Plain End x Plain End, or Bell x Plain End. The minimum laying lengths are determined on the basis of the socket depth and the minimum space required in front of the pipe bell face to insert the locking segments. These minimum laying lengths must be considered when ordering factory cut lengths or field cutting TR FLEX Pipe. The longest pipe possible should be used in any installation to reduce large forces at the joint and also for ease of assembly.



**Table 9:**  
Minimum Laying Lengths and Pull Out For Restrained Joint Pipe

| Size DN | A (mm) | B (mm) | Pull Out (M) |
|---------|--------|--------|--------------|
| 100     | 324    | 273    | .01          |
| 150     | 356    | 298    | .01          |
| 200     | 387    | 330    | .01          |
| 250     | 400    | 343    | .02          |
| 300     | 419    | 337    | .02          |
| 400     | 514    | 387    | .02          |
| 450     | 533    | 394    | .02          |
| 500     | 546    | 406    | .02          |
| 600     | 584    | 432    | .02          |
| 700     | 641    | 470    | .02          |
| 800     | 667    | 495    | .02          |
| 900     | 711    | 527    | .02          |
| 1000    | 572    | 438    | .02          |
| 1200    | 591    | 464    | .02          |
| 1400    | 641    | 514    | .03          |
| 1500    | 711    | 540    | .03          |
| 1600    | 743    | 559    | .03          |

*Field Cut Pipe*  
*Dimensions in millimeters*  
*Pull Out in meters*



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**RESTRAINED JOINT DUCTILE IRON PIPE AND FITTINGS****TR FLEX® - Anchor Gaskets - HP LOK®**

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## Field Cut Pipe Preparation

Before making a field cut, measure the pipe diameter or circumference at the location to be cut. The diameter or circumference should fall within the range shown in TABLE 10. If the measurement is not within the prescribed range, another pipe should be selected and checked before cutting.

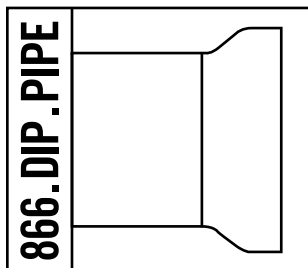
### Making A Field Cut

The pipe must be cut as square as is practical. A field cut end that is not square may leak, especially if the joint is fully deflected. Measure from the factory manufactured spigot end to the desired cut location. Mark the measured distance around the circumference of the pipe (a line perpendicular to the pipe axis). Cut the pipe. (Abrasive saws are commonly used). Bevel the field cut end (a disk grinder can be used). Refer to a shop manufactured bevel as a guide for proper shape. Additional grinding may be required to further bevel the pipe if difficulty in assembly is encountered.

Table 10

| Size DN | Circumference |         | Diameter |         |
|---------|---------------|---------|----------|---------|
|         | Maximum       | Minimum | Maximum  | Minimum |
| 100     | 374           | 362     | 119      | 115     |
| 150     | 537           | 525     | 171      | 167     |
| 200     | 701           | 688     | 223      | 219     |
| 250     | 864           | 851     | 275      | 271     |
| 300     | 1027          | 1013    | 327      | 323     |
| 350     | 1191          | 1180    | 379      | 376     |
| 400     | 1351          | 1341    | 430      | 427     |
| 450     | 1511          | 1501    | 481      | 478     |
| 500     | 1674          | 1664    | 533      | 530     |
| 600     | 1998          | 1988    | 636      | 633     |
| 700     | 2322          | 2311    | 739      | 736     |
| 800     | 2648          | 2637    | 843      | 839     |
| 900     | 2972          | 2960    | 946      | 942     |
| 1000    | 3296          | 3284    | 1049     | 1045    |
| 1200    | 3946          | 3935    | 1256     | 1252    |
| 1400    | 4596          | 4585    | 1463     | 1459    |
| 1500    | 4919          | 4908    | 1566     | 1562    |
| 1600    | 5243          | 5232    | 1669     | 1665    |

*Dimensions in millimeters*



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# RESTRAINED JOINT DUCTILE IRON PIPE AND FITTINGS

TR FLEX® - Anchor Gaskets - HP LOK®



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## The Assembly Mark

Make an assembly mark on the pipe barrel at the location as shown in TABLE 11. Use this assembly mark to assure that the pipe is inserted the proper depth into the socket. If the pipe is “bottomed out” in the socket, the amount of joint deflection will be reduced. If the pipe is not inserted far enough into the socket, the gasket may not seal (particularly if the joint is deflected).

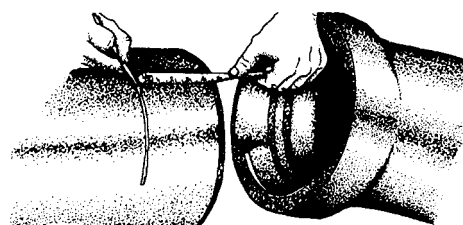


Table 11:

| Size DN | Location of Assembly Mark |
|---------|---------------------------|
| 100     | 123                       |
| 150     | 136                       |
| 200     | 148                       |
| 250     | 153                       |
| 300     | 160                       |
| 350     | 197                       |
| 400     | 202                       |
| 450     | 208                       |
| 500     | 213                       |
| 600     | 225                       |
| 700     | 256                       |
| 800     | 261                       |
| 900     | 276                       |
| 1000    | 193                       |
| 1200    | 207                       |
| 1400    | 221                       |
| 1500    | 257                       |
| 1600    | 271                       |

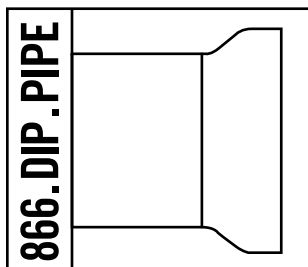
*Dimensions in millimeters*

## Notes Regarding the Use of Restrained Joint Pipe

1. Large unbalanced thrust forces can be produced at dead ends, bends, tees or other changes in direction of high pressure and/or large diameter piping systems.
2. Concrete thrust blocks or restrained joint pipe and fittings can normally be used to resist the unbalanced thrust forces.
3. In underground piping systems, an unbalanced thrust force can normally be resisted by providing a designed length of restraint at a change in direction where thrust forces are anticipated. Restrained joint pipe normally must transfer the thrust forces to the soil surrounding the pipeline.
4. The Thrust Restraint Design For Ductile Iron Pipe published by the Ductile Iron Pipe Research Association (DIPRA) is one method used to calculate the required length of restraint at a change in direction. This publication is available through your U.S. Pipe representative.
5. Most restrained joints allow for the joint take-up after installation. The amount of take-up or slack can vary considerably with the type of joint and installation conditions. Thrust forces produced by internal pressure can result in removal of this joint take-up thereby increasing the length of the restrained section of the line. In any situation or configuration where increases in the line segment length could be detrimental to the pipeline or surrounding structures, the restrained joints should be fully extended during installation.
6. An increase in line segment length can also result in additional joint deflection. If increases in length or other line movements are anticipated, the deflection of the restrained joints should be limited to only a portion of the joint design deflection during the installation of the pipe.
7. In fully extended, totally restrained piping systems, the thrust forces are carried by the piping system, and the resistance to the thrust is not dependent upon the surrounding soil. In situations where there is insufficient space to provide the designed restrained length, or where there are poor soil conditions, the entire section of line should be restrained or other external means of stability or restraint provided.

## Notes Regarding the Use of Restrained Joint Pipe (cont.)

8. If restrained joint pipe is used in a casing and is subjected to thrust, the joints should be fully extended to take up the joint slack prior to making end connections. The length of restraint in the casing should not be considered as part of the designed length of restraint required to provide the soil resistance to the thrust forces.
9. Above ground lines subject to thrust forces should be fully restrained and extended to remove any slack from the joint. The joint can be extended by pulling out on the pipe after the restrained joint assembly is made. The thrust forces can cause an unexpected increase in length of an above ground line if the slack is not first removed from the joint. When restrained joint pipe are used for bridge crossings or other above ground installations, each length of pipe must be supported in a manner to restrict both vertical and horizontal movement.
10. It is the responsibility of the Purchaser or Consulting Engineer to ensure that proper trench preparation, compaction, and pipe installation procedures are followed and that adequate restrained lengths or thrust block designs are provided to resist the unbalanced thrust loads generated by the installed piping systems.
11. In general, restrained joints are more electrically conductive than conventional push-on joints used for Ductile Iron pipe. This increased conductivity can make a restrained section of the line more susceptible to stray current corrosion caused by direct currents from sources such as electrical transit systems or cathodically protected steel structures (steel pipe, underground storage tanks, etc.) If exposure to stray currents is anticipated, contact your U.S. Pipe representative for the recommended method of protection.
12. If Anchor Gaskets are used in a vertical installation, provisions must be made to keep the joint extended and not allow the teeth to become disengaged from the pipe. Failure to keep vertical joints extended can result in joint separation.



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# RESTRAINED JOINT DUCTILE IRON PIPE AND FITTINGS

TR FLEX® - Anchor Gaskets - HP LOK®

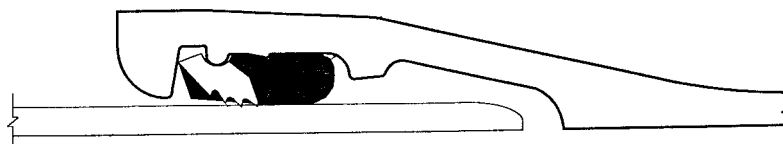
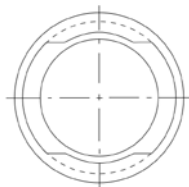


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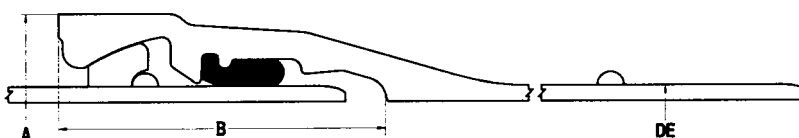
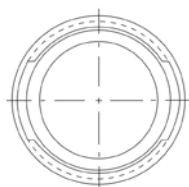
P 26

