Pipe Fitters Handbook

April 2012

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ANVIL® INTERNATIONAL
Building Connections That Last

PIPE FITTINGS

HISTORY

For over 150 years, Anvil has been a trusted name in piping solutions by consistently providing quality products, service, and support to the PVF industry. Our ability to provide cost-efficient piping packages that are tailored to individual markets is unmatched in the industry. From plumbing, mechanical, and fire protection, to mining, oil and gas, our innovative responses are designed to meet your specific demands.

PRODUCTS

Our manufacturing facilities produce an unrivaled package of piping products, while setting a world-wide industry standard for quality and dependability. Our ISO certified facilities use recycled materials in the manufacturing of our product as well as being a proud member of the USGBC.

DISTRIBUTION CHANNEL

The wholesaler has always been the key to Anvil's business. Our dedication to the wholesale trade is the driving force for our services and these relationships remain a primary focus of Anvil's innovation. Our value-added services including a proprietary suite of inventory management tools signifies a strong commitment to our customers needs.

CUSTOMER SERVICE

Having major distribution centers located throughout North America, you can count on getting the product you need - when you need it. Customer satisfaction has always been Anvil's #1 objective. Our experienced Sales and Customer Service Teams are knowledgeable and eager to serve our customers, validating our company's motto "Building Connections that Last."

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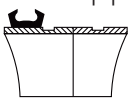
1. Check & Lubricate Gasket

Check gasket to be sure it is compatible for the intended service. Apply a thin coating of Gruvlok lubricant to outside and sealing lips of the gasket. Be careful that foreign particles do not adhere to lubricated surfaces.

2. Gasket Installation

Slip the gasket over the pipe end making sure the gasket lip does not overhang the pipe end.

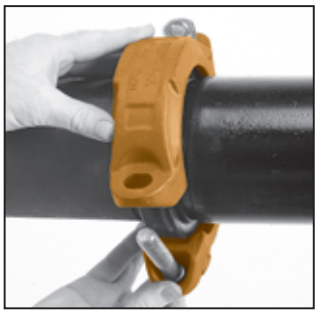
On couplings 10" and larger it may be easier to turn the gasket inside out then lubricate and slide the gasket over the pipe end as shown.



3. Alignment

After aligning the two pipe ends, pull the gasket into position centering it between the grooves on each pipe. Gasket should not extend into the groove on either pipe.

On couplings 10" and larger, flip or roll the gasket into centered position.



4. Housings

Place the coupling housing halves over the gasket making sure the housing keys engage the grooves. Insert bolts and turn nuts finger tight.

5. Tighten Nuts

Tighten the nuts alternately and equally to the specified bolt torque.* The housing bolt pads must make metal-to-metal contact.

CAUTION: Uneven tightening may cause the gasket to pinch.

6. Assembly is complete

Visually inspect the pipe joint to assure the coupling keys are fully engaged in the pipe grooves and the bolt pads are in firm even metal-to-metal contact on both sides of the coupling.

CAUTION: Proper torquing of coupling bolts is required to obtain specified performance. Over torquing the bolts may result in damage to the bolt and/or casting which could result in pipe joint separation. Under torquing the bolts may result in lower pressure retention capabilities, lower bend load capabilities, joint leakage and pipe joint separation. Pipe joint separation may result in significant property damage and serious injury.

CAUTION: Use of an impact wrench is not recommended because the torque output can vary significantly due to many variables including air pressure supply, battery strength and operational variations.

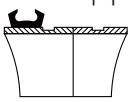
* Refer to page 26 with bolt torque table

GRUVLOK® INSTALLATION AND ASSEMBLY
Figures 7400 & 7401 Couplings

1. Check & Lubricate Gasket
Check gasket to be sure it is compatible for the intended service. Apply a thin coating of Gruvlok lubricant to outside and sealing lips of the gasket. Some applications require lubrication of the entire gasket surface. Be careful that foreign particles do not adhere to lubricated surfaces.

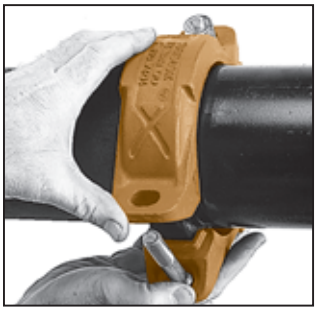
2. Gasket Installation
Slip the gasket over the pipe end making sure the gasket lip does not overhang the pipe end.

On couplings 10" and larger it may be easier to turn the gasket inside out then lubricate and slide the gasket over the pipe end as shown.



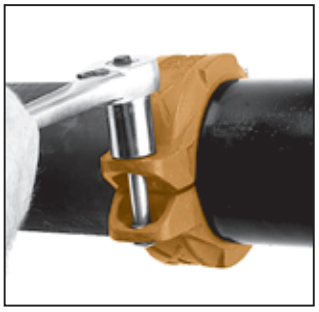
3. Alignment
After aligning the two pipe ends, pull the gasket into position centering it between the grooves on each pipe. Gasket should not extend into the groove on either pipe.

On couplings 10" and larger, flip or roll the gasket into centered position.



4. Housings
Remove one nut and bolt and loosen the other nut. Place one housing over the gasket, making sure the housing keys fit into the pipe grooves. Swing the other housing over the gasket and into the grooves on both pipes, making sure the tongue and recess of each housing is properly mated. Reinsert the bolt and run-up both nuts finger tight.

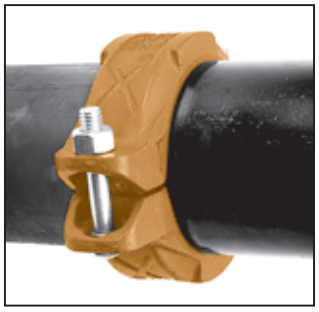
NOTE: Sizes 16" and larger are cast in multiple segments. To install the larger sizes align the tongue and pocket of the couplings appropriately and tighten the nuts alternately to the specified bolt torque. When properly assembled there will be a small equal gap between the adjacent bolt pads.



5. Tighten Nuts
Securely tighten nuts alternately and equally to the specified bolt torque*, keeping the gaps at the bolt pads evenly spaced.

CAUTION: Uneven tightening may cause the gasket to pinch. Gasket should not be visible between segments after bolts are tightened.

* Refer to page 26 with bolt torque table.



6. Assembly is complete
Visually inspect the pipe joint to assure the coupling keys are fully engaged in the pipe grooves. The bolt pads are to have equal gaps on each side of the coupling.

CAUTION: Use of an impact wrench is not recommended because the torque output can vary significantly due to many variables including air pressure supply, battery strength and operational variations.

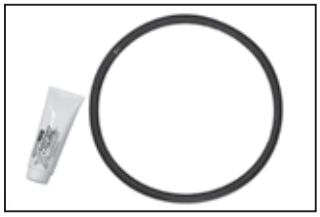
CAUTION: Proper torquing of coupling bolts is required to obtain specified performance. Over torquing the bolts may result in damage to the bolt and/or casting which could result in pipe joint separation. Under torquing the bolts may result in lower pressure retention capabilities, lower bend load capabilities, joint leakage and pipe joint separation. Pipe joint separation may result in significant property damage and serious injury.

GRUVLOK® INSTALLATION AND ASSEMBLY

Figures 7001-2 & 7401-2 Couplings

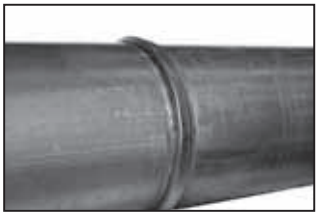
2-Piece Large Diameter Standard Groove Couplings

- 7001-2 & 7401-2 bolts must be lightly coated with Gruvlok Xtreme™ lube before installation. See chart for torque requirements.
- Minimum wall pipe suitable for 14" – 24": 7001-2 & 7401-2 roll grooved installation is 0.250" wall thickness.
- Pipe preparation Grooved dimensions must conform to the Gruvlok Roll/Cut groove specification.

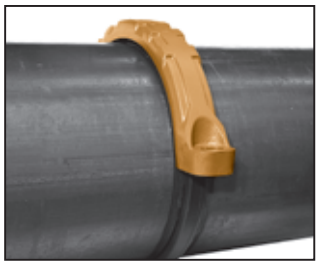


1. Check & Lubricate Gasket
Check gasket to be sure it is compatible for the intended service. Apply a thin coat of Gruvlok lubricant to outside and sealing lips of the gasket. Be careful that foreign particles do not adhere to lubricated surfaces.

2. Gasket Installation
Slip the gasket over the pipe end, making sure the gasket lip does not overhang the pipe end.



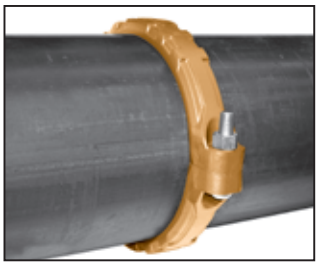
3. Alignment
After aligning the two pipe ends together, pull the gasket into position, centering it between the grooves on each pipe. Gasket should not extend into the groove on either pipe.



4. Housings
Place each housing half on the pipe and into each groove making sure that the gasket does not slip out of position in between the pipe ends or groove.

5. Bolts
Apply a thin coat of Xtreme lube, or Gruvlok Standard Lube to the bolt threads. Tighten the nuts alternately and equally to the specified bolt torque.

CAUTION: Uneven tightening may cause the gasket to pinch.



6. Final Assembly
Visually inspect the pipe joint to assure the coupling keys are fully engaged in the pipe grooves, the bolt pads are in firm even metal-to-metal contact on both sides of the coupling, and gasket is not visible.

ANSI SPECIFIED BOLT TORQUE			
Pipe Sizes	Bolt Size	Specified Bolt Torque	Lubrication
In.	*In.*	*Ft.-Lbs*	–
14	⅞	180 - 220	Gruvlok Xtreme™ Lubricant
16	1	250 - 300	
18	1	250 - 300	
20	1⅛	375 - 425	
24	1⅛	375 - 425	

CAUTION: When using an impact wrench, verify that the torque output on the wrench is within the required torque range.

GRUVLOK® INSTALLATION AND ASSEMBLY

Figure 7011 Standard Coupling

1 Inspect the pipe ends making sure the criteria, in the Gruvlok Large Diameter Pipe Roll and Cut Groove Specifications, are met.

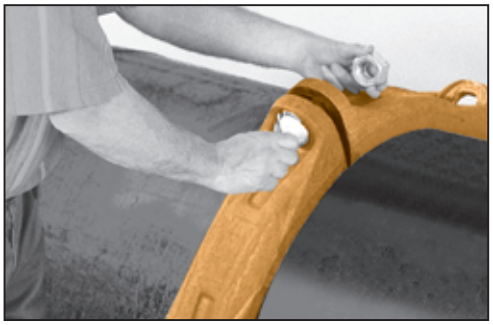
2 Turn the gasket inside out and slide the gasket completely over one of the pipe ends. Turning the gasket inside out will reduce the stretching necessary to put the gasket into position. Ideally, approximately 75% of the pipe's gasket-sealing surface, (Dimension A) should be visible when the gasket is in proper position. This will aid in step 4.

3 Lubricate the gasket sealing lips. The use of Gruvlok lubricants ensures compatibility between the lubricant and the gasket.

4 Pull the two pipes into contact aligning the pipe ends.

CAUTION: Be careful not to pinch fingers during this step. Working your way around the circumference of the pipe, flip the gasket toward the pipe end so that the proper side is facing out. The end of this procedure will result in the gasket snapping into place. Position the gasket centrally between the grooves of the two pipe ends.

5 Lubricate the exterior surface of the gasket. This helps prevent pinching of the gasket during assembly.



6 Secure the housings about the pipes making sure the coupling keys are engaged in the pipe end grooves. Hint: For horizontal assembly, place housing segment on top of the pipe to support the weight of the housing segment. Secure the adjacent housing with an oval neck track bolt and heavy hex nut and then rotate the secured housings, again balancing the weight of the housings on the top of the pipe. Continue this procedure for all segments.

Figure 7011 Standard Coupling *Continued*

7 Firmly torque each bolt. The specified minimum torque for each nut is 600 ft.-lbs. The specified maximum torque for each nut is 800 ft.-lbs.

8 Installation of the Figure 7011 Standard Coupling is completed.

CAUTION: Use of an impact wrench is not recommended because the torque output can vary significantly due to many variables including air pressure supply, battery strength and operational variations.

CAUTION: Proper torquing of coupling bolts is required to obtain specified performance. Over torquing the bolts may result in damage to the bolt and/or casting which could result in pipe joint separation. Under torquing the bolts may result in lower pressure retention capabilities, lower bend load capabilities, joint leakage and pipe joint separation. Pipe joint separation may result in significant property damage and serious injury.

GRUVLOK® INSTALLATION AND ASSEMBLY

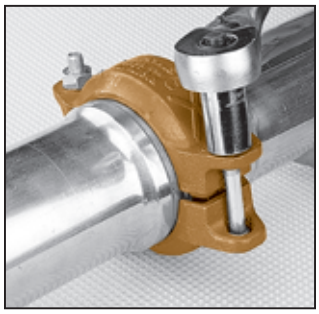
Figure 7400 Rigidlite® Coupling – Advanced Copper Method

1. Check & Lubricate Gasket
Check the gasket to be sure it is compatible for the intended service. Apply a thin coating of Gruvlok Xtreme Lubricant to the entire surface, both internal and external, of the gasket. Be careful that foreign particles do not adhere to lubricated surfaces.

2. Gasket Installation
Slip the gasket over the one tube, making sure the gasket lip does not overhang the tube end.

3. Alignment
After aligning the two tube ends together, pull the gasket into position, centering it between the grooves on each tube. The gasket should not extend into the groove on either tube.

4. Housings
Remove one nut and bolt and loosen the other nut. Place one housing over the gasket, making sure the housing keys fit into the tube grooves. Swing the other housing over the gasket and into the grooves on both tubes, making sure the tongue and recess of each housing is properly mated. Reinsert the bolt and run-up both nuts finger tight.



5. Tighten Nuts
Securely tighten nuts alternately and equally to the specified bolt torque,* keeping the gaps at the bolt pads evenly spaced.

CAUTION: Uneven tightening may cause the gasket to pinch. Gasket should not be visible between segments after bolts are tightened.

6. Assembly is complete
Visually inspect the pipe joint to assure the coupling keys are fully engaged in the pipe grooves. The bolt pads are to have equal gaps on each side of the coupling.

CAUTION: Use of an impact wrench is not recommended because the torque output can vary significantly due to many variables including air pressure supply, battery strength and operational variations.

* Refer to page 26 with bolt torque table.

CAUTION: Proper torquing of coupling bolts is required to obtain specified performance. Over torquing the bolts may result in damage to the bolt and/or casting which could result in pipe joint separation. Under torquing the bolts may result in lower pressure retention capabilities, lower bend load capabilities, joint leakage and pipe joint separation. Pipe joint separation may result in significant property damage and serious injury.

GRUVLOK® INSTALLATION AND ASSEMBLY

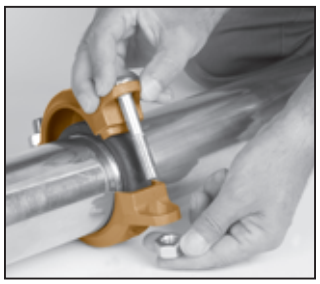
Figure 6400 Rigid Coupling – CTS Copper System

The Fig. 6400 Coupling from Gruvlok is specially designed to provide a rigid pipe connection to meet the specific demands of copper tubing installation. Fast and easy swing-over installation of the rugged lightweight housing produces a secure, rigid pipe joint. Available with the EPDM flush gap style gasket as the standard gasket.