## Restrained Push On Joint Pipe and Fittings

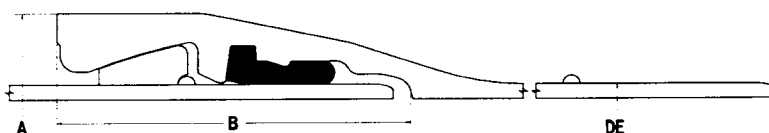
DN 100 - 300 mm



DN 400 - 500 mm



DN 600 - 900 mm



| Size | O.D. Barrel | O. D. Bell Pipe | O.D. Bell Fitting | Socket Depth | Locking Segments | Ruber Retainers | Accessory Weights | Wall Thickness |      |      |      |      |      |
|------|-------------|-----------------|-------------------|--------------|------------------|-----------------|-------------------|----------------|------|------|------|------|------|
| DN   | DE          | A               | A                 | B            | Number           | Number          | *                 | K7             | K8   | K9   | K10  | K11  | K12  |
| 100* | 118         | 177             | 177               | 80           | —                | —               | —                 | —              | —    | 6,1  | 6,1  | 6,6  | 7,2  |
| 150* | 170         | 232             | 233               | 88           | —                | —               | —                 | —              | —    | 6,3  | 6,5  | 7,2  | 7,8  |
| 200* | 222         | 291             | 293               | 94           | —                | —               | —                 | —              | —    | 6,4  | 7,0  | 7,7  | 8,4  |
| 250* | 274         | 351             | 351               | 95           | —                | —               | —                 | —              | —    | 6,8  | 7,5  | 8,3  | 9,0  |
| 300* | 326         | 408             | 408               | 95           | —                | —               | —                 | —              | —    | 7,2  | 8,0  | 8,8  | 9,6  |
| 400  | 429         | 513             | 513               | 202          | 4                | 2               | 6,4               | —              | —    | 8,1  | 9,0  | 9,9  | 10,8 |
| 450* | 480         | 569             | 582               | 208          | 4                | 2               | 7,7               | —              | —    | 8,6  | 9,5  | 10,5 | 11,4 |
| 500  | 532         | 625             | 637               | 213          | 4                | 2               | 9,1               | —              | 8,0  | 9,0  | 10,0 | 11,0 | 12,0 |
| 600  | 635         | 748             | 738               | 225          | 8                | 4               | 14,5              | —              | 8,8  | 9,9  | 11,0 | 12,1 | 13,2 |
| 700  | 738         | 845             | 860               | 256          | 8                | 4               | 22,7              | 8,4            | 9,6  | 10,8 | 12,0 | 13,2 | 14,4 |
| 800  | 842         | 953             | 974               | 261          | 8                | 4               | 22,7              | 9,1            | 10,4 | 11,7 | 13,0 | 14,3 | 15,6 |
| 900  | 945         | 1073            | 1086              | 276          | 8                | 4               | 30,8              | 9,8            | 11,2 | 12,6 | 14,0 | 15,4 | 16,8 |

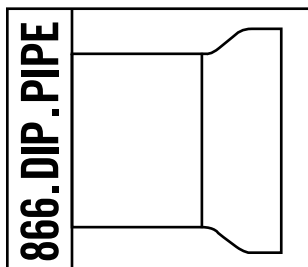
Dimensions in millimeters

Masses in kilograms

NOTE: DN 100 - 900 mm 5,43 METERS IN LENGTH

\*Contact your Sales Representative for availability.

\*Accessory weights include segments, gaskets, and rubber retainers TR FLEX® is a Registered Trademark of United States Pipe and Foundry Company, LLC.



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# RESTRAINED JOINT DUCTILE IRON PIPE AND FITTINGS

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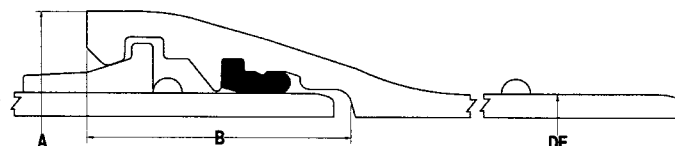
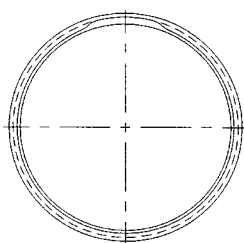


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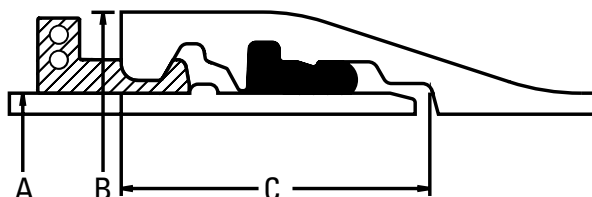
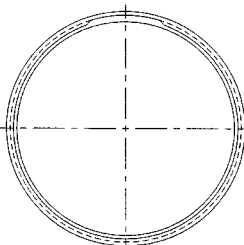
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## Restrained Push On Joint Pipe and Fittings

DN 1000 - 1200 mm



DN 1400 - 1600 mm  
HP LOK® Assembly Cross Section



| Size   | O.D. Barrel | O. D. Bell Pipe | O.D. Bell Fitting | Socket Depth | Locking Segments | Ruber Retainers | Accessory Weights | Wall Thickness |      |      |      |      |      |
|--------|-------------|-----------------|-------------------|--------------|------------------|-----------------|-------------------|----------------|------|------|------|------|------|
| DN     | DE          | A               | A                 | B            | Number           | Number          | *                 | K7             | K8   | K9   | K10  | K11  | K12  |
| 1000   | 1048        | 1170            | 1179              | 193          | 11               | 1               | 39,5              | 10,5           | 12,0 | 13,5 | 15,0 | 16,5 | 18,0 |
| 1200   | 1255        | 1385            | 1382              | 207          | 11               | 1               | 60,3              | 11,9           | 13,6 | 15,3 | 17,0 | 18,7 | 20,4 |
| 1400** | 1462        | 1610            | 1661              | 256          | —                | —               | —                 | 13,3           | 15,2 | 17,1 | 19,0 | 20,9 | 22,8 |
| 1500** | 1565        | 1726            | 1669              | 256          | —                | —               | —                 | 14,0           | 16,0 | 18,0 | 20,0 | 22,0 | 24,0 |
| 1600** | 1668        | 821             | 1877              | 256          | —                | —               | —                 | 14,7           | 16,8 | 18,9 | 21,0 |      | 25,2 |

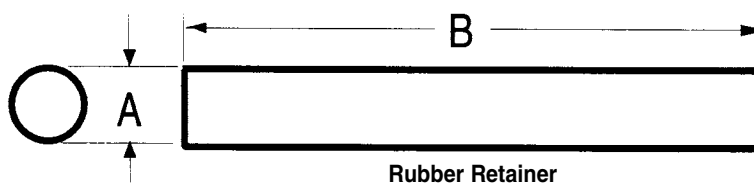
Dimensions in millimeters

Masses in kilograms

NOTE: DN 1000 - 1600 mm 6,0 METERS NOMINAL LENGTH

\* Accessory weights include segments, gaskets, and rubber retainers

\*\* HP LOK - 24 Bar only

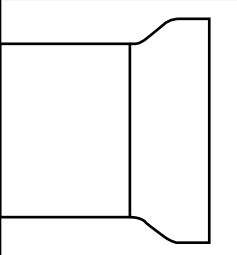


| Size DN          | 400 | 450 | 500 | 600 | 700 | 800 | 900 | 1 000 | 1 200 |
|------------------|-----|-----|-----|-----|-----|-----|-----|-------|-------|
| (A) Diameter     | 25  | 25  | 25  | 25  | 32  | 32  | 32  | 32    | 32    |
| (B) Length       | 216 | 241 | 267 | 184 | 241 | 241 | 267 | 343   | 400   |
| Number Per Joint | 2   | 2   | 2   | 4   | 4   | 4   | 4   | 1     | 1     |

Dimensions in millimeters

Masses in kilograms

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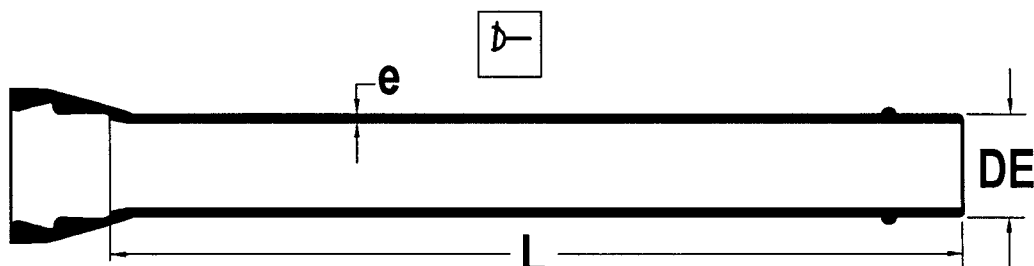
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## Restrained Push On Joint Pipe and Fittings

### Dimensions and Masses K7 - K8



**K7**

| Nominal Diameter<br>DN | Barrel |      |                  | Socket Mass | Total mass approximate for<br>one working length "L" of |             |
|------------------------|--------|------|------------------|-------------|---------------------------------------------------------|-------------|
|                        | DE     | e    | Masses per Meter |             | 5,43 Meters                                             | 5,93 Meters |
| 600                    | 635    | 7,7  | 107,0            | 95,3        | 680                                                     | —           |
| 700                    | 738    | 8,4  | 135,7            | 133,4       | 875                                                     | —           |
| 800                    | 842    | 9,1  | 167,9            | 164,7       | 1084                                                    | —           |
| 900                    | 945    | 9,8  | 203,0            | 221,4       | 1331                                                    | —           |
| 1000                   | 1048   | 10,5 | 241,3            | 146,1       | 1467                                                    | —           |
| 1200                   | 1255   | 11,9 | 327,6            | 203,2       | —                                                       | 2193        |
| 1400                   | 1462   | 13,3 | 426,8            | 430,9       | —                                                       | 3019        |
| 1500                   | 1565   | 14,0 | 480,9            | 494,4       | —                                                       | 3411        |
| 1600                   | 1668   | 14,7 | 538,3            | 575,6       | —                                                       | 3840        |

*Dimensions in millimeters*  
*Masses in kilograms*

**K8**

| Nominal Diameter<br>DN | Barrel |      |                  | Socket Mass | Total mass approximate for<br>one working length "L" of |             |
|------------------------|--------|------|------------------|-------------|---------------------------------------------------------|-------------|
|                        | DE     | e    | Masses per Meter |             | 5,43 Meters                                             | 5,93 Meters |
| 600                    | 635    | 8,8  | 122,1            | 95,3        | 762                                                     | —           |
| 700                    | 738    | 9,6  | 154,9            | 133,4       | 980                                                     | —           |
| 800                    | 842    | 10,4 | 191,6            | 164,7       | 1213                                                    | —           |
| 900                    | 945    | 11,2 | 231,6            | 221,4       | 1488                                                    | —           |
| 1000                   | 1048   | 12,0 | 275,3            | 146,1       | 1654                                                    | —           |
| 1200                   | 1255   | 13,6 | 373,9            | 203,2       | —                                                       | 2474        |
| 1400                   | 1462   | 15,2 | 487,1            | 430,9       | —                                                       | 3386        |
| 1500                   | 1565   | 16,0 | 548,9            | 494,4       | —                                                       | 3824        |
| 1600                   | 1668   | 16,8 | 614,4            | 575,6       | —                                                       | 4302        |

*Dimensions in millimeters*  
*Masses in kilograms*  
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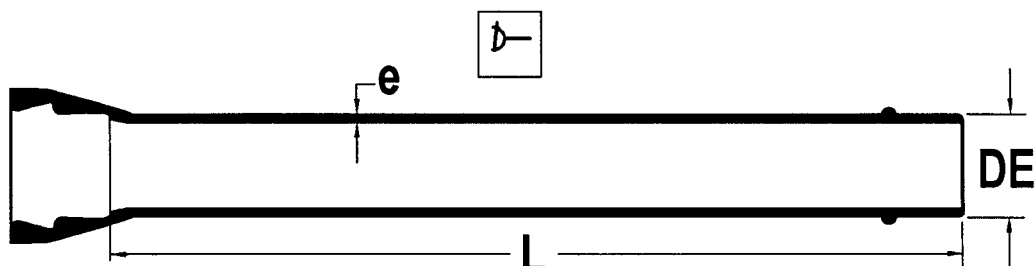
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## Restrained Push On Joint Pipe and Fittings Dimensions and Masses K9



K9

| Nominal Diameter<br>DN | Barrel |      |                  | Socket Mass | Total mass approximate for<br>one working length "L" of |             |
|------------------------|--------|------|------------------|-------------|---------------------------------------------------------|-------------|
|                        | DE     | e    | Masses per Meter |             | 5,43 Meters                                             | 5,93 Meters |
| 100*                   | 118    | 6,1  | 15,1             | 7,7         | 91                                                      | —           |
| 150*                   | 170    | 6,3  | 22,8             | 11,8        | 136                                                     | —           |
| 200*                   | 222    | 6,4  | 30,6             | 17,7        | 186                                                     | —           |
| 250*                   | 274    | 6,8  | 40,2             | 24,0        | 245                                                     | —           |
| 300*                   | 326    | 7,2  | 50,8             | 29,9        | 308                                                     | —           |
| 350*                   | 378    | 7,7  | 63,2             | 43,5        | 390                                                     | —           |
| 400                    | 429    | 8,1  | 75,5             | 49,0        | 463                                                     | —           |
| 450*                   | 480    | 8,6  | 89,8             | 56,2        | 547                                                     | —           |
| 500                    | 532    | 9,0  | 104,3            | 68,0        | 637                                                     | —           |
| 600                    | 635    | 9,9  | 137,1            | 95,3        | 846                                                     | —           |
| 700                    | 738    | 10,8 | 173,9            | 133,4       | 1084                                                    | —           |
| 800                    | 842    | 11,7 | 215,2            | 164,7       | 1343                                                    | —           |
| 900                    | 945    | 12,6 | 260,2            | 221,4       | 1644                                                    | —           |
| 1000                   | 1048   | 13,5 | 309,3            | 146,1       | 1838                                                    | —           |
| 1200                   | 1255   | 15,3 | 420,1            | 203,2       | —                                                       | 2753        |
| 1400                   | 1462   | 17,1 | 547,2            | 430,9       | —                                                       | 3751        |
| 1500                   | 1565   | 18,0 | 616,7            | 494,4       | —                                                       | 4234        |
| 1600                   | 1668   | 18,9 | 690,3            | 575,6       | —                                                       | 4763        |

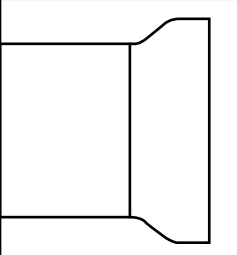
Dimensions in millimeters

Masses in kilograms

\*Anchor Gasket Restraint

\*\*Contact your Sales Representative for availability.

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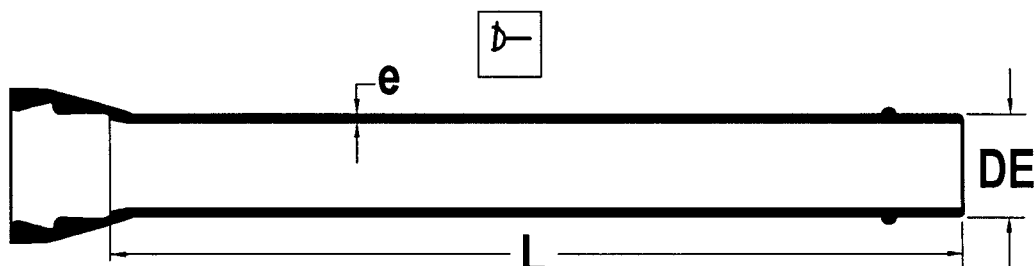
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## Restrained Push On Joint Pipe and Fittings

### Dimensions and Masses K10



**K10**

| Nominal Diameter<br>DN | Barrel |      |                  | Socket Mass | Total mass approximate for<br>one working length "L" of |             |
|------------------------|--------|------|------------------|-------------|---------------------------------------------------------|-------------|
|                        | DE     | e    | Masses per Meter |             | 5,43 Meters                                             | 5,93 Meters |
| 100*                   | 118    | 6,1  | 15,1             | 7,7         | 91                                                      | —           |
| 150*                   | 170    | 6,5  | 23,5             | 11,8        | 141                                                     | —           |
| 200*                   | 222    | 7,0  | 33,3             | 17,7        | 200                                                     | —           |
| 250*                   | 274    | 7,5  | 44,3             | 24,0        | 265                                                     | —           |
| 300*                   | 326    | 8,0  | 56,3             | 29,9        | 338                                                     | —           |
| 350**                  | 378    | 8,5  | 69,6             | 43,5        | 424                                                     | —           |
| 400                    | 429    | 9,0  | 83,7             | 49,0        | 508                                                     | —           |
| 450**                  | 480    | 9,5  | 99,0             | 56,2        | 599                                                     | —           |
| 500                    | 532    | 10,0 | 115,6            | 68,0        | 701                                                     | —           |
| 600                    | 635    | 11,0 | 152,0            | 95,3        | 928                                                     | —           |
| 700                    | 738    | 12,0 | 193,0            | 133,4       | 1188                                                    | —           |
| 800                    | 842    | 13,0 | 238,7            | 164,7       | 1470                                                    | —           |
| 900                    | 945    | 14,0 | 288,7            | 221,4       | 1801                                                    | —           |
| 1000                   | 1048   | 15,0 | 343,2            | 146,1       | 2023                                                    | —           |
| 1200                   | 1255   | 17,0 | 466,1            | 203,2       | —                                                       | 3035        |
| 1400                   | 1462   | 19,0 | 607,2            | 430,9       | —                                                       | 4114        |
| 1500                   | 1565   | 20,0 | 684,4            | 494,4       | —                                                       | 4645        |
| 1600                   | 1668   | 21,0 | 766,0            | 575,6       | —                                                       | 5223        |

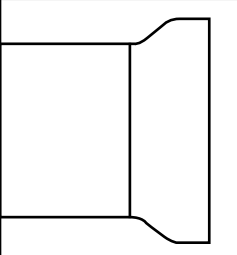
*Dimensions in millimeters*

*Masses in kilograms*

*\*Anchor Gasket Restraint*

*\*\*Contact your Sales Representative for availability.*

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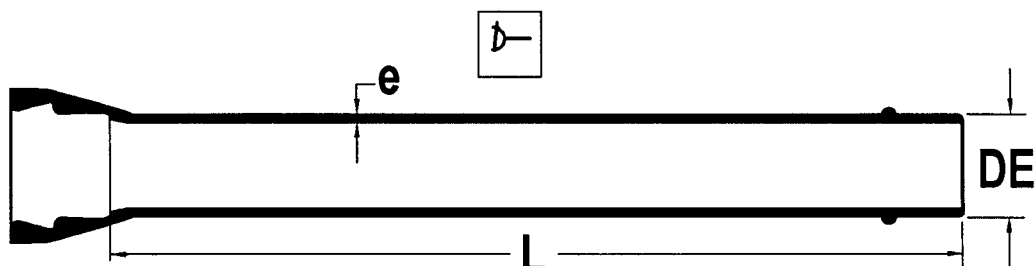
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## Restrained Push On Joint Pipe and Fittings

### Dimensions and Masses K11



K11

| Nominal Diameter<br>DN | Barrel |      |                  | Socket Mass | Total mass approximate for<br>one working length "L" of |             |
|------------------------|--------|------|------------------|-------------|---------------------------------------------------------|-------------|
|                        | DE     | e    | Masses per Meter |             | 5,43 Meters                                             | 5,93 Meters |
| 100*                   | 118    | 6,6  | 16,3             | 7,7         | 98                                                      | —           |
| 150*                   | 170    | 7,2  | 26,0             | 11,8        | 154                                                     | —           |
| 200*                   | 222    | 7,7  | 36,5             | 17,7        | 218                                                     | —           |
| 250*                   | 274    | 8,3  | 48,8             | 24,0        | 290                                                     | —           |
| 300*                   | 326    | 8,8  | 61,8             | 29,9        | 367                                                     | —           |
| 350**                  | 378    | 9,4  | 76,7             | 43,5        | 463                                                     | —           |
| 400                    | 429    | 9,9  | 91,9             | 49,0        | 551                                                     | —           |
| 450**                  | 480    | 10,5 | 109,2            | 56,2        | 653                                                     | —           |
| 500                    | 532    | 11,0 | 126,9            | 68,0        | 762                                                     | —           |
| 600                    | 635    | 12,1 | 166,9            | 95,3        | 1009                                                    | —           |
| 700                    | 738    | 13,2 | 211,9            | 133,4       | 1293                                                    | —           |
| 800                    | 842    | 14,3 | 262,2            | 164,7       | 1559                                                    | —           |
| 900                    | 945    | 15,4 | 317,1            | 221,4       | 1955                                                    | —           |
| 1000                   | 1048   | 16,5 | 377,0            | 146,1       | 2208                                                    | —           |
| 1200                   | 1255   | 18,7 | 512,0            | 203,2       | —                                                       | 3311        |
| 1400                   | 1462   | 20,9 | 667,1            | 430,9       | —                                                       | 4477        |
| 1500                   | 1565   | 22,0 | 751,9            | 494,4       | —                                                       | 5055        |
| 1600                   | 1668   | 23,1 | 841,6            | 575,6       | —                                                       | 5681        |

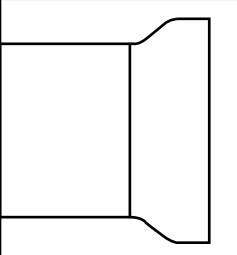
*Dimensions in millimeters*

*Masses in kilograms*

*\*Anchor Gasket Restraint*

*\*\*Contact your Sales Representative for availability.*

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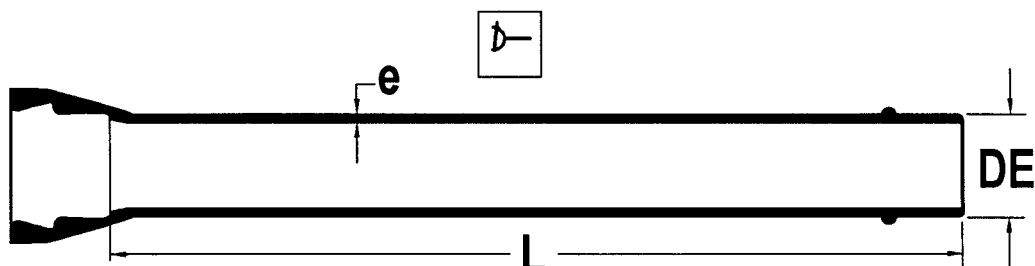
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## Restrained Push On Joint Ductile Iron Pipe: Dimensions and Masses K12