1. Check & Lubricate Gasket
Check the gasket to be sure it is compatible for the intended service. Apply a thin coating of Gruvlok® Xtreme Lubricant to the entire surface, both internal and external, of the gasket. Be careful that foreign particles do not adhere to the lubricated surfaces.

2. Gasket Installation
Slip the gasket over one tube, making sure the gasket lip does not overhang the tube end.

3. Alignment
After aligning the two tube ends together, pull the gasket into position, centering it between the grooves on each tube. The gasket should not extend into the groove on either tube or between the tube ends.



4. Housings
Remove one nut and bolt and loosen the other nut. Place one housing over the gasket, making sure the housing keys fit into the tube grooves. Swing the other housing over the gasket and into the grooves on both tubes, making sure the tongue and recess of each housing is properly mated. Re-insert the bolt and run-up both nuts finger tight.

5. Tighten Nuts
Securely tighten nuts alternately and equally to the specified bolt torque, keeping the gaps at the bolt pads evenly spaced. Assembly is complete. Visually inspect the pipe joint to assure the coupling keys are fully engaged in the pipe grooves. The bolt pads are to have equal gaps on each side of the coupling.

NOTE: Copper is a soft material, and in some cases, the bolt pads may come close to metal-to-metal contact.

CAUTION: Uneven tightening may cause the gasket to pinch. The gasket should not be visible between segments after the bolts are tightened. Proper torquing of coupling bolts is required to obtain specified performance. Over torquing the bolts may result in damage to the bolt and/or casting which could result in pipe joint separation. Under torquing the bolts may result in lower pressure retention capabilities, lower bend load capabilities, joint leakage and pipe joint separation.

SPECIFIED BOLT TORQUE

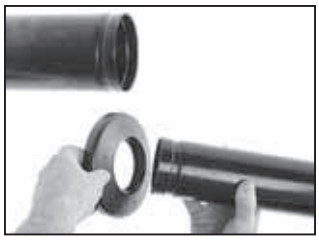
Bolt Size	Wrench Size	Specified Bolt Torque*
In.	*In.*	*Ft.-Lbs*
3/8	11/16	30-45
1/2	7/8	30-45
5/8	1 1/16	60-90

* Non-lubricated bolt torques.

GRUVLOK® INSTALLATION AND ASSEMBLY

Figure 7010 Reducing Coupling

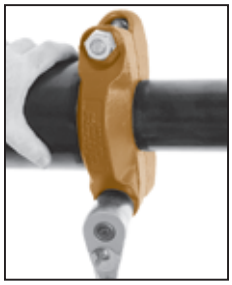
1. Check & Lubricate Gasket
Check gasket to be sure it is compatible for the intended service. Apply a thin coating of Gruvlok lubricant to outside and sealing lips of the gasket. Be careful that foreign particles do not adhere to lubricated surfaces.



2. Gasket Installation
Place the smaller opening of the gasket over the smaller pipe. Angle the gasket over the pipe end and pull the gasket lip open around the circumference of the pipe. The center leg of the gasket should make flush contact with the pipe end and will prevent telescoping of the smaller pipe inside the larger.

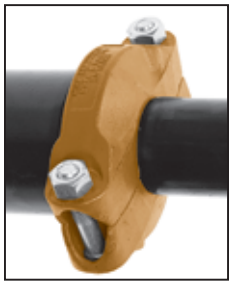
3. Alignment
Align the adjoining pipe center lines, and insert the larger pipe end into the gasket. Angle the pipe end slightly to the face of the gasket and tilt the pipe into the gasket to ease assembly.

4. Housings
Place the coupling housing halves over the gasket making sure the housing keys engage the grooves. Insert bolts and turn nuts finger tight.

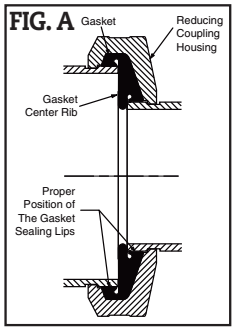


5. Tighten Nuts
Tighten the nuts alternately and equally to the specified bolt torque.* The housing bolt pads must make metal-to-metal contact.

CAUTION: Uneven tightening may cause the gasket to pinch.



6. Assembly Complete
Visually inspect the pipe joint to assure the coupling keys are fully engaged in the pipe grooves and the bolt pads are in firm even metal-to-metal contact on both sides of the coupling.



NOTE: Fig. A illustrates the correct position of the Fig. 7010 Reducing Coupling gasket and housing properly assembled onto adjacent pipe ends.

CAUTION: In vertical installations the pipes must be supported to prevent telescoping during installation.

CAUTION: Proper torquing of coupling bolts is required to obtain specified performance. Over torquing the bolts may result in damage to the bolt and/or casting which could result in pipe joint separation. Under torquing the bolts may result in lower pressure retention capabilities, lower bend load capabilities, joint leakage and pipe joint separation. Pipe joint separation may result in significant property damage and serious injury.

CAUTION: Use of an impact wrench is not recommended because the torque output can vary significantly due to many variables including air pressure supply, battery strength and operational variations.

* Refer to page 26 with bolt torque table

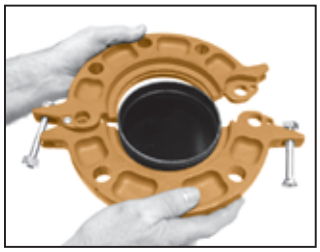
GRUVLOK® INSTALLATION AND ASSEMBLY

Figure 7012 Flange (2" – 12")

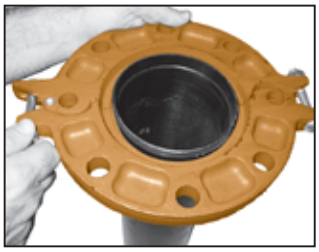
Applications which require a Gruvlok Flange Adapter Insert:

1. When mating to a wafer valve (lug valve), if the valve is rubber faced in the area designated by the sealing surface dimensions (A Max. to B Min.), place the Gruvlok Flange Adapter Insert between the valve and the Gruvlok Flange.
2. When mating to a rubber-faced metal flange, the Gruvlok Flange Adapter Insert is placed between the Gruvlok Flange and the rubber-faced flange.
3. When mating to a serrated flange surface, a standard full-faced flange gasket is installed against the serrated flange face, and the Gruvlok Flange Adapter Insert is placed between the Gruvlok Flange and the standard flange gasket.
4. When mating to valves or other component equipment where the flange face has an insert, use procedure described in note 3.

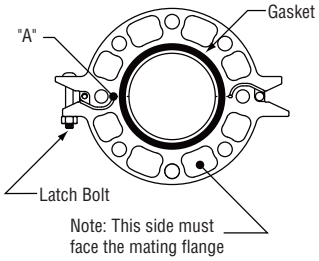
Check pipe end for proper grooved dimensions and to assure that the pipe end is free of indentations and projections that would prevent proper sealing of the Gruvlok flange gasket.



1 On the side without the hinge pin, loosen the latch bolt nut to the end of the bolt thread. (It is not necessary to remove the nut from the latch bolt.) Swing the latch bolt out of the slot. Open the Gruvlok Flange and place around the grooved pipe end with the key section fitting into the groove. The flange gasket cavity must face the pipe end.



2 Place the latch bolt back into the slotted hole. Tighten the nut until there is a 1/16" gap between the flange halves at location "A". (See Figure below)

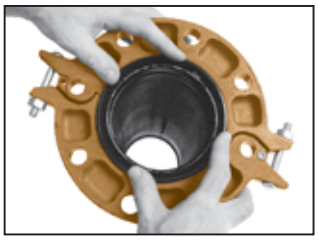


3 Check the gasket to assure that it is properly suited for the intended service. Lubricate the entire exterior surface of the gasket, including the sealing lips, using the proper Gruvlok lubricant.

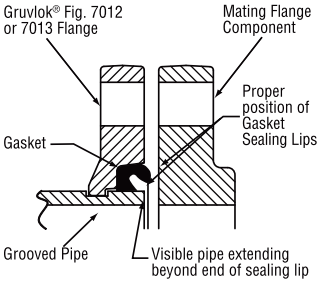
⚠ WARNING

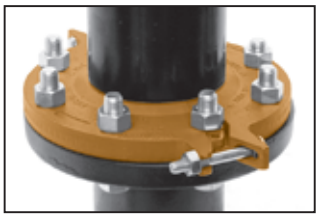
The Gruvlok Flange gasket must be inserted so that the sealing lips face toward the pipe end and the mating flange. The lip of the gasket, sealing on the pipe, should not extend beyond the pipe end. The pipe should extend out beyond the end of the sealing lip by approximately 1/8" on the 2"-6" sizes and 3/16" on the 8"-12" sizes.

Figure 7012 Flange (2" – 12") *Continued*

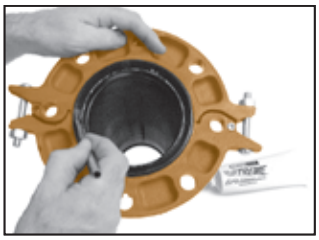


4 Stretch the Gruvlok gasket around the pipe end and then press the gasket into the cavity between the pipe O.D. and the flange. The gasket must be properly positioned as shown in the figure below.



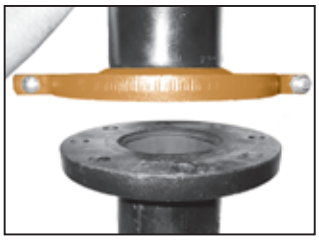


7 Insert a flange bolt or stud with material properties of SAE J429 Grade 5 or higher through the bolt holes and thread a nut on hand tight. Continue this procedure until all bolt holes have been fitted. Tighten the nuts alternately and evenly so the flange faces remain parallel. All the bolts or studs must be torqued to the mating flange bolts specified torque. The flange faces should have metal-to-metal contact.



5 With the gasket in place apply lubricant to the exposed gasket tip, which will seal on the mating flange. **Tighten the nuts on the latch bolts alternately to the specified latch bolt torque.* The flange housings must be in firm metal-to-metal contact.**

* Refer to page 26 with bolt torque table



6 Verify that the mating flange face is hard, flat and smooth, free of indentations, which would prevent proper sealing of the Gruvlok Flange gasket. Assure the gasket is still in the proper position and align Gruvlok Flange bolt holes with the mating flange, pump, tank, etc., bolt holes.

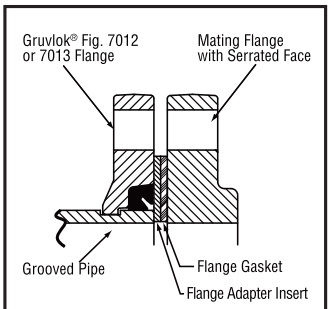


FIG. C1

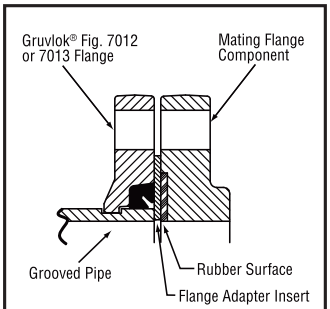


FIG. C2

NOTE: The Gruvlok Fig. 7012 Flange requires the use of a Flange Adapter Insert when used against rubber surfaces (Figure C1), serrated flange surfaces or mating flanges with inserts (Figure C2). The Flange Adapter Insert will be exposed to the fluids in the system. Ensure that the Insert is compatible with the fluids in the systems and with adjacent piping components.

⚠ WARNING

Do not use a steel Flange Adapter Insert in copper systems or in systems where galvanic corrosion is possible.

CAUTION: Proper torquing of flange bolts is required to obtain specified performance. Over torquing the bolts may result in damage to the bolt and/or casting which could result in pipe joint separation. Under torquing the bolts may result in lower pressure retention capabilities, lower bend load capabilities, joint leakage and pipe joint separation. Pipe joint separation may result in significant property damage and serious injury.

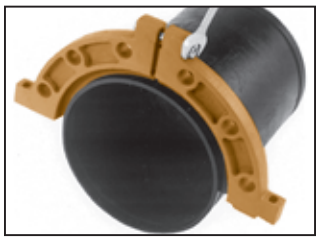
CAUTION: Use of an impact wrench is not recommended because the torque output can vary significantly due to many variables including air pressure supply, battery strength and operational variations.

⚠ WARNING It is important to line up the bolt holes before bringing the two flanges together. Sliding the flanges into place will dislodge the gasket and cause leakage to occur. When using a flange insert, it is important that the insert is properly aligned with the gasket prior to tightening the bolts.

GRUVLOK® INSTALLATION AND ASSEMBLY

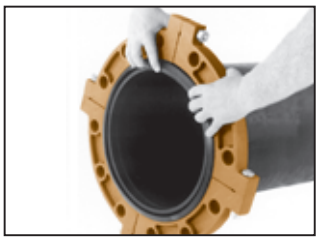
Figure 7012 Flange (14" – 24")

Gruvlok® Flanges of 14" size and larger are cast in four segments to ease handling during assembly. Figure 7012 Gruvlok Flanges should not be used with tie rods nor in a configuration with a wafer valve between two 7012 flanges.

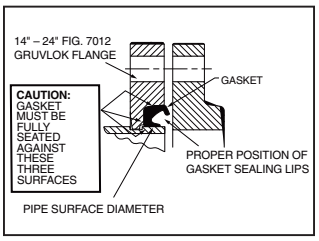


1 Place each Gruvlok Flange segment around the grooved pipe with the key section fitting into the groove and the flange gasket cavity facing the pipe end. Loosely assemble the segments using the four segment-bolts-and nuts. Alternately and equally tighten the latch bolts and nuts to the specified latch bolt torque. Bring the four flange segments into full, firm metal-to-metal contact.

NOTE: An alternative method of assembly is to loosely preassemble two segments into two equal halves of the flange leaving a small gap (approximately 1/8") between the two segments of each flange- half. Place the flange halves around the pipe and complete the assembly as described in Step 1, above.



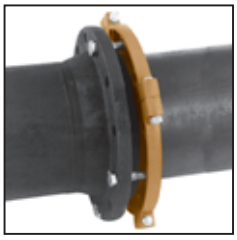
2 Check the gasket grade to verify that it is properly suited for the intended service. Lubricate the entire surface of the gasket and the flange cavity using the appropriate Gruvlok Lubricant. Place the Gruvlok Flange Gasket around the pipe end by pressing the gasket into the cavity between the pipe O.D. and flange recess. Move around the gasket in both directions until the gasket is fully seated in the flange gasket cavity.



3 The correct position and relationship of the components of the Gruvlok Flange assembly is shown in the Figure above. The wide gasket lip must seal on the pipe surface diameter and the narrow gasket lip must face the mating flange. Be careful that foreign particles do not adhere to lubricated surfaces.

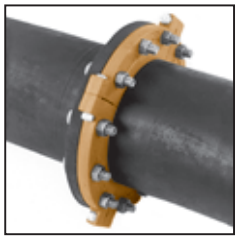
NOTE: Design of the Gruvlok Flange provides sealing only with the special Gruvlok Flange gasket. Only Gruvlok Flange gaskets may be used with Fig. 7012 flanges.

4 Align the Gruvlok Flange bolt holes with mating flange bolt holes. Insert a flange bolt or stud with material properties of SAE J429 Grade 5 or higher through the bolt holes and thread a nut on hand tight. Insert the next bolt or stub opposite the first and again thread the nut on hand tight. Continue this procedure until all bolt holes have been fitted. Insertion of the flange bolts prior to contact of the flanges will help in the alignment of the flanges. Pull the two flanges into contact using care to assure that the gasket remains fully seated within the gasket cavity during assembly.



NOTE: Take care to assure that the gasket lip is not bent backwards and pinched between the two flanges.

5 Tighten the nuts evenly to the specified mating face bolt torque so that the flange faces remain parallel and make firm even contact around the entire flange.