K12

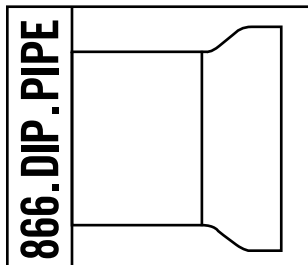
| Nominal Diameter<br>DN | Barrel |      |                  | Socket Mass | Total mass approximate for<br>one working length "L" of |             |
|------------------------|--------|------|------------------|-------------|---------------------------------------------------------|-------------|
|                        | DE     | e    | Masses per Meter |             | 5,43 Meters                                             | 5,93 Meters |
| 100*                   | 118    | 7,2  | 17,7             | 7,7         | 104                                                     | —           |
| 150*                   | 170    | 7,8  | 28,0             | 11,8        | 166                                                     | —           |
| 200*                   | 222    | 8,4  | 39,7             | 17,7        | 236                                                     | —           |
| 250*                   | 274    | 9,0  | 52,8             | 24,0        | 313                                                     | —           |
| 300*                   | 326    | 9,6  | 67,3             | 29,9        | 397                                                     | —           |
| 350**                  | 378    | 10,2 | 83,1             | 43,5        | 499                                                     | —           |
| 400                    | 429    | 10,8 | 100,0            | 49,0        | 596                                                     | —           |
| 450**                  | 480    | 11,4 | 118,3            | 56,2        | 703                                                     | —           |
| 500                    | 532    | 12,0 | 138,2            | 68,0        | 823                                                     | —           |
| 600                    | 635    | 13,2 | 181,8            | 95,3        | 1091                                                    | —           |
| 700                    | 738    | 14,4 | 230,8            | 133,4       | 1726                                                    | —           |
| 800                    | 842    | 15,6 | 285,5            | 164,7       | 2111                                                    | —           |
| 900                    | 945    | 16,8 | 345,4            | 221,4       | 2392                                                    | —           |
| 1000                   | 1048   | 18,0 | 410,6            | 146,1       | —                                                       | —           |
| 1200                   | 1255   | 20,4 | 557,8            | 203,2       | —                                                       | 3590        |
| 1400                   | 1462   | 22,8 | 726,8            | 430,9       | —                                                       | 4840        |
| 1500                   | 1565   | 24,0 | 819,1            | 494,4       | —                                                       | 5464        |
| 1600                   | 1668   | 25,2 | 916,9            | 575,6       | —                                                       | 6137        |

*Dimensions in millimeters*

*Masses in kilograms*

*\*Anchor Gasket Restraint*

*\*\*Contact your Sales Representative for availability.*



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# RESTRAINED JOINT DUCTILE IRON PIPE AND FITTINGS

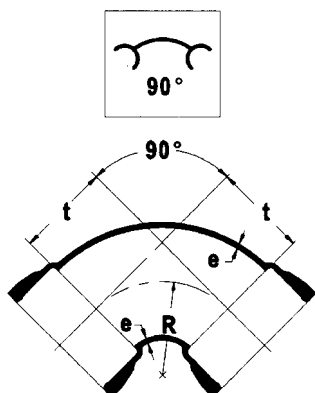
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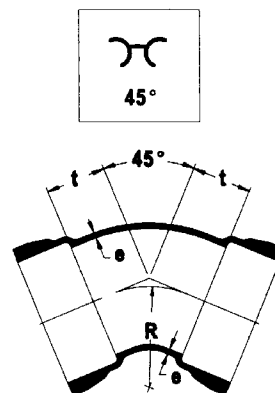
P 33

## Restrained Joint Pipe and Fittings - 90°, and 45° Bends



90° Bend

| Nominal Size DN | e    | t    | R   | Mass Approx |
|-----------------|------|------|-----|-------------|
| 100*            | 7,2  | 114  | 114 | 13,6        |
| 150*            | 7,8  | 152  | 152 | 24,9        |
| 200*            | 8,4  | 178  | 178 | 38,6        |
| 250*            | 9,0  | 229  | 229 | 56,7        |
| 300*            | 9,6  | 254  | 254 | 82          |
| 350***          | 10,2 | 356  | 292 | 141         |
| 400             | 10,8 | 381  | 318 | 159         |
| 450***          | 11,4 | 419  | 356 | 238         |
| 500             | 12,0 | 356  | 314 | 263         |
| 600             | 13,2 | 559  | 470 | 361         |
| 700*            | 14,4 | 640  | 572 | 601         |
| 800             | 15,6 | 739  | 671 | 798         |
| 900             | 16,8 | 660  | 610 | 964         |
| 1000            | 18,0 | 930  | 846 | 939         |
| 1200            | 20,4 | 864  | 711 | 1229        |
| 1400**          | 39,4 | 991  | 900 | 3238        |
| 1500**          | 38,1 | 1041 | 847 | 3539        |
| 1600**          | 38,1 | 1156 | 896 | 4111        |



45° Bend

| Nominal Size DN | e    | t   | R    | Mass Approx |
|-----------------|------|-----|------|-------------|
| 100*            | 7,2  | 51  | 122  | 13,6        |
| 150*            | 7,8  | 76  | 184  | 20,4        |
| 200*            | 8,4  | 89  | 214  | 34,0        |
| 250*            | 9,0  | 114 | 276  | 47,6        |
| 300*            | 9,6  | 140 | 337  | 73          |
| 350*            | 10,2 | 191 | 306  | 120         |
| 400             | 10,8 | 203 | 337  | 134         |
| 450*            | 11,4 | 216 | 368  | 206         |
| 500             | 12,0 | 241 | 429  | 247         |
| 600             | 13,2 | 279 | 356  | 290         |
| 700*            | 14,4 | 325 | 616  | 506         |
| 800             | 15,6 | 371 | 736  | 662         |
| 900             | 16,8 | 292 | 506  | 787         |
| 1000            | 18,0 | 460 | 930  | 685         |
| 1200            | 20,4 | 610 | 736  | 1093        |
| 1400**          | 39,4 | 521 | 1043 | 2438        |
| 1500**          | 38,1 | 546 | 1155 | 2675        |
| 1600**          | 38,1 | 572 | 1214 | 2949        |

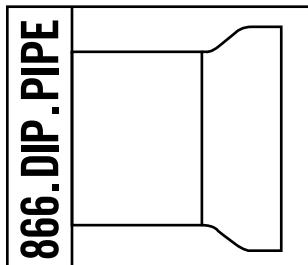
Dimensions in millimeters

Masses in kilograms

\*Anchor Gasket Restraint.

\*\*HP LOK® - 24 Bar only

\*\*\*Contact your Sales Representative for availability.



INTERNATIONAL

# RESTRAINED JOINT DUCTILE IRON PIPE AND FITTINGS

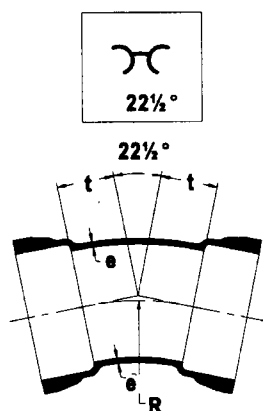
TR FLEX® - Anchor Gaskets - HP LOK®



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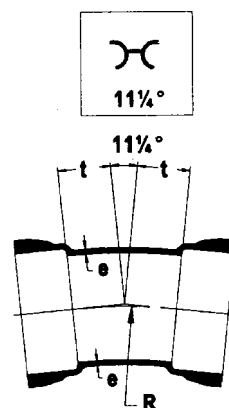
P 34

## Restrained Joint Pipe and Fittings - 22 1/2° and 11 1/4° Bends



22 1/2° Bend

| Nominal Size DN | e    | t   | R    | Mass Approx |
|-----------------|------|-----|------|-------------|
| 100*            | 7,2  | 51  | 256  | 13,6        |
| 150*            | 7,8  | 76  | 383  | 20,4        |
| 200*            | 8,4  | 89  | 448  | 34,0        |
| 250*            | 9,0  | 114 | 575  | 49,9        |
| 300*            | 9,6  | 140 | 702  | 75          |
| 350***          | 10,2 | 191 | 638  | 122         |
| 400             | 10,8 | 203 | 702  | 136         |
| 450***          | 11,4 | 216 | 767  | 206         |
| 500             | 12,0 | 241 | 894  | 249         |
| 600             | 13,2 | 279 | 367  | 293         |
| 700*            | 14,4 | 175 | 532  | 442         |
| 800             | 15,6 | 196 | 653  | 569         |
| 900             | 16,8 | 221 | 766  | 742         |
| 1000            | 18,0 | 241 | 826  | 519         |
| 1200            | 20,4 | 610 | 894  | 1109        |
| 1400**          | 39,4 | 356 | 823  | 2118        |
| 1500**          | 38,1 | 305 | 1001 | 2103        |
| 600**           | 38,1 | 279 | 1059 | 2202        |



11 1/4° Bend

| Nominal Size DN | e    | t   | R    | Mass Approx |
|-----------------|------|-----|------|-------------|
| 100*            | 7,2  | 51  | 516  | 13,6        |
| 150*            | 7,8  | 76  | 775  | 20,4        |
| 200*            | 8,4  | 89  | 902  | 34,0        |
| 250*            | 9,0  | 114 | 1161 | 49,9        |
| 300*            | 9,6  | 140 | 1418 | 75          |
| 350*            | 10,2 | 191 | 1289 | 122         |
| 400             | 10,8 | 203 | 1418 | 136         |
| 450*            | 11,4 | 216 | 1548 | 209         |
| 500             | 12,0 | 241 | 1805 | 249         |
| 600             | 13,2 | 279 | 355  | 293         |
| 700*            | 14,4 | 94  | 517  | 406         |
| 800             | 15,6 | 135 | 962  | 535         |
| 900             | 16,8 | 203 | 1547 | 671         |
| 1000            | 18,0 | 160 | 1163 | 454         |
| 1200            | 20,4 | 610 | 1805 | 1111        |
| 1400**          | 39,4 | 130 | 783  | 1553        |
| 1500**          | 38,1 | 216 | 1119 | 1877        |
| 1600**          | 38,1 | 178 | 1106 | 1926        |

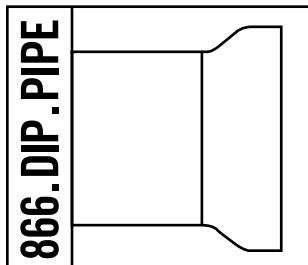
Dimensions in millimeters

Masses in kilograms

\*Anchor Gasket Restraint.

\*\*HP LOK® - 24 Bar only

\*\*\*Contact your Sales Representative for availability.



INTERNATIONAL

# RESTRAINED JOINT DUCTILE IRON PIPE AND FITTINGS

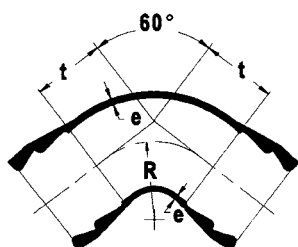
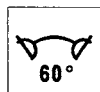
TR FLEX® - Anchor Gaskets - HP LOK®



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## Restrained Joint Pipe and Fittings - 60°, 30° and 55/8° Bends

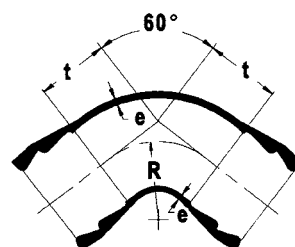


| Nominal Size DN | e    | t   | R   | Mass Approx. |
|-----------------|------|-----|-----|--------------|
| 1400*           | 39,4 | 610 | 876 | 2645         |

Dimensions in millimeters

Masses in kilograms

\* HP LOK® - 24 Bar only

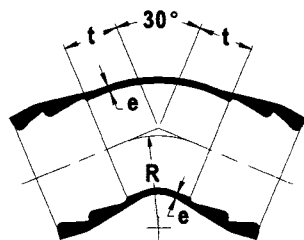
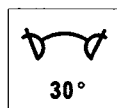


| Nominal Size DN | e    | t   | R    | Mass Approx. |
|-----------------|------|-----|------|--------------|
| 500             | 12,0 | 127 | 1463 | 218          |
| 600             | 13,2 | 152 | 1876 | 245          |
| 900             | 16,8 | 203 | 2327 | 730          |
| 1200            | 20,4 | 254 | 3102 | 703          |
| 1400*           | 39,4 | 279 | 4131 | 1931         |
| 1500*           | 38,1 | 216 | 2244 | 1878         |
| 1600*           | 38,1 | 178 | 2218 | 1926         |

Dimensions in millimeters

Masses in kilograms

\* HP LOK® - 24 Bar only

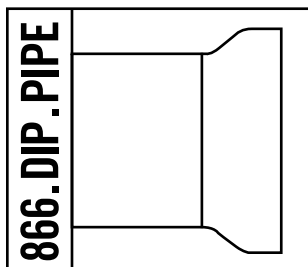


| Nominal Size DN | e    | t   | R    | Mass Approx. |
|-----------------|------|-----|------|--------------|
| 1400*           | 39,4 | 406 | 1130 | 2234         |
| 1500*           | 38,1 | 483 | 1407 | 2552         |
| 1600*           | 38,1 | 470 | 1497 | 2714         |

Dimensions in millimeters

Masses in kilograms

\*HP LOK® - 24 Bar only



INTERNATIONAL

# RESTRAINED JOINT DUCTILE IRON PIPE AND FITTINGS

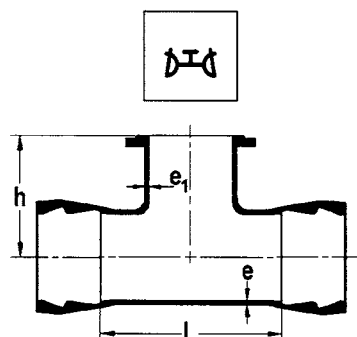
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2008 EDITION

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## Restrained Joint Pipe and Fittings – All Socket Tee



| DN x DN       | e    | L     | e <sub>1</sub> | h     | Mass  |
|---------------|------|-------|----------------|-------|-------|
| 100 x 100*    | 8.4  | 229.0 | 8.4            | 114.0 | 20.4  |
| 150 x 100*    | 9.1  | 305.0 | 8.4            | 152.0 | 34.0  |
| 150 x 150*    | 9.1  | 305.0 | 9.1            | 152.0 | 36.3  |
| 200 x 100*    | 9.8  | 356.0 | 8.4            | 178.0 | 49.9  |
| 200 x 150*    | 9.8  | 356.0 | 9.1            | 178.0 | 52.2  |
| 200 x 200*    | 9.8  | 356.0 | 9.8            | 178.0 | 56.7  |
| 250 x 100*    | 10.5 | 457.0 | 8.4            | 229.0 | 72.6  |
| 250 x 150*    | 10.5 | 457.0 | 9.1            | 229.0 | 74.8  |
| 250 x 200*    | 10.5 | 457.0 | 9.8            | 229.0 | 81.6  |
| 250 x 250*    | 10.5 | 457.0 | 10.5           | 229.0 | 86.2  |
| 300 x 150*    | 11.2 | 508.0 | 9.1            | 254.0 | 107.0 |
| 300 x 200*    | 11.2 | 508.0 | 9.8            | 254.0 | 111.0 |
| 300 x 250*    | 11.2 | 508.0 | 10.5           | 254.0 | 116.0 |
| 300 x 300*    | 11.2 | 508.0 | 11.2           | 254.0 | 125.0 |
| 350 x 150*    | 11.9 | 711.0 | 9.1            | 356.0 | 172.0 |
| 250 x 200*    | 11.9 | 711.0 | 9.8            | 356.0 | 179.0 |
| 350** x 250** | 11.9 | 711.0 | 10.5           | 356.0 | 186.0 |
| 350** x 300** | 11.9 | 711.0 | 11.2           | 356.0 | 197.0 |
| 350** x 350** | 11.9 | 711.0 | 11.9           | 356.0 | 213.0 |
| 400 x 150*    | 12.6 | 762.0 | 9.1            | 381.0 | 200.0 |
| 400 x 200*    | 12.6 | 762.0 | 9.8            | 381.0 | 204.0 |
| 400 x 250*    | 12.6 | 762.0 | 10.5           | 381.0 | 211.0 |
| 400 x 300*    | 12.6 | 762.0 | 11.2           | 381.0 | 222.0 |
| 400 x 350*    | 12.6 | 762.0 | 11.9           | 381.0 | 240.0 |
| 400 x 400*    | 12.6 | 762.0 | 12.6           | 381.0 | 243.0 |

| DN x DN     | e    | L     | e <sub>1</sub> | h     | Mass  |
|-------------|------|-------|----------------|-------|-------|
| 450 x 150*  | 13.3 | 660.0 | 9.1            | 394.0 | 261.0 |
| 450 x 200*  | 13.3 | 660.0 | 9.8            | 394.0 | 265.0 |
| 450 x 250*  | 13.3 | 660.0 | 10.5           | 394.0 | 272.0 |
| 450 x 300*  | 13.3 | 660.0 | 11.2           | 394.0 | 281.0 |
| 450 x 400   | 13.3 | 838.0 | 12.6           | 419.0 | 333.0 |
| 450 x 450** | 13.3 | 838.0 | 13.3           | 419.0 | 361.0 |
| 500 x 150*  | 14.0 | 559.0 | 9.1            | 406.0 | 286.0 |
| 500 x 200*  | 14.0 | 559.0 | 9.8            | 406.0 | 290.0 |
| 500 x 250*  | 14.0 | 559.0 | 10.5           | 406.0 | 297.0 |
| 500 x 300*  | 14.0 | 559.0 | 11.2           | 406.0 | 306.0 |
| 500 x 350*  | 14.0 | 711.0 | 11.9           | 432.0 | 352.0 |
| 500 x 400   | 14.0 | 914.0 | 12.6           | 457.0 | 392.0 |
| 500 x 450** | 14.0 | 914.0 | 13.3           | 457.0 | 424.0 |
| 500 x 500   | 14.0 | 914.0 | 14.0           | 457.0 | 435.0 |
| 600 x 150*  | 15.4 | 762.0 | 9.1            | 483.0 | 367.0 |
| 600 x 200*  | 15.4 | 762.0 | 9.8            | 483.0 | 374.0 |
| 600 x 250*  | 15.4 | 762.0 | 10.5           | 483.0 | 379.0 |
| 600 x 300*  | 15.4 | 762.0 | 11.2           | 483.0 | 390.0 |
| 600 x 350*  | 15.4 | 762.0 | 11.9           | 483.0 | 408.0 |
| 600 x 400   | 15.4 | 762.0 | 12.6           | 483.0 | 411.0 |
| 600 x 450** | 15.4 | 864.0 | 13.3           | 533.0 | 472.0 |
| 600 x 500   | 15.4 | 864.0 | 14.0           | 533.0 | 485.0 |

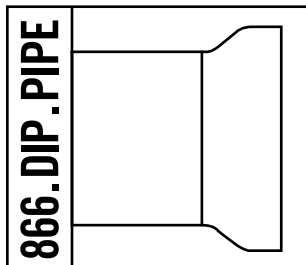
Dimensions in millimeters

Masses in kilograms

\*Anchor Gaskets are used for restraint

\*\*Contact your Sales Representative for availability

1400, 1500 and 1600 sizes are restrained by HP LOK®



INTERNATIONAL

# RESTRAINED JOINT DUCTILE IRON PIPE AND FITTINGS

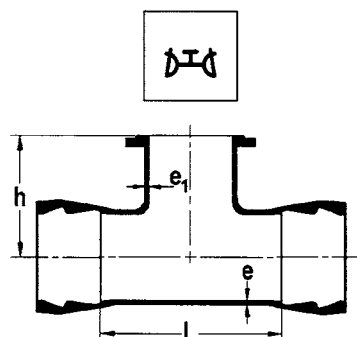
TR FLEX® - Anchor Gaskets - HP LOK®



2008 EDITION

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## Restrained Joint Pipe and Fittings – All Socket Tee (cont.)



| DN x dn     | e    | L      | e <sub>1</sub> | h     | Mass   |
|-------------|------|--------|----------------|-------|--------|
| 600 x 600   | 15.4 | 864.0  | 15.4           | 533.0 | 490.0  |
| 700 x 200*  | 16.8 | 424.0  | 9.8            | 495.0 | 492.0  |
| 700 x 400   | 19.6 | 630.0  | 12.6           | 495.0 | 581.0  |
| 700 x 700** | 16.8 | 996.0  | 16.8           | 500.0 | 805.0  |
| 800 x 200*  | 18.2 | 424.0  | 9.8            | 541.0 | 615.0  |
| 800 x 400   | 18.2 | 635.0  | 12.6           | 551.0 | 719.0  |
| 800 x 450** | 18.2 | 686.0  | 13.3           | 551.0 | 767.0  |
| 800 x 600   | 18.2 | 1044.0 | 15.4           | 526.0 | 896.0  |
| 800 x 700** | 18.2 | 1044.0 | 16.8           | 521.0 | 980.0  |
| 800 x 800   | 18.2 | 1100.0 | 18.2           | 551.0 | 1043.0 |
| 900 x 200*  | 19.6 | 889.0  | 9.8            | 660.0 | 971.0  |
| 900 x 250*  | 19.6 | 889.0  | 10.5           | 660.0 | 975.0  |
| 900 x 300*  | 19.6 | 889.0  | 11.2           | 660.0 | 987.0  |
| 900 x 350*  | 19.6 | 889.0  | 11.9           | 660.0 | 1002.0 |
| 900 x 400   | 19.6 | 889.0  | 12.6           | 660.0 | 1005.0 |
| 900 x 450** | 19.6 | 889.0  | 13.3           | 660.0 | 1034.0 |
| 900 x 500   | 19.6 | 889.0  | 14.0           | 660.0 | 1048.0 |
| 900 x 600   | 19.6 | 889.0  | 15.4           | 660.0 | 1052.0 |
| 900 x 900   | 19.6 | 1422.0 | 19.6           | 711.0 | 1479.0 |
| 1000 x 200* | 21.0 | 450.0  | 9.8            | 650.0 | 553.0  |
| 1000 x 400  | 21.0 | 645.0  | 12.6           | 594.0 | 761.0  |
| 1000 x 500  | 21.0 | 780.0  | 14.0           | 650.0 | 782.0  |
| 1000 x 600  | 21.0 | 1306.0 | 15.4           | 625.0 | 1030.0 |
| 1000 x 800  | 21.0 | 1105.0 | 18.2           | 645.0 | 1066.0 |
| 1000 x 900  | 21.0 | 1306.0 | 19.6           | 655.0 | 1227.0 |
| 1000 x 1000 | 21.0 | 1316.0 | 21.0           | 655.0 | 1077.0 |