CAUTION: Proper torquing of flange bolts is required to obtain specified performance. Over torquing the bolts may result in damage to the bolt and/or casting which could result in pipe joint separation. Under torquing the bolts may result in lower pressure retention capabilities, lower bend load capabilities, joint leakage and pipe joint separation. Pipe joint separation may result in significant property damage and serious injury.

CAUTION: Use of an impact wrench is not recommended because the torque output can vary significantly due to many variables including air pressure supply, battery strength and operational variations.

GRUVLOK® INSTALLATION AND ASSEMBLY

Figures 7045 & 7046 Clamp-T® Branch Outlets

ALWAYS USE A GRUVLOK LUBRICANT FOR PROPER COUPLING ASSEMBLY.
Thorough lubrication of the gasket is essential to assist the gasket into the proper sealing position.

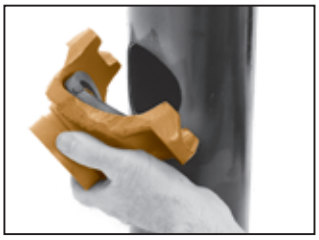
1. Pipe Preparation

Cut the appropriate size hole in the pipe and remove any burrs. Be sure to remove the slug from inside the pipe. Clean the gasket sealing surface within 5/8" of the hole and visually inspect the sealing surface for defects that may prevent proper sealing of the gasket.

BRANCH SIZE	HOLE SAW SIZE
(Inches)	*(Inches) (+1/8, -0)*
½, ¾, 1	1½
1¼, 1½	2
2	2½
2½	2¾
3	3½
4	4½

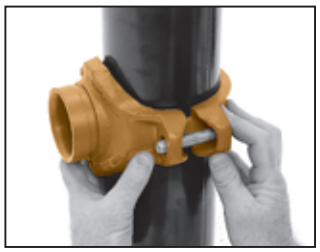
2. Check & Lubricate Gasket

Check the gasket to be sure it is compatible for the intended service. Apply a thin layer of Gruvlok lubricant to the back surface of the gasket. Be careful that foreign particles do not adhere to the lubricated surfaces. Insert the gasket back into the outlet housing making sure the tabs in the gasket line up with the tab recesses in the housing.



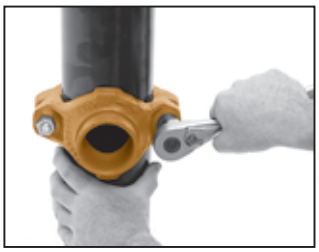
3. Gasket Installation

Lubricate the exposed surface of the gasket. Align the outlet housing over the pipe hole making sure that the locating collar is in the pipe hole.



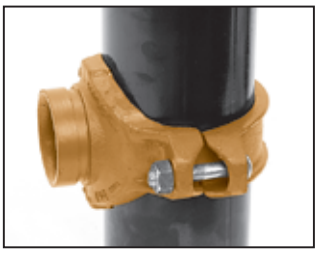
4. Alignment

Align the strap around the pipe, insert the bolts and tighten the nuts finger tight. Some sizes use a U-bolt design.



5. Tighten Nuts

Alternately and evenly tighten the nuts to the specified bolt torque.



6. Assembly is complete

FIGS. 7045 & 7046—SPECIFIED BOLT TORQUE

Specified bolt torque is for the oval neck track bolts and U-bolts used on the Gruvlok® Clamp-T's. The nuts must be tightened alternately and evenly until fully tightened.

CAUTION: Use of an impact wrench is not recommended because the torque output can vary significantly due to many variables including air pressure, battery strength and operational variations.

CAUTION: Proper torquing of the bolts or U-bolts is required to obtain the specified performance. Overtorquing the bolts or U-bolts may result in damage to the bolt, U-bolt and/or casting which could result in lower pressure retention capabilities, lower bend load capabilities, pipe joint leakage and pipe joint separation.

ANSI SPECIFIED BOLT TORQUE		
Bolt Size	Wrench Size	Specified Bolt Torque *
In.	*In.*	*Ft.-Lbs.*
U-Bolt	⅞	30-40
½	⅞	60-80
⅝	1 1/16	100-130
¾	1¼	130-180

* Non-lubricated bolt torques

GRUVLOK® INSTALLATION AND ASSEMBLY

Figure 7305 HDPE Coupling

1 Make certain the pipe ends are free of indentations, projections or other imperfections, which could prevent proper sealing of the gasket. Mark each pipe at a distance from the end of the pipe according to the pipe size:

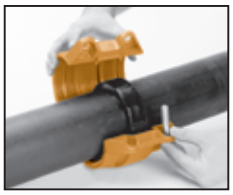
Size Inches	Distance to Mark
2 - 4" (51 - 102 mm)	1" (25.4 mm)
5 - 8" (127 - 203 mm)	1¼" (31.8 mm)
10 & 12" (254 - 305 mm)	1¾" (44.5 mm)

NOTE: Make certain the HDPE pipe end is square cut to 1/8" maximum for the 2" to 4" and 5/32" maximum for the 6" and larger sizes.

2 Check to assure the gasket material is acceptable for the intended service. The Gasket color code is green for EPDM and orange for Nitrile (Buna-N).

CAUTION: Use only Gruvlok Xtreme™ Lubricant. Gruvlok Xtreme Lubricant contains silicone. If silicone is unacceptable for the application contact Gruvlok for the lubrication recommendation. Apply a thin coating of Gruvlok Xtreme Lubricant to the gasket lip and outside surface of the gasket.

3 Slip the gasket over one of the pipe ends. Make sure the gasket does not overhang the pipe end. Align the second pipe and while keeping the pipes in the butted position slide the gasket back over the second pipe end. The gasket must be positioned centrally between the lines on the pipe ends.



4 Place the Figure 7305 housing casting over the gasket, making sure the tongue on one casting is aligned with the recess of the other casting.

5 Insert the bolts and secure the nuts alternately and uniformly until the bolt pads are in contact. Torque all bolts to the required bolt torque levels. Refer to the Specified Bolt Torque Table. There is no gap between the bolt pads and the bolt torque should be within the range given when the coupling is properly assembled. Alternate and even tightening of the bolts will significantly reduce the torque needed to close the gap at the pipe joint.

APFH-12.11

SPECIFIED BOLT TORQUE

Specified bolt torque is for the oval neck track bolts used on Gruvlok® couplings. The nuts must be tightened alternately and evenly until fully tightened.

CAUTION: Use of an impact wrench is not recommended because the torque output can vary significantly due to many variables including air pressure supply, battery strength and operational variations.

CAUTION: Proper torquing of coupling bolts is required to obtain specified performance. Over torquing the bolts may result in damage to the bolt and/or casting which could result in pipe joint separation. Under torquing the bolts may result in lower pressure retention capabilities, lower bend load capabilities, joint leakage and pipe joint separation. Pipe joint separation may result in significant property damage and serious injury.

FIG. 7305 SPECIFIED BOLT TORQUE

Coupling Bolts	Minimum	Maximum
In.	*Ft.-Lbs./N-m*	*Ft.-Lbs./N-m*
½ x 2⅜	80 *110*	100 *150*
½ x 3	80 *110*	100 *150*
⅝ x 3½	100 *135*	130 *175*
¾ x 4¾	130 *175*	180 *245*

GRUVLOK® INSTALLATION AND ASSEMBLY

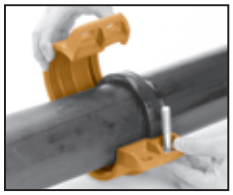
Figure 7307 HDPE Transition Coupling

1 Make certain the HDPE pipe end is square cut to 1/8" maximum for the 2" to 4" and 5/32" maximum for the 6" and larger sizes. The steel pipe must be grooved in accordance with Gruvlok® Grooving Specifications for Steel Pipe. The pipe ends must be free of scratches, indentations, projections or other imperfections, which could prevent proper sealing of the gasket.

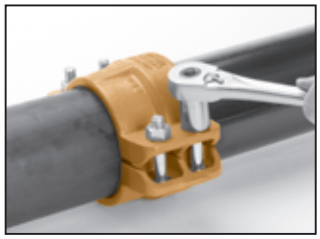
2 Check to assure the gasket material is acceptable for the intended service. The Gasket color code is green for EPDM and orange for Nitrile (Buna-N).

CAUTION: Use only Gruvlok Xtreme™ Lubricant. Gruvlok Xtreme Lubricant contains silicone. If silicone is unacceptable for the application contact Gruvlok for the lubrication recommendation. Apply a thin coating of Gruvlok Xtreme Lubricant to the gasket lips and outside surface of the gasket.

3 Slip the gasket over one of the pipe ends. Make sure the gasket does not overhang the pipe end. Align the second pipe and while holding it in the butted position, slide the gasket back over the second pipe end. The gasket must be positioned on the gasket seat surface of the grooved steel pipe. Make sure the gasket does not overhang into the pipe groove.



4 Place each half of the coupling housing over the gasket, making sure the housing grooved end is directed into the pipe groove.



5 Insert the bolts and secure the nuts alternately and uniformly until the bolt pads are in contact. Torque all bolts to the required bolt torque levels. Refer to the Specified Bolt Torque Table. There is no gap between the bolt pads and the bolt torque should be within the range given when the coupling is properly assembled. Alternate and even tightening of the bolts will significantly reduce the torque needed to close the gap at the pipe joint.

SPECIFIED BOLT TORQUE

Specified bolt torque is for the oval neck track bolts used on Gruvlok® couplings. The nuts must be tightened alternately and evenly until fully tightened.

CAUTION: Use of an impact wrench is not recommended because the torque output can vary significantly due to many variables including air pressure supply, battery strength and operational variations.

CAUTION: Proper torquing of coupling bolts is required to obtain specified performance. Over torquing the bolts may result in damage to the bolt and/or casting which could result in pipe joint separation. Under torquing the bolts may result in lower pressure retention capabilities, lower bend load capabilities, joint leakage and pipe joint separation. Pipe joint separation may result in significant property damage and serious injury.

FIG. 7307 SPECIFIED BOLT TORQUE

Coupling Bolts	Minimum	Maximum
In.	*Ft.-Lbs./N-m*	*Ft.-Lbs./N-m*
½ x 2⅜	80 *110*	100 *150*
½ x 3	80 *110*	100 *150*
⅝ x 3½	100 *135*	130 *175*
⅞ x 5½	180 *245*	220 *300*

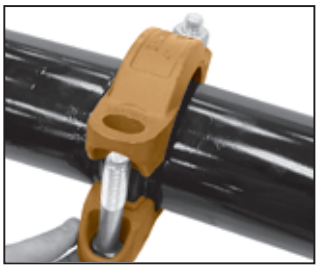
GRUVLOK® INSTALLATION AND ASSEMBLY

Figure 7004 High Pressure Coupling

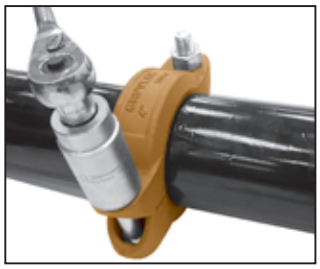
1. Check & Lubricate Gasket
Check gasket to be sure it is compatible for the intended service. Apply a thin coat of Gruvlok Lubricant to outside and sealing lips of the gasket. Be careful that foreign particles do not adhere to lubricated surfaces.

2. Gasket Installation
Slip the gasket over the pipe end, making sure the gasket lip does not overhang the pipe end.

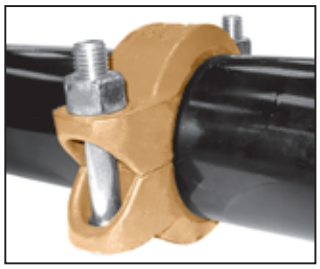
3. Alignment
After aligning the two pipe ends together, pull the gasket into position, centering it between the grooves on each pipe. Gasket should not extend into the groove on either pipe.



4. Housings
Place each housing halves on the pipe making sure the housing key fits into the groove. Be sure that the tongue and recess portions of the housing mate properly. Insert the bolts and run up the nuts finger tight.



5. Tighten Nuts
Securely tighten nuts alternately and equally to the required indicator. For 2" - 4" 7004 couplings, please use the table below for required torque values. For 7004 5" and larger, tighten nuts till housings are in metal-to-metal contact.



6. Assembly is complete
Visually inspect the pipe joint to assure the coupling keys are fully engaged in the pipe grooves. For 2" - 4" ensure the gaps on each side are evenly space, and for 5" and larger couplings ensure the housings are in firm even metal-to-metal contact on both sides.

SPECIFIED BOLT TORQUE		
Size	Bolt Size	Torque
In.	*In.*	*Ft.-Lbs*
2	5/8	100 - 130
2½	5/8	100 - 130
3	5/8	100 - 130
4	3/4	130 - 180
5	7/8	*
6	7/8	*
8	1	*
10	1	*
12	1	*

* Torque required to bring housing metal-to-metal contact.

CAUTION: When using an impact wrench, verify that the output of the torque wrench is within the required torque range. It is recommended that a torque wrench be used for accurate assembly in order to obtain specified performance.

GRUVLOK® INSTALLATION AND ASSEMBLY

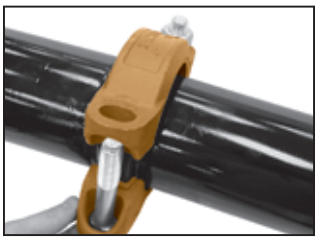
Figure 7004 with EG® Gasket
High Pressure Coupling with End Guard® Gasket

For 7400 with EG® gasket required specified pipe end groove dimensions and fittings, see pages 34-35 for groove dimensions.

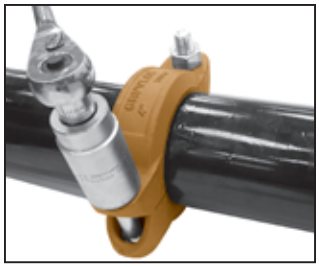
CAUTION: Not using the correct groove dimensions will result in pipe joint separation. Pipe joint separation may result in significant property damage and serious injury.

1. Check & Lubricate Gasket
Check gasket to be sure it is compatible for the intended service. Apply a thin coat of Gruvlok Lubricant to outside and sealing lips of the gasket. Be careful that foreign particles do not adhere to lubricated surfaces.

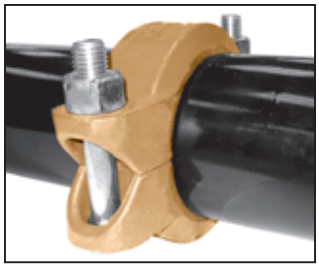
2. Gasket Installation
Slip the gasket half way on to the pipe end, stop when the center gasket leg comes in contact with the pipe end. Slide the second pipe end half way into the gasket, stopping then the pipe end comes in contact with the center gasket leg. Ensure pipes are aligned properly.



3. Housings
Place each housing halves on the pipe making sure the housing key fits into the groove. Be sure that the tongue and recess portions of the housing mate properly. Insert the bolts and run up the nuts, finger tight.



4. Tighten Nuts
Securely tighten nuts alternately and equally to the required indicator. For 2" - 4" couplings, please use the table on this page for required torque values. For 5" and larger, tighten nuts till housings are in firm metal-to-metal contact.



5. Assembly is complete
Visually inspect the pipe joint to assure the coupling keys are fully engaged in the pipe grooves. For 2" - 4" ensure the gaps on each side are evenly space, and for 5" and larger couplings ensure the housings are in firm even metal-to-metal contact on both sides.

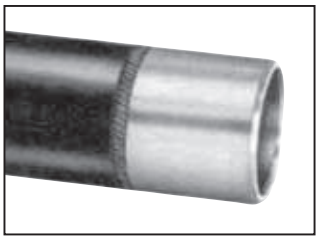
SPECIFIED BOLT TORQUE

Size	Bolt Size	Torque
In.	*In.*	*Ft.-Lbs*
2	5/8	100 - 130
2½	5/8	100 - 130
3	5/8	100 - 130
4	3/4	130 - 180
5	7/8	*
6	7/8	*
8	1	*
10	1	*
12	1	*

* Torque required to bring housing metal-to-metal contact.

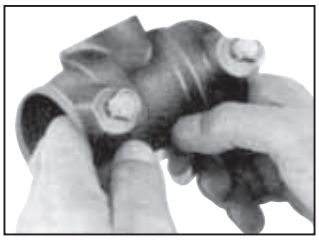
CAUTION: When using an impact wrench, verify that the output of the torque wrench is within the required torque range. It is recommended that a torque wrench be used for accurate assembly in order to obtain specified performance.

GRUVLOK® INSTALLATION AND ASSEMBLY
Sock-It® Fittings

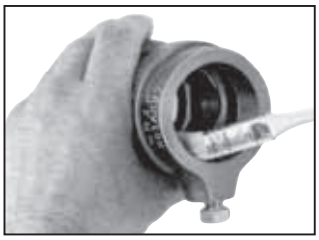


1 Pipe surface shall be cleaned at least 1" from the end of the pipe to remove any coating, indentations, projections, and sharp edges which could affect proper gasket sealing. As a guide for installation, mark the pipe at a distance of 1 1/2" from the end for 1", 1 1/4", and 1 1/2" size fittings and 1 3/4" for the 2" & 2 1/2" size fittings.

NOTE: When Allied XL pipe is used it is necessary only to remove sharp edges and burrs at the end of the pipe. No additional cleaning is required.

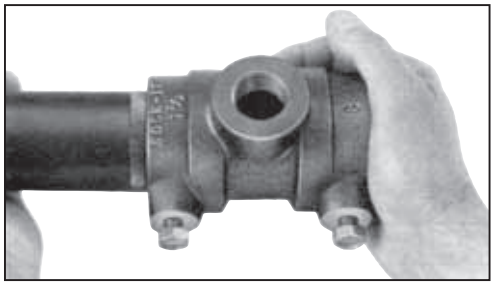


2 Check all lock bolts to be sure they do not extend into the I.D. of the Sock-It Fittings as this would prevent proper insertion of the pipe.



3 Apply a light coating of GRUVLOK Lubricant to the gaskets located in each end of the Sock-It Fitting. Also apply a light coating of lubricant to the pipe ends to further ease insertion of the pipe into the Sock-It Fitting.

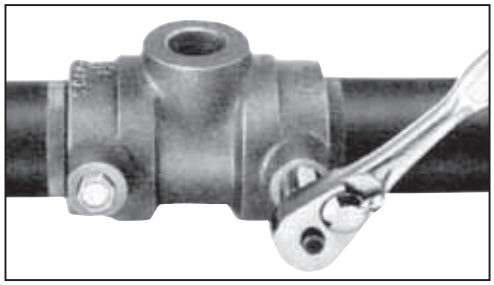
NOTE: Use only Gruvlok Lubricants. Other lubricants may affect gasket performance.



4 Insert the prepped and lubricated pipe end into the Sock-It Fitting until the pipe end makes contact with the internal pipe stop. A slight twist while pushing fitting and pipe together will ease the required insertion force. The end of the Sock-It Fitting should be within 1/16" from the edge of the marking on the pipe. (See Step 1). Rotate the fitting until the desired position is obtained. Tighten the lock bolt until the bolt head bottoms against the threaded boss. (NOTE: The 2 1/2" Sock-It fitting has 2 locking bolts for each pipe end.)

Install the other prepped and lubricated pipe end into the Sock-It fitting in the same manner.

CAUTION: Do NOT hammer fitting on.



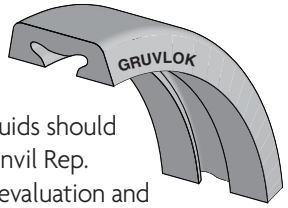
5 Sock-It Fittings may be removed by loosening the lock bolts. Reinstallation may be accomplished as described in Steps 1-4. Install the other prepped and lubricated pipe end into the Sock-It fitting in the same manner.

WARNING: System pressure must be relieved and vented, and the system drained of fluid prior to loosening the lock bolts to remove or reposition the Sock-It Fitting.

Bolt end must be inspected to assure bolts ability to cut into pipe. Replace bolts in cases where bolt end sharpness has been comprised.

NOTES

GRUVLOK® TECHNICAL DATA
Gruvlok Gasket Grade Index



The lists are provided as an aid in selecting the optimum gasket grade for a specific application to assure the maximum service life.

The recommendations have been developed from current information supplied by manufacturers of the elastomers, technical publications, and industry applications. The information supplied should be considered as a basis for evaluation but not as a guarantee.

Selection of the optimum gasket grade for a specific service requires the consideration of many factors; primarily temperature, fluid concentration, and continuity of service. Unless otherwise noted, all gasket recommendations are based on 100°F (38°C) maximum temperature service condition. Where more than one gasket grade is shown, the preferred grade is listed first.

Combinations of fluids should be referred to an Anvil Rep. for an engineering evaluation and recommendation. In unusual or severe services, gasket materials should be subjected to simulated service conditions to determine the most suitable gasket grade.

Gasket recommendations apply only to Gruvlok gaskets. Contact an Anvil Representative for recommendations for services not listed. These listings do not apply to Gruvlok Butterfly Valves.

All Gruvlok products marked with UL/ULC Listed, FM approved VdS and/or LPC symbols are Listed/Approved with EPDM material. For other Listed/Approved materials, please contact an Anvil Representative for more information.

GASKET GRADE INDEX:

STANDARD GASKETS				
Grade	Temperature Range	Compound	Color Code	General Service Applications
E	-40°F to +230°F (-40°C to 110°C)	EPDM	Green	Water, dilute acids, alkalies, salts, and many chemical services not involving hydrocarbons, oils, or gases. Excellent oxidation resistance. **NOT FOR USE WITH HYDROCARBONS**
EP	-40°F to +250°F (-40°C to 121°C)	EPDM	Green and Red	Water, dilute acids, alkalies, salts, and many chemical services not involving hydrocarbons, oils, or gases. Excellent oxidation resistance. **NOT FOR USE WITH HYDROCARBONS**
T	-20°F to +180°F (-29°C to 82°C)	Nitrile (Buna-N)	Orange	Petroleum products, vegetable oils, mineral oils, and air contaminated with petroleum oils. **NOT FOR USE IN HOT WATER SERVICES**

SPECIAL GASKETS				
Grade	Temperature Range	Compound	Color Code	General Service Applications
O	+20°F to +300°F (-20°C to 149°C)	Fluoro Elastomer	Blue	High temperature resistance to oxidizing acids, petroleum oils, hydraulic fluids, halogenated, hydrocarbons and lubricants
L	-40°F to +350°F (-40°C to 177°C)	Silicone	Red Gasket	Dry, hot air and some high temperature chemical services.
E Type A	-40°F to +150°F (-40°C to 66°C)	Pre-Lubricated	Violet	Wet & Dry (oil free air) Pipe in Fire Protection Systems. For dry pipe systems, Gruvlok Xtreme™ Temperature Lubricant is required.

GRUVLOK® TECHNICAL DATA
Gruvlok Gasket Recommendation List & Vacuum Service

GASKET RECOMMENDATION LISTING:

WATER & AIR	
Service	**Gasket Grade**
Air, (no oil vapors) Temp. -40°F to 230°F (-40°C to 110°C)	E/EP
Air, (no oil vapors) Temp. -40°F to 350°F (-40°C to 177°C)	L
Air, Oil vapor Temp. -20°F to 150°F (-29°C to 66°C)	T
Air, Oil vapor Temp. 20°F to 300°F (-7°C to 149°C)	O
Water, Temp to 150°F (66°C)	E/EP/T
Water, Temp to 230°F (110°C)	E
Water, Acid Mine	E/T
Water, Chlorine	(E/EP/O)
Water, Deionized	E/EP/T
Water, Seawater	E/EP/T
Water, Waste	E/EP/T
Water, Lime	E/EP/T

Where more than one gasket grade is shown the preferred gasket grade is listed first. Where the gasket grade is shown in parentheses, Contact an Anvil Representative for an engineering evaluation and recommendation. Specify gasket grade when ordering. Use Gruvlok lubricant on gasket. Check gasket color code to be certain it is recommended for the service intended.

PETROLEUM PRODUCTS	
Service	**Gasket Grade**
Crude Oil - Sour	T
Diesel Oil	T
Fuel Oil	T
Gasoline, Leaded	T
Gasoline, Unleaded*	(O)
Hydraulic Oil	T
JP-3, JP-4 and JP-5	T/O
JP-6, 100°F (38°C) Maximum Temp.	O
Kerosene	T
Lube Oil, to 150°F (66°C)	T
Motor Oil	T
Tar and Tar Oil	T
Transmission Fluid —Type A	O
Turbo Oil #15 Diester Lubricant	O

Unless otherwise noted, all gasket listings are based upon 100°F (38°C) maximum temperature service conditions.

For services not listed, contact an Anvil Representative for recommendation.

*Contact an Anvil Representative for service evaluation.

VACUUM SERVICE:

VACUUM SERVICE		
Size	**Vacuum Level**	**Gasket Recommendation**
1" - 12" (25 - 300mm)	0" - 10" Hg	Standard or Flush Gap
1½" - 12" (40 - 200mm)	10" - 29.9" Hg	Flush Gap

LARGER SIZES: Contact an Anvil Representative for more information.

Gruvlok Lubricants

GRUVLOK® XTREME™ LUBRICANT

NSF Certified to ANSI/NSF 61

Gruvlok® Xtreme™ Lubricant has been developed for use with Gruvlok couplings in services where improved lubrication is beneficial. This lubricant has an operating temperature range from -65°F to 400°F (-53.8°C to 204°C), well exceeding the temperature range of Gruvlok gaskets. This lubricant is waterproof, thereby eliminating water wash-out and it will not dry out in the absence of water. There are five primary applications where the Xtreme Lubricant will provide increased benefits: low temperature applications below -20°F(-28.0°C), high temperature applications above 150°F (65.6°C), applications where increased pipe joint flexibility is needed, lubrication of gaskets in copper systems, and for the lubrication of gaskets on HDPE couplings. Since it is formulated from a non-hydro carbon base, it can be used with EPDM, Nitrile and Fluoroelastomer gasket materials. **It is not to be used with Silicone gaskets.**

- In low temperature applications the gasket will shrink, thereby lowering the sealing force on the gasket sealing lips. The temperature change will also force the gasket to slightly re-position itself. This will cause pipe end sealing surfaces, with small cuts or damage, to become more susceptible to leakage. Gruvlok Xtreme Lubricant will maintain its lubricating properties at lower temperatures allowing a properly lubricated pipe end and gasket (assembly) to reposition itself during temperature cycles.
- For high temperature service and copper systems, it is required that the gasket be lubricated not only on the outside, as with the normal installation of a Gruvlok gasket, but also on the inside. Lubrication on the inside of the gasket is easily accomplished by turning the gasket inside out and applying the lubricant. Gruvlok Xtreme Lubricant will maintain its lubricating properties at higher temperatures, allowing a properly lubricated pipe end and gasket assembly to re-position itself during temperature cycles. Lubrication of the pipe end and gasket will help the gasket to adjust into the proper sealing position during temperature cycles. The lubricant on the interior of the gasket will act to improve the chemical resistance of the gasket material by providing a thin lubricant barrier between the piping system fluid and the gasket surface. This is particularly important at higher temperatures where oxidizing agents in the piping system become more aggressive. **However, gasket chemical compatibility must still be considered.**
- The Gruvlok Xtreme Lubricant has been formulated from low viscosity, non-petroleum based oils to ease spreading of the lubricant. In applications where pipe movement is expected, proper lubrication of the gasket's exterior assists the gasket into the proper sealing position as pipe system movement occurs. This lubricating film enhances our flexible coupling gasket's ability to compensate for axial, transverse and rotational pipe movements.
- Gruvlok Xtreme Lubricant is the only Gruvlok lubricant that is to be used with Gruvlok couplings and gaskets in HDPE and copper piping systems. It's low temperature capability and lubricity ensure a highly reliable connection.

Gruvlok® Xtreme™ Lubricant is a Teflon® fortified white, tasteless and odorless grease made from Silicone Oil and other ingredients that are safe to ingest. It is sanctioned by the FDA under C.F.R. 21.172.878 & 21.177.1550 (Incidental Food Contact). It is NSF approved for use with potable water.

CAUTION: Silicone based lubricants are not allowed in some facilities. Do not use with CPVC Products.

®Teflon is a registered trademark of Dupont.

GRUVLOK® QUICK DRY LUBRICANT

Gruvlok® Quick Dry Lubricant is a fast drying lubricant that has been developed for applications where the piping system is exposed. The service temperature range for this lubricant is from 0° F to 150° F (-17.8°C to 65.6°C) and may be used with all Gruvlok gasket material grades. The lubricant is made from a water emulsion that is non-toxic, it will not impart taste or odor, and does not support bacterial growth. Gruvlok Quick Dry Lubricant is non-corrosive, non-flammable, and is NSF approved for use with potable water.

This lubricant is easy to apply by brush or hand, and it quickly dries to a thin film when in contact with air. It is water-soluble. The quick drying quality of the lubricant eliminates lubricant drips caused by over lubrication. If necessary, reapply lubricant prior to assembly. Do not thin or mix with solvents.

GRUVLOK® LUBRICANT

Gruvlok® Lubricant is the standard lubricant that has been provided for use with Gruvlok products for years. Gruvlok Lubricant is water soluble, non-toxic, non-corrosive, non-flammable, and will not impart taste or odor. It is NSF approved for use with potable water. This lubricant is acceptable for most applications, however, the Gruvlok Xtreme Lubricant and Gruvlok Quick Dry Lubricant are now available to improve the performance of the couplings and flanges in certain applications.

CAUTION: HDPE pipe requires the use of Gruvlok Xtreme Lubricant and should not be used with Gruvlok Lubricant.

Specified Bolt Torque

Specified bolt torque is for the oval neck track bolts used on Gruvlok couplings and flanges. The nuts must be tightened alternately and evenly until fully tightened.

CAUTION: Use of an Impact wrench is not recommended because the torque output can vary significantly due to many variables including air pressure supply, battery strength and operational variations.

CAUTION: Proper torquing of coupling bolts is required to obtain specified performance. **Over torquing the bolts may result in damage to the bolt and/or casting which could result in pipe joint separation.** Under torquing the bolts may result in lower pressure retention capabilities, lower bend load capabilities, joint leakage and pipe joint separation. Pipe joint separation may result in significant property damage and serious injury.

NOTE: Use specified bolt torque unless otherwise indicated on product installation pages.

ANSI SPECIFIED BOLT TORQUE		
Bolt Size	Wrench Size	Specified Bolt Torque *
In.	*In.*	*Ft.-Lbs.*
3/8	11/16	30-45
1/2	7/8	80-100
5/8	1 1/16	100-130
3/4	1 1/4	130-180
7/8	1 7/16	180-220
1	1 5/8	200-250
1 1/8	1 13/16	225-275
1 1/4	2	250-300

* Non-lubricated bolt torques

METRIC SPECIFIED BOLT TORQUE		
Bolt Size	Wrench Size	Specified Bolt Torque *
mm	*mm*	*N-m*
M10	16	40-60
M12	22	110-150
M16	24	135-175
M20	30	175-245
M22	34	245-300
M24	36	270-340

* Non-lubricated bolt torques

Pipe Preparation

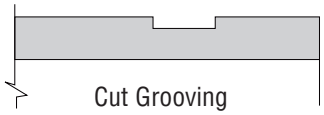
To create a Gruvlok pipe joint, all pipe must be prepared to receive Gruvlok coupling or other Gruvlok pipe system components. The required pipe preparation may be grooving or cleaning the pipe ends, or cutting a hole in the pipe wall.