| DN x dn      | e    | L      | e <sub>1</sub> | h      | Mass   |
|--------------|------|--------|----------------|--------|--------|
| 1200 x 300*  | 23.8 | 1321.0 | 11.2           | 864.0  | 1331.0 |
| 1200 x 350*  | 23.8 | 1321.0 | 11.9           | 864.0  | 1347.0 |
| 1200 x 400   | 23.8 | 1321.0 | 12.6           | 864.0  | 1349.0 |
| 1200 x 450** | 23.8 | 1321.0 | 13.3           | 864.0  | 1379.0 |
| 1200 x 500   | 23.8 | 1321.0 | 14.0           | 864.0  | 1393.0 |
| 1200 x 600   | 23.8 | 1321.0 | 15.4           | 864.0  | 1395.0 |
| 1200 x 800   | 23.8 | 1486.0 | 18.2           | 754.0  | 1583.0 |
| 1200 x 900   | 23.8 | 1727.0 | 19.6           | 864.0  | 1864.0 |
| 1200 x 1000  | 23.8 | 1544.0 | 21.0           | 655.0  | 1495.0 |
| 1200 x 1200  | 23.8 | 1727.0 | 23.8           | 864.0  | 1746.0 |
| 1400 x 600   | 26.6 | 965.0  | 15.4           | 991.0  | 1780.0 |
| 1400 x 900   | 26.6 | 1575.0 | 19.6           | 940.0  | 2481.0 |
| 1400 x 1200  | 26.6 | 1575.0 | 23.8           | 991.0  | 2420.0 |
| 1400 x 1400  | 26.6 | 1816.0 | 26.6           | 909.0  | 2724.0 |
| 1500 x 900   | 28.0 | 1575.0 | 19.6           | 1067.0 | 2558.0 |
| 1500 x 1200  | 28.0 | 2083.0 | 23.8           | 1092.0 | 2980.0 |
| 1500 x 1400  | 28.0 | 2083.0 | 26.6           | 1092.0 | 3205.0 |
| 1500 x 1500  | 28.0 | 2083.0 | 28.0           | 1041.0 | 3062.0 |
| 1600 x 900   | 29.4 | 1499.0 | 19.6           | 1118.0 | 2769.0 |
| 1600 x 1200  | 29.4 | 2311.0 | 23.8           | 1143.0 | 3570.0 |
| 1600 x 1400  | 29.4 | 2311.0 | 26.6           | 1168.0 | 3817.0 |
| 1600 x 1500  | 29.4 | 2311.0 | 28.0           | 1118.0 | 3731.0 |
| 1600 x 1600  | 29.4 | 2311.0 | 29.4           | 1156.0 | 3765.0 |

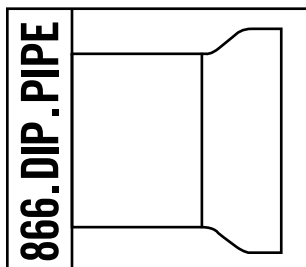
Dimensions in millimeters

Masses in kilograms

\*Anchor Gaskets are used for restraint

\*\*Contact your Sales Representative for availability

1400, 1500 and 1600 sizes are restrained by HP LOK®



INTERNATIONAL

# RESTRAINED JOINT DUCTILE IRON PIPE AND FITTINGS

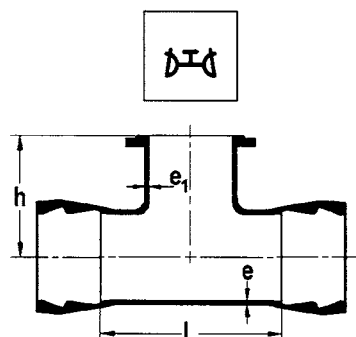
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## Restrained Joint Pipe and Fittings - Double Socket Body Tees with Flanged Branch



| DN x DN       | e    | L     | e <sub>1</sub> | h     | Mass  |       |      |
|---------------|------|-------|----------------|-------|-------|-------|------|
|               |      |       |                |       | PN10  | PN16  | PN25 |
| 100 x 100*    | 8.4  | 229.0 | 8.4            | 192.0 | 20.4  | 20.4  | 20.4 |
| 150 x 100*    | 9.1  | 305.0 | 8.4            | 230.0 | 34.0  | 34.0  | 34.0 |
| 150 x 150*    | 9.1  | 305.0 | 9.1            | 224.0 | 36.3  | 36.3  | 36.3 |
| 200 x 100*    | 9.8  | 356.0 | 8.4            | 256.0 | 49.9  | 49.9  | 49.9 |
| 200 x 150*    | 9.8  | 356.0 | 9.1            | 249.0 | 52.2  | 52.2  | 52.2 |
| 200 x 200*    | 9.8  | 365.0 | 9.8            | 254.0 | 54.4  | 54.4  | 54.4 |
| 250 x 100*    | 10.5 | 457.0 | 8.4            | 306.0 | 70.3  | 70.3  | 70.3 |
| 250 x 150*    | 10.5 | 457.0 | 9.1            | 300.0 | 74.8  | 74.8  | 74.8 |
| 250 x 200*    | 10.5 | 457.0 | 9.8            | 305.0 | 77.1  | 77.1  | 77.1 |
| 250 x 250*    | 10.5 | 457.0 | 10.5           | 290.0 | 79.4  | 79.4  | 83.9 |
| 300 x 100*    | 11.2 | 508.0 | 8.4            | 332.0 | 102.0 | 102.0 | 102  |
| 300 x 150*    | 11.2 | 508.0 | 9.1            | 325.0 | 104.0 | 104.0 | 104  |
| 300 x 200*    | 11.2 | 508.0 | 9.8            | 330.0 | 107.0 | 107.0 | 109  |
| 300 x 250*    | 11.2 | 508.0 | 10.5           | 315.0 | 111.0 | 111.0 | 113  |
| 300 x 300*    | 11.2 | 508.0 | 11.2           | 310.0 | 113.0 | 113.0 | 118  |
| 350** x 150** | 11.9 | 711.0 | 9.1            | 375.0 | 170.0 | 170.0 | 172  |
| 350** x 200** | 11.9 | 711.0 | 9.8            | 375.0 | 175.0 | 175.0 | 175  |
| 350** x 250** | 11.9 | 711.0 | 10.5           | 375.0 | 177.0 | 177.0 | 181  |
| 350** x 300** | 11.9 | 711.0 | 11.2           | 419.0 | 186.0 | 186.0 | 191  |
| 350** x 350** | 11.9 | 711.0 | 11.9           | 445.0 | 191.0 | 193.0 | 200  |
| 400 x 150     | 12.6 | 762.0 | 9.1            | 400.0 | 195.0 | 195.0 | 197  |
| 400 x 200*    | 12.6 | 762.0 | 9.8            | 400.0 | 200.0 | 200.0 | 200  |
| 400 x 250*    | 12.6 | 762.0 | 10.5           | 400.0 | 202.0 | 202.0 | 206  |
| 400 x 300*    | 12.6 | 762.0 | 11.2           | 445.0 | 211.0 | 211.0 | 215  |
| 400 x 350*    | 12.6 | 762.0 | 11.9           | 470.0 | 218.0 | 220.0 | 227  |
| 400 x 400*    | 12.6 | 762.0 | 12.6           | 474.0 | 222.0 | 227.0 | 236  |

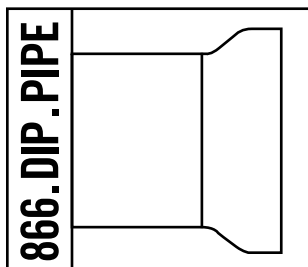
| DN x DN      | e    | L     | e <sub>1</sub> | h     | Mass  |       |      |
|--------------|------|-------|----------------|-------|-------|-------|------|
|              |      |       |                |       | PN10  | PN16  | PN25 |
| 450** x 150* | 13.3 | 660.0 | 9.1            | 413.0 | 256.0 | 256.0 | 259  |
| 450** x 200* | 13.3 | 660.0 | 9.8            | 413.0 | 261.0 | 261.0 | 261  |
| 450** x 250* | 13.3 | 660.0 | 10.5           | 413.0 | 263.0 | 263.0 | 268  |
| 450** x 300* | 13.3 | 660.0 | 11.2           | 413.0 | 268.0 | 268.0 | 272  |
| 450** x 350* | 13.3 | 838.0 | 11.9           | 445.0 | 299.0 | 302.0 | 308  |
| 450** x 400  | 13.3 | 838.0 | 12.6           | 445.0 | 304.0 | 308.0 | 318  |
| 450** x 450  | 13.3 | 838.0 | 13.3           | 445.0 | 304.0 | 311.0 | 322  |
| 500 x 150*   | 14.0 | 559.0 | 9.1            | 451.0 | 283.0 | 283.0 | 283  |
| 500 x 200*   | 14.0 | 559.0 | 9.8            | 451.0 | 286.0 | 286.0 | 288  |
| 500 x 250*   | 14.0 | 559.0 | 10.5           | 451.0 | 290.0 | 290.0 | 293  |
| 500 x 300*   | 14.0 | 559.0 | 11.2           | 495.0 | 297.0 | 297.0 | 302  |
| 500 x 350*   | 14.0 | 711.0 | 11.9           | 521.0 | 329.0 | 331.0 | 338  |
| 500 x 400    | 14.0 | 914.0 | 12.6           | 483.0 | 363.0 | 363.0 | 379  |
| 500 x 450    | 14.0 | 914.0 | 13.3           | 483.0 | 367.0 | 374.0 | 383  |
| 500 x 500    | 14.0 | 914.0 | 14.0           | 489.0 | 370.0 | 383.0 | 392  |
| 600 x 150*   | 15.4 | 762.0 | 9.1            | 502.0 | 365.0 | 365.0 | 365  |
| 600 x 200*   | 15.4 | 762.0 | 9.8            | 502.0 | 367.0 | 367.0 | 370  |
| 600 x 250*   | 15.4 | 762.0 | 10.5           | 502.0 | 370.0 | 370.0 | 374  |
| 600 x 300*   | 15.4 | 762.0 | 11.2           | 546.0 | 379.0 | 376.0 | 383  |
| 600** x 350* | 15.4 | 762.0 | 11.9           | 572.0 | 383.0 | 386.0 | 392  |
| 600 x 400    | 15.4 | 762.0 | 12.6           | 575.0 | 390.0 | 395.0 | 404  |
| 600** x 450  | 15.4 | 864.0 | 13.3           | 584.0 | 417.0 | 424.0 | 435  |
| 600 x 500    | 15.4 | 864.0 | 14.0           | 591.0 | 424.0 | 438.0 | 447  |

Dimensions in millimeters

Masses in kilograms

\*Anchor Gaskets are used for restraint

\*\*Contact your Sales Representative for availability.