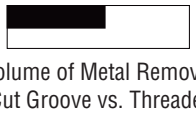
For grooved-end joints, pipe may be grooved by either of two methods; cut or roll grooving. Branch outlet connections require a properly sized and correctly located hole to be cut into the pipe. Sock-it connections require cleaning of the pipe end. Gruvlok plain-end pipe couplings require that the pipe be free of burrs and other sharp projections which could damage the gasket; grooving is not required.

Gruvlok pipe grooving and hole cutting machines are available in a wide variety of designs to meet specific or general requirements. Gruvlok roll grooving machines produce a groove to proper dimensional tolerances, concentric with the pipe O.D., even on out-of-round pipe. Gruvlok hole cutting tools properly center holes for correct assembly of Gruvlok branch outlet components.

Cut-Grooving:

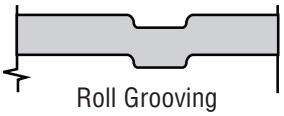
Cut grooving is intended for use with standard and heavier wall pipe. Cut grooving produces a groove in the pipe wall by removing metal from the pipe O.D. The groove removes less than one half of the pipe wall and does not cut as deeply into the pipe wall as do standard pipe threads. The square cut edge of the groove allows for the full expansion, contraction, and deflection capabilities of the Gruvlok coupling.

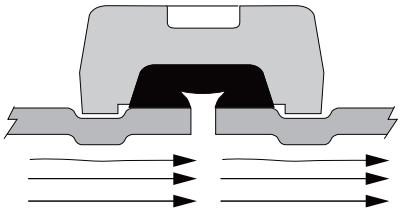




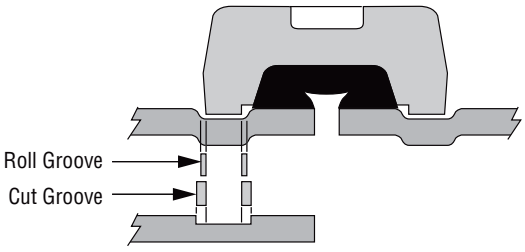
Roll-Grooving:

Roll grooving does not remove metal. Instead, metal is displaced while a groove is formed into the outer surface of the pipe wall. The groove configuration has slightly rounded edges resulting in a less flexible joint than a cut groove joint. This reduces available pipe joint movement by 50% over cut grooved coupling joints. Roll grooving is commonly used on a wide range of pipe thicknesses up to 0.375" wall steel pipe and sizes to 24" O.D.



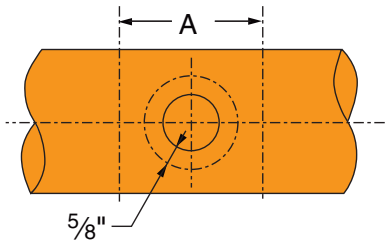


The I.D. "dimple" formed from roll grooving reduces the I.D. (on an average) less than 2%.



Available Movement
Roll Groove vs. Cut Groove

Branch Outlet Pipe: Clamp-T®



Clamp-T installations require the cutting of a hole through the pipe wall. The hole must be properly sized and located on the centerline of the pipe to assure reliable performance of the Clamp-T gaskets.

After the hole has been cut into the pipe wall, any burrs and sharp or rough edges must be removed from the hole. The outside pipe surfaces within 5/8" of the hole must be clean and smooth. Any scale, projections or indentation which might effect the gasket sealing on the pipe must be removed. The surface around the entire circumference of the pipe within the "A" dimension in the charts must be free from dirt, scale, or projections which might effect the proper assembly of the Clamp-T.

CLAMP-T INSTALLATION

Branch Size	Hole Dimensions		Surface Prep. "A"
	Hole Saw Size	Max. Perm. Diameter	
DN/mm	*In./mm*	*In./mm*	*In./mm*
½, ¾, 1 *15, 20, 25*	1½ *38.1*	1⅝ *41.3*	3½ *88.9*
1¼, 1½ *32, 40*	2 *50.8*	2⅛ *54.0*	4 *101.6*
2 *50*	2½ *63.5*	2⅝ *66.7*	4½ *114.3*
2½ *65*	2¾ *69.9*	2⅞ *73.0*	4¾ *120.7*
3 *80*	3½ *88.9*	3⅝ *92.1*	5½ *139.7*
4 *100*	4½ *114.3*	4⅝ *117.5*	6½ *165.1*

Roughneck®:

Plain-End pipe for use with Fig. 7005 Roughneck Couplings must be free of any notches, bumps, weld bead, score marks, etc. for at least 1 1/2" (38 mm) back from the pipe end to provide a smooth sealing surface for the gasket. Pipe ends (plain or beveled end) must be square cut as measured from a true square line with the maximum allowable tolerance as follows: 0.030" (0.7 mm) for 2" through 3"; 0.045 (1.1 mm) for 4" through 6"; and 0.060" (1.5 mm) for 8" sizes. The nominal outside diameter of pipe should not vary more than ff11% for sizes up to 2 1/2", +1%-1/32" for sizes 3"-5"; +1/16"-1/32" for sizes 6" and larger. Pipe ends must be marked a distance of 1" from the pipe end for Sizes 2"-4" and 1 1/4" from the pipe end for Sizes 5"-8" as a guide for centering of the gasket on the pipe ends.

Pipe Preparation *Continued*

Sock-It®:

For Sock-It Fittings, the pipe ends must be square cut as measured from a true square line.

The maximum allowable tolerance is 0.030" (0.76mm) for all sizes. Any sharp edges, burrs, etc. left on the pipe from cutting must be removed. If these are not removed, they may damage the gasket as the pipe is inserted into the Sock-It Fitting.

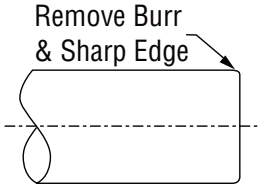
After cutting, pipe ends must be completely cleaned a minimum of 1" (25.4mm) back from the pipe end to remove all pipe coating, weld beads, rust, sharp projections, etc., which might effect gasket sealing integrity.

NOTE: When Allied XL pipe is used it is necessary only to remove sharp edges and burrs at the end of the pipe. No additional cleaning is required.

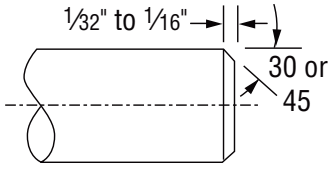
PIPE TOLERANCES

Size	Schedule 10 & 40		Min. O.D.	XL Min. O.D.
	Nom O.D.	Max. O.D.		
DN/mm	*In./mm*	*In./mm*	*In./mm*	*In./mm*
1 *25*	1.315 *33.4*	1.325 *33.6*	1.295 *32.9*	1.285 *32.6*
1¼ *32*	1.660 *42.2*	1.670 *42.4*	1.642 *41.7*	1.630 *41.4*
1½ *40*	1.900 *48.3*	1.910 *48.5*	1.882 *47.8*	1.875 *47.6*
2 *50*	2.375 *60.3*	2.385 *60.6*	2.357 *59.9*	2.352 *59.7*
2½ *65*	2.875 *73.0*	2.904 *73.8*	2.846 *72.3*	2.837 *72.1*

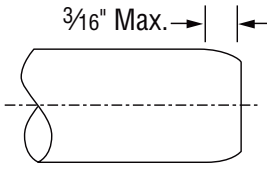
ACCEPTABLE PIPE END CONFIGURATION



Square cut pipe with O.D. burr & sharp edge removed is preferred configuration.

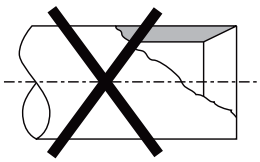


Beveled pipe. Bevel not to exceed 1/16".

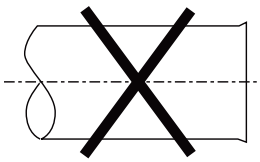


Soft pipe when roll cut may be swaged inward. Swaged portion not to exceed 3/16"

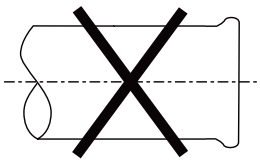
UNACCEPTABLE



Excessive chamfer on I.D. will tend to cut gasket during assembly.



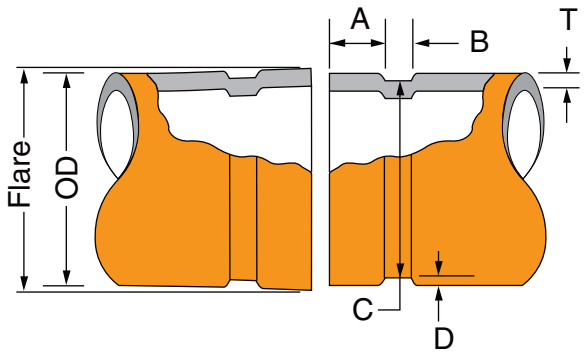
Abrasive wheels & saws leave edge burrs especially pronounced on one side.



Dull wheel cutter produces a raised ridge at the pipe O.D. giving an oversize diameter.

The sharp O.D. edge left by different methods of cutting pipe ***must be removed***. If this sharp edge is not removed, it may damage the gasket as the pipe is inserted into the Sock-It Fitting.

ROLL GROOVE SPECIFICATIONS



COLUMN 1 - Nominal IPS Pipe size. Nominal ISO Pipe size.
COLUMN 2 - IPS outside diameter. ISO outside diameter.
COLUMN 3 - Gasket seat must be free from scores, seams, chips, rust or scale which may interfere with proper sealing of the gasket. Gasket seat width (Dimension A) is to be measured from the pipe end to the vertical flank in the groove wall.
COLUMN 4 - Groove width (Dimension B) is to be measured between vertical flank of the groove size walls.
COLUMN 5 - The groove must be of uniform depth around the entire pipe circumference. (See column 6).
COLUMN 6 - Groove depth: for reference only. Groove must conform to the groove diameter "C" listed in column 5.
COLUMN 7 - Minimum allowable wall thickness which may be roll grooved.
COLUMN 8 - Maximum allowable pipe end flare diameter. Measured at the most extreme pipe end diameter of the gasket seat area.

Out of roundness: Difference between maximum O.D. and minimum O.D. measured at 90° must not exceed total O.D. tolerance listed (reference column 2).

For IPS pipe, the maximum allowable tolerance from square cut ends is 0.03" for 1" thru 3½"; 0.045" for 4" thru 6"; and 0.060" for sizes 8" and above measured from a true square line.

For ISO size pipe, the maximum allowable tolerance from square cut ends is 0.75mm for sizes 25mm-80mm; 1.15mm for sizes 100mm-150mm; and 1.50mm for sizes 200mm and above, measured from a true square line.

Beveled-End Pipe in conformance with ANSI B16.25 (37½°) is acceptable, however square cut is preferred. Seams must be ground flush with the pipe O.D. and ID prior to roll grooving. Failure to do so may result in damage to the roll grooving machine and unacceptable roll grooves may be produced.

Weld Seams must be ground flush with the pipe O.D. and ID prior to roll grooving. Failure to do so may result in damage to the roll grooving machine and unacceptable roll grooves may be produced.

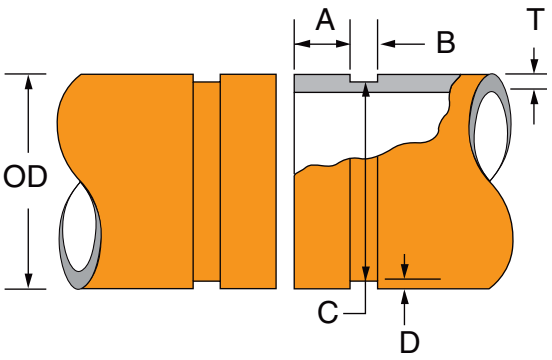
▼ "A" tolerance +0.030" / -0.060" (+0.77 / -1.54 mm)

NOTE: VdS - Roll Grooving Approval Specifications, see the Technical Data/Install Instructions section on Anvil's web site - www.anvilintl.com

GRUVLOK STANDARD ROLL GROOVE SPECIFICATION FOR STEEL & OTHER IPS OR ISO SIZE PIPE

-1-	-2-			-3-	-4-	-5-		-6-	-7-	-8-
Nom. Pipe Size	O.D.			"A" ±0.030/ ±0.76	"B" ±0.030/ ±0.76	"C" Actual	"C" Tol. +0.000	"D" (Ref. Only)	"T" Min. Allow. Wall Thick	Max. Flare Dia.
	Actual	Tolerance								
In./DN(mm)	*In./mm*	*+In./mm*	*-In./mm*	*In./mm*	*In./mm*	*In./mm*	*-In./mm*	*In./mm*	*In./mm*	*In./mm*
1 *25*	1.315 *33.4*	+0.028 *+0.71*	-0.015 *-0.38*	0.625 *15.88*	0.281 *7.14*	1.190 *30.23*	-0.015 *-0.38*	0.063 *1.60*	0.065 *1.7*	1.430 *36.3*
1¼ *32*	1.660 *42.2*	+0.029 *+0.74*	-0.016 *-0.41*	0.625 *15.88*	0.281 *7.14*	1.535 *38.99*	-0.015 *-0.38*	0.063 *1.60*	0.065 *1.7*	1.770 *45.0*
1½ *40*	1.900 *48.3*	+0.019 *+0.48*	-0.019 *-0.48*	0.625 *15.88*	0.281 *7.14*	1.775 *45.09*	-0.015 *-0.38*	0.063 *1.60*	0.065 *1.7*	2.010 *51.1*
2 *50*	2.375 *60.3*	+0.024 *+0.61*	-0.024 *-0.61*	0.625 *15.88*	0.344 *8.74*	2.250 *57.15*	-0.015 *-0.38*	0.063 *1.60*	0.065 *1.7*	2.480 *63.0*
2½ *65*	2.875 *73.0*	+0.029 *+0.74*	-0.029 *-0.74*	0.625 *15.88*	0.344 *8.74*	2.720 *69.09*	-0.018 *-0.46*	0.078 *1.98*	0.083 *2.1*	2.980 *75.7*
3 O.D. 76.1	*2.996* 76.1	*+0.030* +0.76	*-0.030* -0.76	*0.625* 15.88	*0.344* 8.74	*2.845* 72.26	*-0.018* -0.46	*0.076* 1.93	*0.083* 2.1	*3.100* 78.7
3 *80*	3.500 *88.9*	+0.035 *+0.89*	-0.031 *-0.79*	0.625 *15.88*	0.344 *8.74*	3.344 *84.94*	-0.018 *-0.46*	0.078 *1.98*	0.083 *2.1*	3.600 *91.4*
3½ *90*	4.000 *101.6*	+0.040 *+1.02*	-0.031 *-0.79*	0.625 *15.88*	0.344 *8.74*	3.834 *97.38*	-0.020 *-0.51*	0.083 *2.11*	0.083 *2.1*	4.100 *104.1*
4¼ O.D. 108.0	*4.250* 108.0	*+0.042* +1.07	*-0.031* -0.79	*0.625* 15.88	*0.344* 8.74	*4.084* 103.73	*-0.020* -0.51	*0.083* 2.11	*0.083* 2.1	*4.350* 110.5
4 *100*	4.500 *114.3*	+0.045 *+1.14*	-0.031 *-0.79*	0.625 *15.88*	0.344 *8.74*	4.334 *110.08*	-0.020 *-0.51*	0.083 *2.11*	0.083 *2.1*	4.600 *116.8*
5¼ O.D. 133.0	*5.236* 133.0	*+0.052* +1.32	*-0.031* -0.79	*0.625* 15.88	*0.344* 8.74	*5.084* 129.13	*-0.020* -0.51	*0.076* 1.93	*0.109* 2.8	*5.350* 135.9
5½ O.D. 139.7	*5.500* 139.7	*+0.055* +1.40	*-0.031* -0.79	*0.625* 15.88	*0.344* 8.74	*5.334* 135.48	*-0.020* -0.51	*0.083* 2.11	*0.109* 2.8	*5.600* 142.2
5 *125*	5.563 *141.3*	+0.056 *+1.42*	-0.031 *-0.79*	0.625 *15.88*	0.344 *8.74*	5.395 *137.03*	-0.022 *-0.56*	0.084 *2.13*	0.109 *2.8*	5.660 *143.8*
6¼ O.D. 159.0	*6.259* 159.0	*+0.063* +1.60	*-0.031* -0.79	*0.625* 15.88	*0.344* 8.74	*6.084* 154.53	*-0.022* -0.56	*0.088* 2.24	*0.109* 2.8	*6.350* 161.3
6½ O.D. 165.1	*6.500* 165.1	*+0.063* +1.60	*-0.031* -0.79	*0.625* 15.88	*0.344* 8.74	*6.334* 160.88	*-0.022* -0.56	*0.085* 2.16	*0.109* 2.8	*6.600* 167.6
6 *150*	6.625 *168.3*	+0.063 *+1.60*	-0.031 *-0.79*	0.625 *15.88*	0.344 *8.74*	6.455 *163.96*	-0.022 *-0.56*	0.085 *2.16*	0.109 *2.8*	6.730 *170.9*
8 *200*	8.625 *219.1*	+0.063 *+1.60*	-0.031 *-0.79*	0.750 *19.05*	0.469 *11.91*	8.441 *214.40*	-0.025 *-0.64*	0.092 *2.34*	0.109 *2.8*	8.800 *223.5*
10 *250*	10.750 *273.1*	+0.063 *+1.60*	-0.031 *-0.79*	0.750 *19.05*	0.469 *11.91*	10.562 *268.27*	-0.027 *-0.69*	0.094 *2.39*	0.134 *3.4*	10.920 *277.4*
12 *300*	12.750 *323.9*	+0.063 *+1.60*	-0.031 *-0.79*	0.750 *19.05*	0.469 *11.91*	12.531 *318.29*	-0.030 *-0.76*	0.109 *2.77*	0.156 *4.0*	12.920 *328.2*
14 O.D. *355.6*	14.000 *355.6*	+0.063 *+1.60*	-0.031 *-0.79*	0.938 *23.83*	0.469 *11.91*	13.781 *350.04*	-0.030 *-0.76*	0.109 *2.77*	0.156 *4.0*	14.100 *358.1*
16 O.D. *406.4*	16.000 *406.4*	+0.063 *+1.60*	-0.031 *-0.79*	0.938 *23.83*	0.469 *11.91*	15.781 *400.84*	-0.030 *-0.76*	0.109 *2.77*	0.165 *4.2*	16.100 *408.9*
18 O.D. *457.2*	18.000 *457.2*	+0.063 *+1.60*	-0.031 *-0.79*	1.000 *25.40*	0.469 *11.91*	17.781 *451.64*	-0.030 *-0.76*	0.109 *2.77*	0.165 *4.2*	18.160 *461.3*
20 O.D. *508.0*	20.000 *508.0*	+0.063 *+1.60*	-0.031 *-0.79*	1.000 *25.40*	0.469 *11.91*	19.781 *502.44*	-0.030 *-0.76*	0.109 *2.77*	0.188 *4.8*	20.160 *512.1*
24 O.D. *609.6*	24.000 *609.6*	+0.063 *+1.60*	-0.031 *-0.79*	1.000 *25.40*	0.500 *12.70*	23.656 *600.86*	-0.030 *-0.76*	0.172 *4.37*	0.218 *5.5*	24.200 *614.7*
30 O.D. *762.0*	30.000 *762.0*	+0.093 *2.36*	-0.031 *0.79*	1.750▼ *44.45*	0.625 *15.88*	29.500 *749.30*	-0.063 *1.60*	0.250 *6.35*	0.250 *6.35*	30.200 *761.1*

CUT GROOVE SPECIFICATIONS



COLUMN 1 - Nominal IPS Pipe size. Nominal ISO Pipe size.
COLUMN 2 - IPS outside diameter. ISO outside diameter.
COLUMN 3 & 4 - Gasket seat must be free from scores, seams, chips, rust or scale which may interfere with proper coupling assembly.
COLUMN 5 - The groove must be of uniform depth around the entire pipe circumference. (See column 6).
COLUMN 6 - Groove depth: for reference only. Groove must conform to the groove diameter "C" listed in column 5.
COLUMN 7 - Minimum allowable wall thickness which may be cut grooved.

Out of roundness: Difference between maximum O.D. and minimum O.D. measured at 90° must not exceed total O.D. tolerance listed (reference column 2).

For IPS pipe, the maximum allowable tolerance from square cut ends is 0.03" for 1" thru 3½"; 0.045" for 4" thru 6"; and 0.060" for sizes 8" and above measured from a true square line.

For ISO size pipe, the maximum allowable tolerance from square cut ends is 0.75mm for sizes 25mm-80mm; 1.15mm for sizes 100mm-150mm; and 1.50mm for sizes 200mm and above, measured from a true square line.

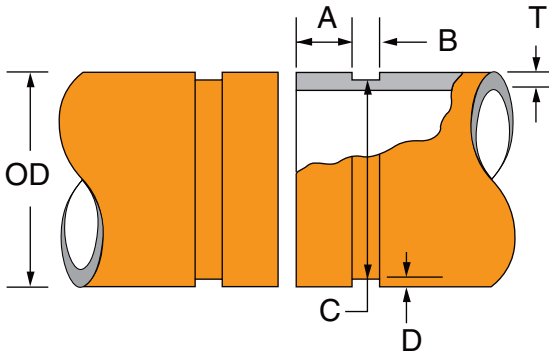
Beveled-End Pipe in conformance with ANSI B16.25 (37½°) is acceptable, however square cut is preferred. **Not to be used with End Guard gaskets.**

▼ "A" tolerance +0.030" / -0.060" (+0.77 / -1.54 mm)

GRUVLOK STANDARD CUT GROOVE SPECIFICATION FOR STEEL & OTHER IPS OR ISO SIZE PIPE

-1-	-2-			-3-	-4-	-5-		-6-	-7-
Nom. IPS Pipe Size	O.D.			Gasket Seat "A" ±0.030 ±0.76	Groove Width "B" ±0.030 ±0.76	Groove Diameter "C"		Actual Groove Depth "D" (Ref. Only)	Min. Allow. Wall Thick. "T"
	Actual	Tolerance				Actual	Tol. +0.000		
In./DN(mm)	*In./mm*	*+In./mm*	*-In./mm*	*In./mm*	*In./mm*	*In./mm*	*-In./mm*	*In./mm*	*In./mm*
1 *25*	1.315 *33.4*	+0.028 *+0.71*	-0.015 *-0.38*	0.625 *15.88*	0.312 *7.92*	1.190 *30.23*	-0.015 *-0.38*	0.062 *1.6*	0.133 *3.4*
1¼ *32*	1.660 *42.2*	+0.029 *+0.74*	-0.016 *-0.41*	0.625 *15.88*	0.312 *7.92*	1.535 *38.99*	-0.015 *-0.38*	0.062 *1.6*	0.140 *3.6*
1½ *40*	1.900 *48.3*	+0.019 *+0.48*	-0.019 *-0.48*	0.625 *15.88*	0.312 *7.92*	1.775 *45.09*	-0.015 *-0.38*	0.062 *1.6*	0.145 *3.7*
2 *50*	2.375 *60.3*	+0.024 *+0.61*	-0.024 *-0.61*	0.625 *15.88*	0.312 *7.92*	2.250 *57.15*	-0.015 *-0.38*	0.062 *1.6*	0.154 *3.9*
2½ *65*	2.875 *73.0*	+0.029 *+0.74*	-0.029 *-0.74*	0.625 *15.88*	0.312 *7.92*	2.720 *69.09*	-0.018 *-0.46*	0.078 *2.0*	0.187 *4.8*
3 O.D. 76.1	*2.996* 76.1	*+0.030* +0.76	*-0.030* -0.76	*0.625* 15.88	*0.312* 7.92	*2.845* 72.26	*-0.018* -0.46	*0.076* 1.9	*0.188* 4.8
3 *80*	3.500 *88.9*	+0.035 *+0.89*	-0.031 *-0.79*	0.625 *15.88*	0.312 *7.92*	3.344 *84.94*	-0.018 *-0.46*	0.078 *2.0*	0.188 *4.8*
3½ *90*	4.000 *101.6*	+0.040 *+1.02*	-0.031 *-0.79*	0.625 *15.88*	0.312 *7.92*	3.834 *97.38*	-0.020 *-0.51*	0.083 *2.1*	0.188 *4.8*
4¼ O.D. 108.0	*4.250* 108.0	*+0.042* +1.07	*-0.031* -0.79	*0.625* 15.88	*0.375* 9.53	*4.084* 103.73	*-0.020* -0.51	*0.083* 2.1	*0.203* 5.2
4 *100*	4.500 *114.3*	+0.045 *+1.14*	-0.031 *-0.79*	0.625 *15.88*	0.375 *9.53*	4.334 *110.08*	-0.020 *-0.51*	0.083 *2.1*	0.203 *5.2*
5¼ O.D. 133.0	*5.236* 133.0	*+0.052* +1.32	*-0.031* -0.79	*0.625* 15.88	*0.375* 9.53	*5.084* 129.13	*-0.020* -0.51	*0.076* 1.9	*0.203* 5.2
5½ O.D. 139.7	*5.500* 139.7	*+0.055* +1.40	*-0.031* -0.79	*0.625* 15.88	*0.375* 9.53	*5.334* 135.48	*-0.020* -0.51	*0.083* 2.1	*0.203* 5.2
5 *125*	5.563 *141.3*	+0.056 *+1.42*	-0.031 *-0.79*	0.625 *15.88*	0.375 *9.53*	5.395 *137.03*	-0.022 *-0.56*	0.084 *2.1*	0.203 *5.2*
6¼ O.D. 159.0	*6.259* 159.0	*+0.063* +1.60	*-0.031* -0.79	*0.625* 15.88	*0.375* 9.53	*6.084* 154.53	*-0.022* -0.56	*0.088* 2.2	*0.249* 6.3
6½ O.D. 165.1	*6.500* 165.1	*+0.063* +1.60	*-0.031* -0.79	*0.625* 15.88	*0.375* 9.53	*6.334* 160.88	*-0.022* -0.56	*0.085* 2.2	*0.219* 5.6
6 *150*	6.625 *168.3*	+0.063 *+1.60*	-0.031 *-0.79*	0.625 *15.88*	0.375 *9.53*	6.455 *163.96*	-0.022 *-0.56*	0.085 *2.2*	0.219 *5.6*
8 *200*	8.625 *219.1*	+0.063 *+1.60*	-0.031 *-0.79*	0.750 *19.05*	0.437 *11.10*	8.441 *214.40*	-0.025 *-0.64*	0.092 *2.3*	0.238 *6.1*
10 *250*	10.750 *273.1*	+0.063 *+1.60*	-0.031 *-0.79*	0.750 *19.05*	0.500 *12.70*	10.562 *268.27*	-0.027 *-0.69*	0.094 *2.4*	0.250 *6.4*
12 *300*	12.750 *323.9*	+0.063 *+1.60*	-0.031 *-0.79*	0.750 *19.05*	0.500 *12.70*	12.531 *318.29*	-0.030 *-0.76*	0.109 *2.8*	0.279 *7.1*
14 O.D. *355.6*	14.000 *355.6*	+0.063 *+1.60*	-0.031 *-0.79*	0.938 *23.83*	0.500 *12.70*	13.781 *350.04*	-0.030 *-0.76*	0.109 *2.8*	0.281 *7.1*
16 O.D. *406.4*	16.000 *406.4*	+0.063 *+1.60*	-0.031 *-0.79*	0.938 *23.83*	0.500 *12.70*	15.781 *400.84*	-0.030 *-0.76*	0.109 *2.8*	0.312 *7.9*
18 O.D. *457.2*	18.000 *457.2*	+0.063 *+1.60*	-0.031 *-0.79*	1.000 *25.40*	0.500 *12.70*	17.781 *451.64*	-0.030 *-0.76*	0.109 *2.8*	0.312 *7.9*
20 O.D. *508.0*	20.000 *508.0*	+0.063 *+1.60*	-0.031 *-0.79*	1.000 *25.40*	0.500 *12.70*	19.781 *502.44*	-0.030 *-0.76*	0.109 *2.8*	0.312 *7.9*
24 O.D. *609.6*	24.000 *609.6*	+0.063 *+1.60*	-0.031 *-0.79*	1.000 *25.40*	0.563 *14.30*	23.656 *600.86*	-0.030 *-0.76*	0.172 *4.4*	0.375 *9.5*
28 I.D. *733.4*	28.875 *733.4*	+0.063 *+1.60*	-0.031 *-0.79*	1.000 *25.40*	0.563 *14.30*	28.531 *724.69*	-0.030 *-0.76*	0.172 *4.4*	0.437 *11.1*
30 I.D. *787.4*	31.000 *787.4*	+0.063 *+1.60*	-0.031 *-0.79*	1.250 *31.75*	0.625 *15.88*	30.594 *777.09*	-0.030 *-0.76*	0.203 *5.2*	0.500 *12.7*
30 O.D. *762.0*	30.000 *762.0*	0.093 *2.36*	0.031 *0.79*	1.750▼ *44.45*	0.625 *15.88*	29.500 *749.30*	0.063 *1.60*	0.250 *6.35*	0.625 *15.88*

CUT GROOVE END GUARD® SPECIFICATIONS



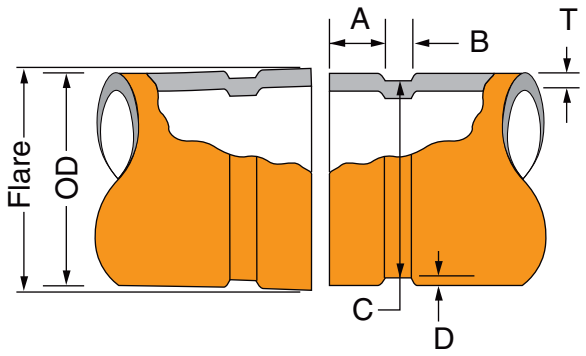
End Guard (EG) cut groove is designed for standard or heavier wall thickness pipe to be joined by HPR 7004 EG couplings. Gruvlok EG fittings are grooved in accordance with these dimensions.