INTERNATIONAL

# RESTRAINED JOINT DUCTILE IRON PIPE AND FITTINGS

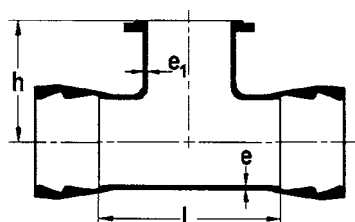
TR FLEX® - Anchor Gaskets - HP LOK®



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## Restrained Joint Pipe and Fittings - Double Socket Body Tees with Flanged Branch



| DN x DN     | e    | L      | e <sub>1</sub> | h     | Mass   |        |      |
|-------------|------|--------|----------------|-------|--------|--------|------|
|             |      |        |                |       | PN10   | PN16   | PN25 |
| 600 x 600   | 15.4 | 864.0  | 15.4           | 574.0 | 431.0  | 454.0  | 465  |
| 700 x 200*  | 16.8 | 424.0  | 9.8            | 617.0 | 490.0  | 490.0  | 492  |
| 700 x 400   | 16.8 | 630.0  | 12.6           | 638.0 | 565.0  | 569.0  | 581  |
| 700 x 700   | 16.8 | 996.0  | 16.8           | 657.0 | 705.0  | 717.0  | 746  |
| 800 x 200*  | 18.2 | 242.0  | 9.8            | 686.0 | 615.0  | 615.0  | 717  |
| 800 x 400   | 18.2 | 635.0  | 12.6           | 689.0 | 703.0  | 708.0  | 719  |
| 800 x 450   | 18.2 | 686.0  | 13.3           | 690.0 | 723.0  | 733.0  | 742  |
| 800 x 600   | 18.2 | 1044.0 | 15.4           | 664.0 | 860.0  | 882.0  | 891  |
| 800 x 700   | 18.2 | 1044.0 | 16.8           | 678.0 | 878.0  | 891.0  | 921  |
| 800 x 800   | 18.2 | 1100.0 | 18.2           | 709.0 | 919.0  | 932.0  | 975  |
| 900 x 200*  | 19.6 | 889.0  | 9.8            | 679.0 | 964.0  | 964.0  | 966  |
| 900 x 250*  | 19.6 | 889.0  | 10.5           | 679.0 | 968.0  | 968.0  | 971  |
| 900 x 300*  | 19.6 | 889.0  | 11.2           | 679.0 | 971.0  | 971.0  | 975  |
| 900 x 350*  | 19.6 | 889.0  | 11.9           | 686.0 | 973.0  | 975.0  | 982  |
| 900 x 400   | 19.6 | 889.0  | 12.6           | 686.0 | 975.0  | 980.0  | 991  |
| 900 x 450   | 19.6 | 889.0  | 13.3           | 686.0 | 977.0  | 987.0  | 996  |
| 900 x 500   | 19.6 | 889.0  | 14.0           | 692.0 | 982.0  | 996.0  | 1005 |
| 900 x 600   | 19.6 | 889.0  | 15.4           | 676.0 | 989.0  | 1012.0 | 1023 |
| 900 x 900   | 19.6 | 1422.0 | 19.6           | 743.0 | 1259.0 | 1277.0 | 1329 |
| 1000 x 200* | 21.0 | 450.0  | 9.8            | 768.0 | 551.0  | 551.0  | 553  |
| 1000 x 400  | 21.0 | 645.0  | 12.6           | 735.0 | 655.0  | 660.0  | 669  |
| 1000 x 500  | 21.0 | 780.0  | 14.0           | 790.0 | 735.0  | 748.0  | 758  |
| 1000 x 600  | 21.0 | 1306.0 | 15.4           | 765.0 | 993.0  | 1016.0 | 1025 |
| 1000 x 800  | 21.0 | 1105.0 | 18.2           | 804.0 | 943.0  | 957.0  | 1000 |
| 1000 x 900  | 21.0 | 1306.0 | 19.6           | 825.0 | 1064.0 | 1080.0 | 1132 |
| 1000 x 1000 | 21.0 | 1316.0 | 21.0           | 829.0 | 1075.0 | 1109.0 | 1175 |

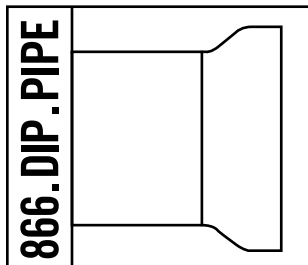
| DN x DN     | e    | L      | e <sub>1</sub> | h      | Mass   |        |      |
|-------------|------|--------|----------------|--------|--------|--------|------|
|             |      |        |                |        | PN10   | PN16   | PN25 |
| 1200 x 300* | 23.8 | 1321.0 | 11.2           | 883.0  | 1315.0 | 1315.0 | 1320 |
| 1200 x 350* | 23.8 | 1321.0 | 11.9           | 889.0  | 1318.0 | 1320.0 | 1327 |
| 1200 x 400  | 23.8 | 1321.0 | 12.6           | 889.0  | 1320.0 | 1324.0 | 1336 |
| 1200 x 450* | 23.8 | 1321.0 | 13.3           | 889.0  | 1322.0 | 1329.0 | 1340 |
| 1200 x 500  | 23.8 | 1321.0 | 14.0           | 895.0  | 1327.0 | 1340.0 | 1349 |
| 1200 x 600  | 23.8 | 1321.0 | 15.4           | 879.0  | 1331.0 | 1354.0 | 1365 |
| 1200 x 800  | 23.8 | 1486.0 | 18.2           | 915.0  | 1548.0 | 1474.0 | 1517 |
| 1200 x 900  | 23.8 | 1727.0 | 19.6           | 895.0  | 1644.0 | 1662.0 | 1712 |
| 1200 x 1000 | 23.8 | 1544.0 | 21.0           | 945.0  | 1549.0 | 1583.0 | 1649 |
| 1200 x 1200 | 23.8 | 1727.0 | 23.8           | 965.0  | 1721.0 | 1774.0 | 1851 |
| 1400 x 600  | 26.6 | 965.0  | 15.4           | 1006.0 | 1717.0 | 1742.0 | 1751 |
| 1400 x 900  | 26.6 | 1575.0 | 19.6           | 1035.0 | 2288.0 | 2304.0 | 2356 |
| 1400 x 1200 | 26.6 | 1575.0 | 23.8           | 1092.0 | 2393.0 | 2445.0 | 2522 |
| 1400 x 1400 | 26.6 | 1816.0 | 26.6           | 1137.0 | 2638.0 | 2688.0 | 2810 |
| 1500 x 900  | 28.0 | 1575.0 | 19.6           | 1067.0 | 2327.0 | 2343.0 | 2395 |
| 1500 x 1200 | 28.0 | 2083.0 | 23.8           | 1092.0 | 2887.0 | 2939.0 | 3016 |
| 1500 x 1400 | 28.0 | 2083.0 | 26.6           | 1092.0 | 2921.0 | 2973.0 | 3053 |
| 1500 x 1500 | 28.0 | 2083.0 | 28.0           | 1092.0 | 2896.0 | 2978.0 |      |
| 1600 x 900  | 29.4 | 1499.0 | 19.6           | 1118.0 | 2538.0 | 2556.0 | 2606 |
| 1600 x 1200 | 29.4 | 2311.0 | 23.8           | 1143.0 | 3479.0 | 3529.0 | 3608 |
| 1600 x 1400 | 29.4 | 2311.0 | 26.6           | 1219.0 | 3579.0 | 3629.0 | 3751 |
| 1600 x 1500 | 29.4 | 2311.0 | 28.0           | 1168.0 | 3565.0 | 3645.0 |      |
| 1600 x 1600 | 29.4 | 2311.0 | 29.4           | 1168.0 | 3540.0 | 3620.0 | 3758 |

Dimensions in millimeters

Masses in kilograms

\*Anchor Gaskets are used for restraint

1400, 1500 and 1600 sizes are restrained by HP LOK®



INTERNATIONAL

# RESTRAINED JOINT DUCTILE IRON PIPE AND FITTINGS

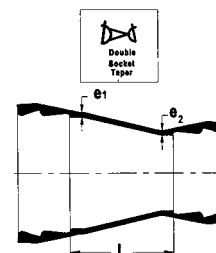
TR FLEX® - Anchor Gaskets - HP LOK®



2008 EDITION

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## Restrained Joint Pipe and Fittings - Double Socket Taper



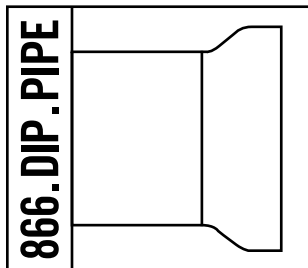
| Large Diameter  |                | Small Diameter  |                | L   | Mass Approx |
|-----------------|----------------|-----------------|----------------|-----|-------------|
| Nominal Size DN | e <sub>1</sub> | Nominal Size DN | e <sub>2</sub> |     |             |
| 150*            | 7,8            | 100*            | 7,2            | 127 | 15,9        |
| 200*            | 8,4            | 100*            | 7,2            | 178 | 24,9        |
| 200*            | 8,4            | 150*            | 7,8            | 178 | 27,2        |
| 250*            | 9,0            | 100*            | 7,2            | 203 | 31,8        |
| 250*            | 9,0            | 150*            | 7,8            | 203 | 36,3        |
| 250*            | 9,0            | 200*            | 8,4            | 203 | 40,8        |
| 300*            | 9,6            | 100*            | 7,2            | 254 | 45          |
| 300*            | 9,6            | 150*            | 7,8            | 254 | 48          |
| 300*            | 9,6            | 200*            | 8,4            | 254 | 54          |
| 300*            | 9,6            | 250*            | 9,0            | 254 | 61          |
| 350*            | 10,2           | 150*            | 7,8            | 406 | 77          |
| 350*            | 10,2           | 200*            | 8,4            | 406 | 84          |
| 350*            | 10,2           | 250*            | 9,0            | 406 | 93          |
| 350*            | 10,2           | 300*            | 9,6            | 406 | 104         |
| 400             | 10,8           | 150*            | 7,8            | 457 | 86          |
| 400             | 10,8           | 200*            | 8,4            | 457 | 95          |
| 400             | 10,8           | 250*            | 9,0            | 457 | 102         |
| 400             | 10,8           | 300*            | 9,6            | 457 | 116         |
| 400             | 10,8           | 350*            | 10,2           | 457 | 136         |
| 450*            | 11,4           | 200*            | 8,4            | 483 | 132         |
| 450*            | 11,4           | 250*            | 9,0            | 483 | 138         |
| 450*            | 11,4           | 300*            | 9,6            | 483 | 152         |
| 450*            | 11,4           | 350*            | 10,2           | 483 | 172         |
| 450*            | 11,4           | 400             | 10,8           | 483 | 179         |
| 500             | 12,0           | 250*            | 9,0            | 508 | 161         |
| 500             | 12,0           | 300*            | 9,6            | 508 | 172         |
| 500             | 12,0           | 350*            | 10,2           | 508 | 193         |
| 500             | 12,0           | 400             | 10,8           | 508 | 200         |
| 500             | 12,0           | 450*            | 11,4           | 508 | 236         |