END GUARD (EG) CUT GROOVE SPECIFICATIONS*

-1-	-2-			-3-		-4-		-5-		-6-	-7-
Nom. IPS Pipe Size	Pipe Outside Diameter			Gasket Seat "A"		Groove Width "B"		Groove Diameter "C"		Groove Depth (Ref. Only) "D"	Min. Allow. Wall Thick. "T"
	Actual	Tolerance		Actual	Tol.+/-	Actual	Tol. (+0.010)	Actual	Tol.		
In./DN(mm)	*In./mm*	*+In./mm*	*-In./mm*	*In./mm*	*In./mm*	*In./mm*	*-In./mm*	*In./mm*	*In./mm*	*In./mm*	*In./mm*
2 *50*	2.375 *60.3*	+0.024 *+0.61*	-0.024 *-0.61*	0.562 *14.27*	+0.010 *0.25*	0.255 *6.48*	-0.005 *-0.13*	2.250 *57.15*	-0.015 *-0.38*	0.062 *1.6*	0.154 *4.0*
2½ *65*	2.875 *73.0*	+0.029 *+0.74*	-0.029 *-0.74*	0.562 *14.27*	+0.010 *0.25*	0.255 *6.48*	-0.005 *-0.13*	2.720 *69.09*	-0.018 *-0.46*	0.078 *2.0*	0.188 *4.8*
3 *80*	3.500 *88.9*	+0.035 *+0.89*	-0.031 *-0.79*	0.562 *14.27*	+0.010 *0.25*	0.255 *6.48*	-0.005 *-0.13*	3.344 *84.94*	-0.018 *-0.46*	0.078 *2.0*	0.188 *4.8*
4 *100*	4.500 *114.3*	+0.045 *+1.14*	-0.031 *-0.79*	0.605 *15.37*	+0.015 *0.38*	0.305 *7.75*	-0.005 *-0.13*	4.334 *110.08*	-0.020 *-0.51*	0.083 *2.1*	0.203 *5.2*
5 *125*	5.563 *141.3*	+0.056 *+1.42*	-0.031 *-0.79*	0.605 *15.37*	+0.015 *0.38*	0.305 *7.75*	-0.005 *-0.13*	5.395 *137.03*	-0.022 *-0.56*	0.084 *2.1*	0.203 *5.2*
6 *150*	6.625 *168.3*	+0.063 *+1.60*	-0.031 *-0.79*	0.605 *15.37*	+0.015 *0.38*	0.305 *7.75*	-0.005 *-0.13*	6.455 *163.96*	-0.022 *-0.56*	0.085 *2.2*	0.219 *5.6*
8 *200*	8.625 *219.1*	+0.063 *+1.60*	-0.031 *-0.79*	0.714 *18.14*	+0.015 *0.38*	0.400 *10.16*	-0.010 *-0.254*	8.441 *214.40*	-0.025 *-0.64*	0.092 *2.3*	0.238 *6.1*
10 *250*	10.750 *273.1*	+0.063 *+1.60*	-0.031 *-0.79*	0.714 *18.14*	+0.015 *0.38*	0.400 *10.16*	-0.010 *-0.25*	10.562 *268.27*	-0.027 *-0.69*	0.094 *2.4*	0.250 *6.4*
12 *300*	12.750 *323.9*	+0.063 *+1.60*	-0.031 *-0.79*	0.714 *18.14*	+0.015 *0.38*	0.400 *10.16*	-0.010 *-0.25*	12.531 *318.29*	-0.030 *-0.76*	0.109 *2.8*	0.279 *7.1*

*Refer to additional notes on page 32.

ROLL GROOVE END GUARD® SPECIFICATIONS



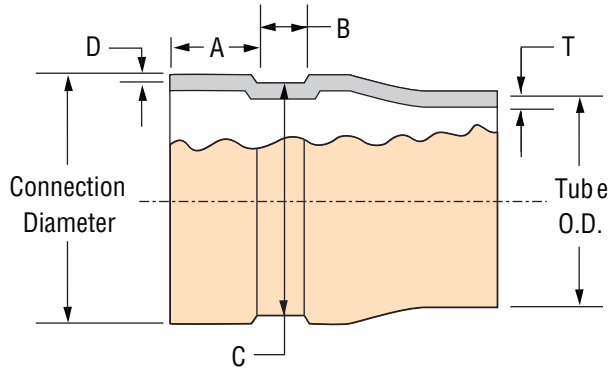
End Guard (EG) roll groove is designed for lightwall pipe to be joined by HPR 7004 EG couplings.

END GUARD (EG) ROLL GROOVE SPECIFICATIONS*

-1-	-2-			-3-		-4-		-5-		-6-	-7-
Nom. IPS Pipe Size	Pipe Outside Diameter			Gasket Seat "A"		Groove Width "B"		Groove Diameter "C"		Groove Depth (Ref. Only) "D"	Min. Allow. Wall Thick. "T"
	Actual	Tolerance		Actual	Tol.+/-	Actual	Tol. (+0.010)	Actual	Tol.		
In./DN(mm)	*In./mm*	*+In./mm*	*-In./mm*	*In./mm*	*In./mm*	*In./mm*	*-In./mm*	*In./mm*	*In./mm*	*In./mm*	*In./mm*
2 *50*	2.375 *60.3*	+0.024 *+0.61*	-0.024 *-0.61*	0.572 *+14.53*	-0.020 *-0.51*	0.250 *6.35*	+0.015 *0.38*	2.250 *57.15*	-0.015 *-0.38*	0.062 *1.6*	0.065 *1.7*
2½ *65*	2.875 *73.0*	+0.029 *+0.74*	-0.029 *-0.74*	0.572 *+14.53*	-0.020 *-0.51*	0.250 *6.35*	+0.015 *0.38*	2.720 *69.09*	-0.018 *-0.46*	0.078 *2.0*	0.083 *2.1*
3 *80*	3.500 *88.9*	+0.035 *+0.89*	-0.031 *-0.79*	0.572 *+14.53*	-0.020 *-0.51*	0.250 *6.35*	+0.015 *0.38*	3.344 *84.94*	-0.018 *-0.46*	0.078 *2.0*	0.083 *2.1*
4 *100*	4.500 *114.3*	+0.045 *+1.14*	-0.031 *-0.79*	0.610 *+15.49*	-0.020 *-0.51*	0.300 *7.62*	+0.020 *0.51*	4.334 *110.08*	-0.020 *-0.51*	0.083 *2.1*	0.083 *2.1*
5 *125*	5.563 *141.3*	+0.056 *+1.42*	-0.031 *-0.79*	0.610 *+15.49*	-0.020 *-0.51*	0.300 *7.62*	+0.020 *0.51*	5.395 *137.03*	-0.022 *-0.56*	0.084 *2.1*	0.109 *2.8*
6 *150*	6.625 *168.3*	+0.063 *+1.60*	-0.031 *-0.79*	0.610 *+15.49*	-0.020 *-0.51*	0.300 *7.62*	+0.020 *0.51*	6.455 *163.96*	-0.022 *-0.56*	0.085 *2.2*	0.109 *2.8*
8 *200*	8.625 *219.1*	+0.063 *+1.60*	-0.031 *-0.79*	0.719 *+18.26*	-0.020 *-0.51*	0.390 *9.91*	+0.020 *0.51*	8.441 *214.40*	-0.025 *-0.64*	0.092 *2.3*	0.109 *2.8*
10 *250*	10.750 *273.1*	+0.063 *+1.60*	-0.031 *-0.79*	0.719 *+18.26*	-0.020 *-0.51*	0.390 *9.91*	+0.020 *0.51*	10.562 *268.27*	-0.027 *-0.69*	0.094 *2.4*	0.134 *3.4*
12 *300*	12.750 *323.9*	+0.063 *+1.60*	-0.031 *-0.79*	0.719 *+18.26*	-0.020 *-0.51*	0.390 *9.91*	+0.020 *0.51*	12.531 *318.29*	-0.030 *-0.76*	0.109 *2.8*	0.156 *4.0*

*Refer to additional notes on page 32.

GRUVLOK® ADVANCED COPPER METHOD (IPS)
Copper Prep Specifications



Gruvlok copper prep roll groove specifications for
Types K, L, M and DWV copper tubing

COLUMN 1 - Nominal ASTM B 88 copper tubing size.
COLUMN 2 - Outside diameter of copper tubing in accordance with ASTM B 88.
COLUMN 3 - Outside diameter of Copper Prep roll grooved copper tubing.
COLUMN 4 - Gasket seat and groove must be free from scores, seams, chips, rust or scale which may interfere with proper coupling assembly.
COLUMN 5 - Groove width is to be measured between vertical flank of the groove size walls.
COLUMN 6 - The groove must be of uniform depth around the entire tubing circumference. (See column 7).
COLUMN 7 - Groove depth: for reference only. Groove must conform to the groove diameter "C" listed in column 6.
COLUMN 8 - Minimum allowable copper tube wall thickness which may be prepared to Gruvlok Copper-Prep specifications.
COLUMN 9 - Maximum allowable end flare diameter. Measured at the most extreme tubing end diameter of the gasket seat area.

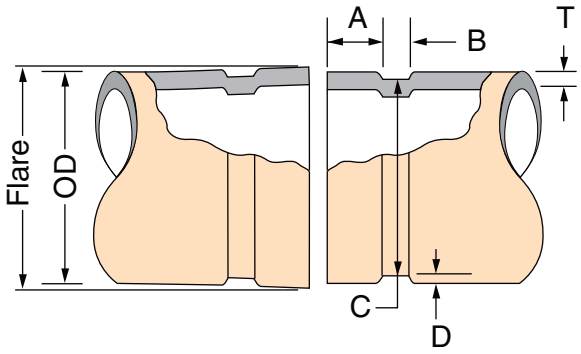
GRUVLOK COPPER PREP SPECIFICATIONS

-1-	-2-			-3-			-4-	-5-	-6-		-7-	-8-	-9-
Nom. Tubing Size	Tubing Outside Dia.			Tube End Connection Dia.			Gasket Seat A ± .030 ± .77	Groove Width B ± .030 ± .77	Groove Diameter "C"		Groove Depth D (Ref. Only)	Allow Wall Thick T	Max. Flare Dia.
	Actual	Tolerance		Actual	Tolerance				Actual	Tol. +0.000			
In./DN(mm)	*In./mm*	*+In./mm*	*–In./mm*	*In./mm*	*+In./mm*	*–In./mm*	*In./mm*	*In./mm*	*In./mm*	*–In./mm*	*In./mm*	*In./mm*	*In./mm*
2	2.125	0.002	0.002	2.375	0.045	0.024	0.625	0.344	2.250	-0.015	0.063	0.059	2.447
50	*54.0*	*0.05*	*0.05*	*60.33*	*1.14*	*0.61*	*15.88*	*8.74*	*57.15*	*-0.381*	*1.60*	*1.50*	*62.15*
2½	2.625	0.002	0.002	2.875	0.029	0.029	0.625	0.344	2.720	-0.018	0.077	0.065	2.962
65	*66.7*	*0.05*	*0.05*	*73.03*	*0.74*	*0.74*	*15.88*	*8.74*	*69.09*	*-0.46*	*1.96*	*1.65*	*75.23*
3	3.125	0.002	0.002	3.500	0.035	0.031	0.625	0.344	3.344	-0.018	0.078	DWV	3.566
80	*79.4*	*0.05*	*0.05*	*88.90*	*0.89*	*0.79*	*15.88*	*8.74*	*84.94*	*-0.46*	*1.98*		*90.58*
4	4.125	0.002	0.002	4.500	0.045	0.031	0.625	0.344	4.334	-0.020	0.083	DWV	4.576
100	*104.8*	*0.05*	*0.05*	*114.30*	*1.14*	*0.79*	*15.88*	*8.74*	*110.08*	*-0.51*	*2.11*		*116.23*
5	5.125	0.002	0.002	5.562	0.056	0.031	0.625	0.344	5.395	-0.022	0.084	DWV	5.650
125	*130.2*	*0.05*	*0.05*	*141.27*	*1.42*	*0.79*	*15.88*	*8.74*	*137.03*	*-0.56*	*2.13*		*143.51*
6	6.125	0.002	0.002	6.625	0.063	0.031	0.625	0.344	6.455	-0.022	0.085	DWV	6.719
150	*155.6*	*0.05*	*0.05*	*168.28*	*1.60*	*0.79*	*15.88*	*8.74*	*163.96*	*-0.56*	*2.16*		*170.66*
8	8.125	0.002	0.004	8.625	0.063	0.031	0.750	0.469	8.441	-0.025	0.092	DWV	8.719
200	*206.4*	*0.05*	*0.10*	*219.08*	*1.60*	*0.79*	*19.05*	*11.91*	*214.40*	*-0.64*	*2.34*		*221.46*

NOTES: Out of roundness: Difference between maximum O.D. and minimum O.D. measured at 90° must not exceed tolerance listed.

The maximum allowable tolerance from square cut ends is 0.030" for 2" thru 3"; 0.045" for 4" thru 6"; and 0.060" for 8" measured from a true square line.

GRUVLOK® CTS COPPER SYSTEM
Roll Groove Specifications



GRUVLOK CTS COPPER SYSTEM – ROLL GROOVE SPECIFICATIONS

-1-	-2-			-3-	-4-	-5-		-6-	-7-	-8-
Nom. Size	Tubing Outside Diameter			Gasket Seat "A" +/– 0.03 in. +/– 0.76mm	Groove Width "B" +0.03/–0.00 in. +0.76/–0.00mm	Groove Diameter "C"		Nom. Groove Depth "D"	Min. Wall "T"	Max. Flare Diam.
	Actual	Tolerance				Actual	Tolerance +0.000			
In.	*In./mm*	*+ In./mm*	*– In./mm*	*In./mm*	*In./mm*	*In./mm*	*– In./mm*	*In./mm*	*In./mm*	*In./mm*
2	2.125 *54.0*	0.002 *0.05*	0.002 *0.05*	0.610 *15.5*	0.300 *7.6*	2.029 *51.54*	-0.020 *-0.51*	0.048 *1.2*	0.058 *1.6*	2.220 *56.4*
2½	2.625 *66.7*	0.002 *0.05*	0.002 *0.05*	0.610 *15.5*	0.300 *7.6*	2.525 *64.14*	-0.020 *-0.51*	0.050 *1.3*	0.065 *1.7*	2.720 *69.1*
3	3.125 *79.4*	0.002 *0.05*	0.002 *0.05*	0.610 *15.5*	0.300 *7.6*	3.025 *76.84*	-0.020 *-0.51*	0.050 *1.3*	DWV	3.220 *81.8*
4	4.125 *104.8*	0.002 *0.05*	0.002 *0.05*	0.610 *15.5*	0.300 *7.6*	4.019 *102.08*	-0.020 *-0.51*	0.053 *1.3*	DWV	4.220 *107.2*
5	5.125 *130.2*	0.002 *0.05*	0.002 *0.05*	0.610 *15.5*	0.300 *7.6*	4.999 *126.97*	-0.020 *-0.51*	0.053 *1.3*	DWV	5.220 *132.6*
6	6.125 *155.6*	0.002 *0.05*	0.002 *0.05*	0.610 *15.5*	0.300 *7.6*	5.999 *152.37*	-0.020 *-0.51*	0.063 *1.6*	DWV	6.220 *158.0*
8	8.125 *206.4*	0.002 *0.05*	0.004 *0.10*	0.610 *15.5*	0.300 *7.6*	7.959 *202.16*	-0.020 *-0.51*	0.083 *2.1*	DWV	8.220 *208.8*

COLUMN 1 - Nominal tubing size ASTM B88

COLUMN 2 - Outside diameter of copper tubing per ASTM B88. Allowable tolerance from square cut ends is 0.030"/0.76mm for sizes 2"-3"; 0.045"/1.14mm for sizes 4-8"

COLUMN 3 - Gasket seat must be free from scores, roll marks, indentations, grease and dirt which may interfere with gasket sealing.

COLUMN 4 - Groove width is to be free from chips, dirt, etc. which may interfere with proper coupling assembly.

COLUMN 5 - Groove diameter must be of uniform depth for the entire circumference of the tubing. See column 6.

COLUMN 6 - Groove depth is for reference only; the groove diameter must conform to column 5.

COLUMN 7 - DWV (Drain, Waste and Vent Piping) per ASTM B306.

COLUMN 8 - Maximum flare diameter is the OD at the most extreme tubing diameter.

DESIGN FACTORS
Gruvlok® Couplings

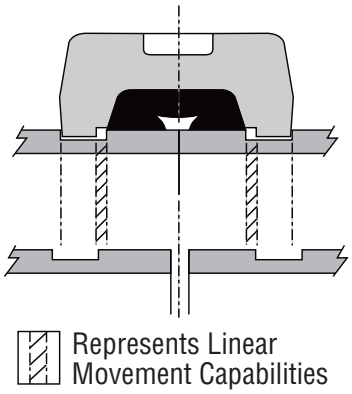
MOVEMENT
Each flexible design Gruvlok coupling can provide for pipe system movement up to the design maximum for the specific size and type coupling being utilized. Movement is possible in the Gruvlok coupling due to two factors: (1) designed-in clearance between the key of the coupling and the groove diameter and groove width, and (2) the gap between pipe ends joined by the coupling.