| Large Diameter  |                | Small Diameter  |                | L   | Mass Approx |
|-----------------|----------------|-----------------|----------------|-----|-------------|
| Nominal Size DN | e <sub>1</sub> | Nominal Size DN | e <sub>2</sub> |     |             |
| 600             | 13,2           | 300*            | 9,6            | 610 | 202         |
| 600             | 13,2           | 350*            | 10,2           | 610 | 222         |
| 600             | 13,2           | 400             | 10,8           | 610 | 231         |
| 600             | 13,2           | 450*            | 11,4           | 610 | 268         |
| 600             | 13,2           | 500             | 12,0           | 610 | 286         |
| 700*            | 14,4           | 500             | 12,0           | 445 | 354         |
| 700*            | 14,4           | 600             | 13,2           | 295 | 336         |
| 800             | 15,6           | 600             | 13,2           | 470 | 433         |
| 800             | 15,6           | 700*            | 14,4           | 579 | 560         |
| 900             | 16,8           | 500             | 12,0           | 914 | 612         |
| 900             | 16,8           | 600             | 13,2           | 610 | 553         |
| 900             | 16,8           | 700*            | 14,4           | 480 | 615         |
| 900             | 16,8           | 800             | 15,6           | 310 | 621         |
| 1000            | 18,0           | 800             | 15,6           | 470 | 556         |
| 1000            | 18,0           | 900             | 16,8           | 574 | 671         |
| 1200            | 20,4           | 900             | 16,8           | 914 | 923         |
| 1200            | 20,4           | 1000            | 18,0           | 320 | 948         |
| 1400            | 39,4           | 600             | 22,6           | 965 | 1441        |
| 1400            | 39,4           | 900             | 29,2           | 711 | 1503        |
| 1400            | 39,4           | 1200            | 36,1           | 457 | 1606        |
| 1500            | 38,1           | 900             | 29,2           | 762 | 1605        |
| 1500            | 38,1           | 1200            | 36,1           | 457 | 1672        |
| 1500            | 38,1           | 1400            | 39,4           | 330 | 1693        |
| 1600            | 38,1           | 900             | 29,2           | 826 | 1754        |
| 1600            | 38,1           | 1200            | 36,1           | 572 | 1873        |
| 1600            | 38,1           | 1400            | 39,4           | 394 | 1848        |
| 1600            | 38,1           | 1500            | 38,1           | 318 | 1799        |

Dimensions in millimeters  
Masses in kilograms

\*Anchor Gaskets are used for Restraint.

\*\*Contact your Sales Representative for availability.



INTERNATIONAL

# RESTRAINED JOINT DUCTILE IRON PIPE AND FITTINGS

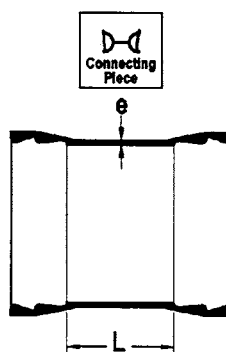
TR FLEX® - Anchor Gaskets - HP LOK®



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## Restrained Joint Pipe and Fittings - Connecting Piece



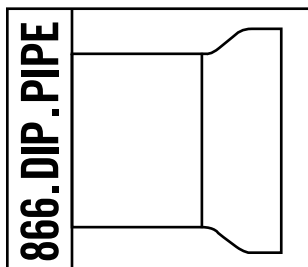
| Nominal Size DN | e    | L   | Mass Approx. |
|-----------------|------|-----|--------------|
| 100*            | —    | —   | —            |
| 150*            | —    | —   | —            |
| 200*            | —    | —   | —            |
| 250*            | —    | —   | —            |
| 300*            | —    | —   | —            |
| 350             | 10,2 | 203 | 107          |
| 400             | 10,8 | 203 | 116          |
| 450             | 11,4 | 105 | 168          |
| 500             | 12,0 | 110 | 197          |
| 600             | 13,2 | 121 | 211          |
| 700*            | —    | —   | —            |
| 800             | 15,6 | 150 | 503          |
| 900             | 16,8 | 203 | 658          |
| 1000*           | —    | —   | —            |
| 1200            | 20,4 | 196 | 524          |
| 1400*           | —    | —   | —            |
| 1500*           | —    | —   | —            |
| 1600*           | —    | —   | —            |

Dimensions in millimeters

Masses in kilograms

\*Anchor Gaskets are used for Restraint.

\*\*Contact your Sales Representative for availability.



INTERNATIONAL

# RESTRAINED JOINT DUCTILE IRON PIPE AND FITTINGS

TR FLEX® - Anchor Gaskets - HP LOK®



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## Restrained Joint Pipe and Fittings - Connecting Piece



| Nominal Size DN | e    | L   | Mass Approx. |
|-----------------|------|-----|--------------|
| 100*            | 8,4  | 133 | 6            |
| 150*            | 9,1  | 145 | 9            |
| 200*            | 9,9  | 160 | 16           |
| 250*            | 10,4 | 166 | 22           |
| 300*            | 11,2 | 174 | 33           |
| 350*            | 20,8 | 223 | 98           |
| 400             | 22,6 | 230 | 110          |
| 450*            | 24,4 | 237 | 164          |
| 500             | 26,2 | 245 | 154          |
| 600             | 29,5 | 260 | 227          |
| 700*            | 30,5 | 287 | 259          |
| 800             | 30,5 | 299 | 379          |
| 900             | 40,1 | 319 | 540          |
| 1000            | 45,2 | 240 | 567          |
| 1200            | 49,8 | 258 | 907          |
| 1400            | 56,6 | 278 | 1272         |
| 1500            | 63,5 | 320 | 1512         |
| 1600            | 69,9 | 340 | 1764         |

Dimensions in millimeters

Masses in kilograms

\*Anchor Gaskets are used for Restraint.

\*\*Contact your Sales Representative for availability.

Caps can be provided with bosses suitable for tapping.

1400, 1500 and 1600 sizes are restrained by HP LOK®

| Nominal Size DN | DE   | e    | L   | Mass Approx. |
|-----------------|------|------|-----|--------------|
| 100*            | 118  | 8,4  | 165 | 5            |
| 150*            | 170  | 9,1  | 178 | 7            |
| 200*            | 222  | 9,9  | 191 | 14           |
| 250*            | 274  | 10,4 | 203 | 21           |
| 300*            | 326  | 11,2 | 210 | 23           |
| 350*            | 378  | 11,9 | 260 | 30           |
| 400             | 429  | 12,7 | 260 | 41           |
| 450*            | 480  | 19,1 | 267 | 70           |
| 500             | 532  | 20,3 | 273 | 84           |
| 600             | 635  | 22,6 | 286 | 138          |
| 700*            | 738  | 26,2 | 343 | 262          |
| 800             | 842  | 26,2 | 343 | 286          |
| 900             | 945  | 29,2 | 368 | 357          |
| 1000            | 1048 | 32,5 | 330 | 544          |
| 1200            | 1255 | 36,1 | 356 | 794          |
| 1400            | 1462 | 39,4 | 394 | 850          |
| 1500            | 1565 | 44,5 | 406 | 1361         |
| 1600            | 1668 | 44,5 | 406 | 1497         |

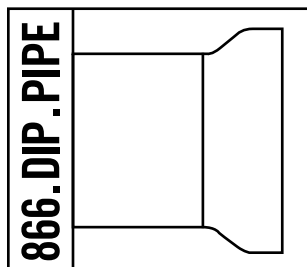
Dimensions in millimeters

Masses in kilograms

\*Anchor Gaskets are used for Restraint.

\*\*Contact your Sales Representative for availability.

Plugs can be provided with bosses suitable for tapping.



INTERNATIONAL

# RESTRAINED JOINT DUCTILE IRON PIPE AND FITTINGS

TR FLEX® - Anchor Gaskets - HP LOK®



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## Products for Water, Wastewater and Fire Protection

| Ductile Iron Pipe                                                                  | SIZE RANGE (inches)  | SIZE RANGE (metric) |
|------------------------------------------------------------------------------------|----------------------|---------------------|
| TYTON JOINT® Pipe                                                                  | 4"-64" Ductile Iron  | 100-1600            |
| Mechanical Joint Pipe                                                              | 4"-12" Ductile Iron  |                     |
| TR FLEX® Restrained Joint Pipe                                                     | 4"-64" Ductile Iron  | 400-1600            |
| HP LOK® Restrained Joint Pipe                                                      | 30"-64"              | 1400-1600           |
| Flanged Pipe                                                                       | 4"-64" Ductile Iron  | 100-1600            |
| USIFLEX® Boltless Flexible Joint Pipe —<br>for Subaqueous Installations            | 4"-48" Ductile Iron  |                     |
| <b>Restrained Joints</b>                                                           |                      |                     |
| TR FLEX® Restrained Joint Pipe                                                     | 4"-64" Ductile Iron  | 400-1600            |
| TYTON JOINT® Pipe with Anchor Gaskets                                              |                      | 100-300             |
| HP LOK® Restrained Joint                                                           | 30"-64"              | 1400-1600           |
| MJ FIELD LOK® Gaskets                                                              | 4"-24"               |                     |
| FIELD LOK 350® Gaskets                                                             | 4"-24"               |                     |
| FIELD LOK® Gaskets                                                                 | 30" & 36"            |                     |
| TR FLEX GRIPPER® Rings                                                             | 4"-36" Ductile Iron  |                     |
| TR TELE FLEX® Assemblies                                                           | 4"-24" Ductile Iron  |                     |
| <b>Ductile Iron Fittings</b>                                                       |                      |                     |
| TYTON® Fittings (Push-On)                                                          | 14"-64" Ductile Iron | 100-1600            |
| TRIM TYTON® Fittings                                                               | 4"-12" Ductile Iron  |                     |
| TR FLEX® Fittings and TR FLEX® Telescoping Sleeves                                 | 4"-64" Ductile Iron  | 400-1600            |
| Mechanical Joint Fittings                                                          | 3"-48" Ductile Iron  |                     |
| TRIM TYTE® MJ Fittings                                                             | 3"-48" Ductile Iron  |                     |
| Flanged Fittings                                                                   | 3"-64" Ductile Iron  | 100-1600            |
| XTRA FLEX® Couplings                                                               | 4"-24" Ductile Iron  |                     |
| HP LOK™ (350 psi)                                                                  |                      | 1400-1600           |
| <b>Miscellaneous Products</b>                                                      |                      |                     |
| PROTECTO 401™ Lined Ductile Iron Pipe for<br>Domestic Sewage and Industrial Wastes | 4"-64" Ductile Iron  | 100-1600            |
| RING FLANGE-TYTE™ Gaskets                                                          | 4"-36"               | 100-1600            |
| FULL FACE FLANGE-TYTE™ Gaskets                                                     | 4"-64"               | 1400-1600           |
| Saddle Outlets                                                                     | Various Ductile Iron |                     |
| Welded Outlets                                                                     | Various Ductile Iron |                     |
| Polyethylene Encasement                                                            | 4"-64"               | 100-1600            |
| Anchor Gaskets                                                                     |                      | 100-300             |

*Our products are manufactured in conformance with National and International Standards so that our customers may be assured of getting the performance and longevity they expect. Use of accessories or other appurtenances that do not comply with recognized standards may jeopardize the performance and longevity of the project.*

**INTERNATIONAL SALES OFFICE**

*All U.S. Pipe brochures and/or products are  
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