LINEAR MOVEMENT:

FLEXIBLE COUPLING
LINEAR MOVEMENT

Linear movement is accommodated within the coupling by allowing the pipe ends to move together or apart in response to pressure thrusts and temperature changes. The available linear movement provided by Standard Gruvlok couplings is shown below:

LINEAR MOVEMENT		
Sizes	Roll Groove Pipe	Cut Groove Pipe
1" - 3½"	1/32"	1/16"
4" - 24"	3/32"	3/16"



RIGID COUPLINGS

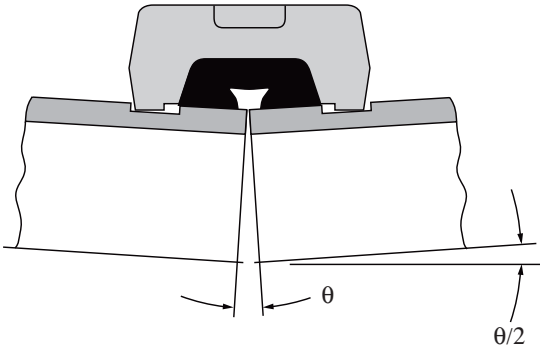
Gruvlok rigid couplings Fig. 7400, Fig. 7401 and Fig. 7004 HPR are designed to provide a joint with the attributes of a welded or flanged connection. Therefore, these joints would remain in strict alignment and would resist deflection and linear movement during service.

ANGULAR MOVEMENT:

FLEXIBLE COUPLING
ANGULAR MOVEMENT

Designed-in clearances allow limited deflection of the pipe joint within the coupling, without introducing eccentric loads into the coupling joint.

The maximum available angular movement of Gruvlok flexible couplings on roll groove joints is shown in the performance data for each coupling. The amount of angular flexibility varies for each coupling size and type. The values account for pipe, groove, and coupling tolerances.



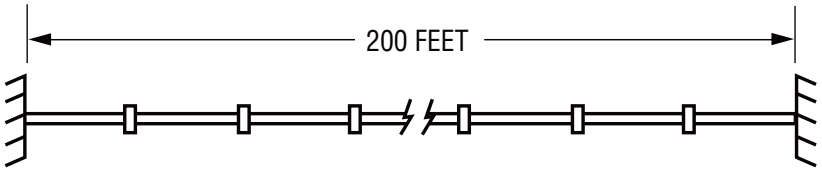
FLEXIBLE COUPLINGS

Figs. 7000, 7001, 7003, 7010 are the flexible couplings provided in the Gruvlok product line. The following information on movement applies to these flexible couplings.

THERMAL MOVEMENT

A sufficient amount of coupling joints must be provided to accommodate the calculated movement (expansion or contraction) in a pipe run or segment thereof .

EXAMPLE:
A 200 foot long straight run of 4" steel cut grooved pipe between anchor points. Minimum Temperature: 40° F (4 .4° C) (at time of installation) .
Maximum Oper . Temperature: 160° F (71 .1° C) .



Thermal expansion tables show this system will expand a total of 1 .80" due to the temperature change .

DESIGN QUESTION
How many couplings are required to account for the thermal growth?

AVAILABLE LINEAR MOVEMENT PER FLEXIBLE COUPLING:
Using the table on page 39, we see that there is 0 .188" linear movement per coupling (4" Flexible Coupling)

COUPLINGS REQUIRED
As indicated above, the total movement is 1 .80". Thus, the number of couplings is determined as follows:

No . of Couplings = Tot . Movement ⁄ Avail . Movement per Coupling

FOR OUR EXAMPLE:
No . of Couplings = (1 .80") ⁄ (0 .187") = 9 .6,
Therefore 10 couplings are needed

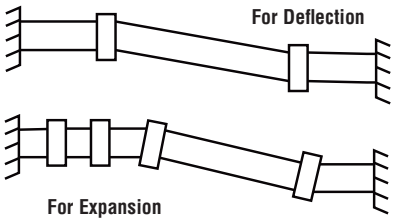
POSITION OF COUPLINGS
In order for the couplings to provide for the movement indicated by the above example, it would be necessary to install all couplings with the maximum gap between pipe ends. Conversely, if the thermal movement was contraction due to a reduction of system temperature, the coupling joints would have be installed with the pipe ends butted, thus accommodating the “shrink” of the pipe system.

COMBINED LINEAR & ANGULAR MOVEMENT

The clearance in the grooved coupling joint, will allow a limited capability for combined linear and angular movement. A partially deflected joint will not provide full linear movement capability. A fully deflected coupling joint provides no linear movement capability. The Gruvlok coupling will not allow for both maximum linear and maximum angular movement simultaneously.

In systems where both are expected, additional joints may be required.

COMBINED LINEAR & ANGULAR MOVEMENT *Continued*



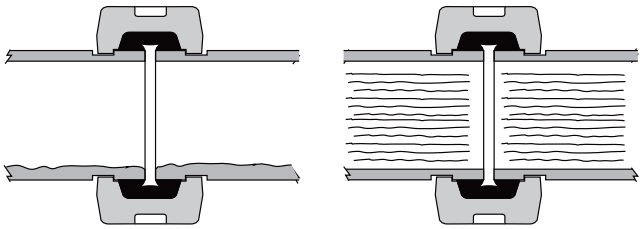
NOTE: Fully Deflected Joint Will Not Allow For Linear Expansion.

In the example above, two couplings were added to account for thermal expansion and the other couplings accommodate only the misalignment. The additional stress from the combined movement is therefore relieved.

ROTATIONAL MOVEMENT:

Piping systems designed with Gruvlok Couplings can accommodate minor rotational movement from thermal expansion, settlement, vibration, or other similar movements. However, Gruvlok Couplings ***should never be used as a continuous swivel joint.***

EXAMPLE:



Utilizing the rotational capability of the Gruvlok Coupling, the pipe life of a slurry or similar coarse material piping system can be extended.

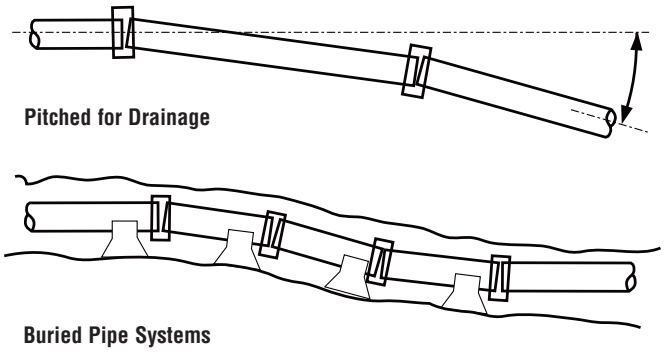
For pipe rotation, the system must be shut down and internal pressure relieved.

The pipe may then be rotated one-quarter turn, the couplings retightened, and service resumed. If performed on a regular basis, pipe rotation will evenly distribute wear over the entire inner surface of the pipe.

CURVE LAYOUT

DRAINAGE, BURIED SYSTEMS, ETC

The flexible design of the Gruvlok coupling makes it ideal for use in a wide variety of systems in which random changes of the pipe direction can be accommodated by the Gruvlok coupling's angular deflection capability rather than requiring the use of special fittings.



Pitched drainage systems, buried pipe systems where pipe laying conditions are subject to settlement, and exposed pipe systems laid on rough ground are but a few of the many types of pipe installations that present conditions where the functional capability of the Gruvlok coupling are useful.

DEFLECTION FROM CENTERLINE

Gruvlok® Couplings

FIG. 7000, 7001, 7001-2 & 7003

Nominal Size	Deflection from ℄	
	Per Coupling	of Pipe
In./DN(mm)	*Degrees(°)-Minutes(')*	*In./ft-mm/m*
1 *25*	1° 22'	0.29 *23.8*
1¼ *32*	1° 5'	0.23 *18.8*
1½ *40*	0° 57'	0.20 *16.5*
2 *50*	0° 45'	0.16 *13.1*
2½ *65*	0° 37'	0.13 *10.9*
3 O.D. 76.1	*0° 36'*	*0.13* 10.4
3 *80*	0° 31'	0.11 *8.9*
3½ *90*	0° 27'	0.09 *7.8*
4 *100*	1° 12'	0.25 *20.8*
4¼ O.D. 108.0	*1° 16'*	*0.26* 22.0
5 *125*	0° 58'	0.20 *16.8*
5¼ O.D. 133.0	*1° 2'*	*0.21* 17.9
5½ O.D. 139.7	*0° 59'*	*0.20* 17.0
6 *150*	0° 49'	0.17 *14.1*
6¼ O.D. 159.0	*0° 51'*	*0.18* 14.9
6½ O.D. 165.1	*0° 50'*	*0.17* 13.1
8 *200*	0° 37'	0.13 *10.9*
10 *250*	0° 30'	0.11 *8.7*
12 *300*	0° 25'	0.09 *7.3*
14 *350*	0° 23'	0.08 *6.7*
16 *400*	0° 20'	0.07 *5.9*
18 *450*	0° 18'	0.06 *5.2*
20 *500*	0° 16'	0.06 *4.7*
24 *600*	0° 13'	0.05 *3.9*
28" O.D. *733.4*	0° 11'	0.04 *3.2*
30" O.D. *787.4*	0° 10'	0.04 *3.0*

FIG. 7010

Nominal Size	Deflection from ℄	
	Per Coupling	of Pipe
In./DN(mm)	*Degrees(°)-Minutes(')*	*In./ft-mm/m*
2 x 1½ *50 x 40*	0° 45'	0.16 *13.1*
2½ x 2 *65 x 50*	0° 37'	0.13 *10.9*
3 x 2 *80 x 50*	0° 31'	0.11 *8.9*
3 x 2½ *80 x 65*	0° 31'	0.11 *8.9*
4 x 2 *100 x 50*	1° 12'	0.25 *20.8*
4 x 2½ *100 x 65*	1° 12'	0.25 *20.8*
4 x 3 *100 x 80*	1° 12'	0.25 *20.8*
5 x 4 *125 x 100*	1° 58'	0.20 *16.8*
6 x 4 *150 x 100*	0° 49'	0.17 *14.1*
6 x 5 *150 x 125*	0° 49'	0.17 *14.1*
8 x 6 *200 x 150*	0° 37'	0.13 *10.9*

FIG. 7011

Nominal Size	Deflection from ℄	
	Per Coupling	of Pipe
In./DN(mm)	*Degrees(°)-Minutes(')*	*In./ft-mm/m*
30 O.D. *750*	0° 16'	0.06 *4.7*

RANGE OF PIPE END SEPARATION

Gruvlok® Couplings

RANGE OF PIPE END SEPARATION			
Type of Coupling	0-1/32 (0-0.79) In./mm	0-3/32 (0-2.38) In./mm	Nominal Coupling Sizes (In./DN(mm))
Fig. 7000 LW Flexible Coupling	1, 1¼, 1½, 2, 2½, 3 O.D., 3, 3½ *25, 32, 40, 50, 65, 76.1, 80, 90*	4, 4¼ O.D. 5, 5¼ O.D., 5½ O.D., 6, 6¼ O.D., 6½ O.D., 8 *100, 108.0, 125, 133.0, 139.7 150, 159.0, 165.1, 200*	
Fig. 7001 Standard Coupling	1, 1¼, 1½, 2, 2½, 3 O.D., 3, 3½ *25, 32, 40, 50, 65, 76.1, 80, 90*	4, 5, 6, 6½ O.D., 8, 10, 12, 14, 16, 18, 20, 24, 28 O.D., 30 O.D. *100, 125, 150, 165.1, 200, 250, 300, 350, 400, 450, 500, 600, 733.4, 787.4*	
Fig. 7001-2 Standard Coupling	– –	14, 16, 18, 20, 24 *350, 400, 450, 500, 600*	
Fig. 7003 Hingelok Coupling	1, 1¼, 1½, 2, 2½, 3 *25, 32, 40, 50, 65, 80*	4, 5, 6, 8 *100, 125, 150, 200*	
Fig. 7010 Reducing Coupling	2 x 1½, 2½ x 2, 3 x 2, 3 x 2½ *50 x 40, 65 x 50, 80 x 50, 80 x 65*	4 x 2, 4 x 2½, 4 x 3, 5 x 4, 6 x 4, 6 x 5, 8 x 6 *100 x 50, 100 x 65, 100 x 80, 125 x 100, 150 x 100, 150 x 125, 200 x 150*	
Fig. 7011 Standard Coupling	The Range of Pipe End Separation for the 30" O.D. (750mm) Coupling is 0-9/64 (0-3.57)		
Fig. 7400 Rigidlite Coupling	1, 1¼, 1½, 2, 2½, 3 O.D., 3 *25, 32, 40, 50, 65, 76.1, 80*	4, 5, 5½ O.D., 6, 6½ O.D., 8 *100, 125, 139.7, 150, 165.1, 200*	
Fig. 7401 Rigidlok Coupling	1½, 2, 2½, 3 O.D., 3 *40, 50, 65, 76.1, 80*	4, 5, 5½ O.D., 6, 6½ O.D., 8, 10, 12, 14, 16, 18, 20, 24 *100, 125, 139.7, 150, 165.1, 200, 250, 300, 350, 400, 450, 500, 600*	
Fig. 7401-2 Rigidlok Coupling	– –	14, 16, 18, 20, 24 *350, 400, 450, 500, 600*	

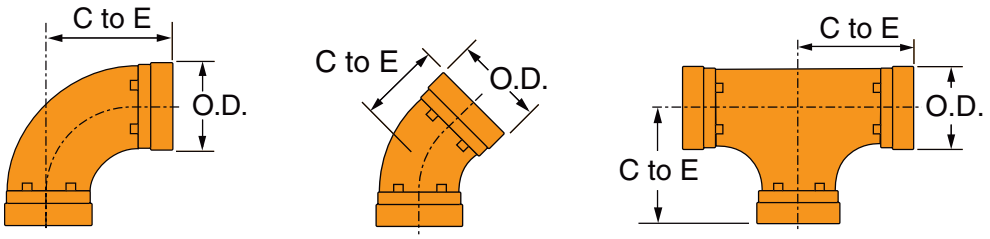
Fig. 7042 Outlet Coupling							
Nominal Pipe Size			Range of Pipe End Separation	Nominal Pipe Size			Range of Pipe End Separation
Run	Outlet			Run	Outlet		
	FPT F	MPT/Grv. M/G			FPT F	MPT/Grv. M/G	
In./DN(mm)	In./mm	In./mm	In./mm	In./DN(mm)	In./mm	In./mm	In./mm
1½ 40	½ 15	— —	¾-1 1/16 19-27	3 80	¾ 20	— —	1 3/16-1½ 30-38
	¾ 20	— —	¾-1 1/16 19-27		1 25	1 25	1 3/16-1½ 30-38
	1 25	— —	¾-1 1/16 19-27		— —	1½ 40	1 3/16-1½ 30-38
2 50	½ 15	— —	1 1/16-1 17-25	4 100	¾ 20	— —	1 9/16-1⅞ 40-48
	¾ 20	— —	1 1/16-1 17-25		1 25	— —	1 9/16-1⅞ 40-48
	1 25	1 25	1 1/16-1 17-25		— —	1½ 40	1 9/16-1⅞ 40-48
2½ 65	½ 15	— —	1 3/16-1½ 30-38		— —	2 50	1 9/16-1⅞ 40-48
	¾ 20	— —	1 3/16-1½ 30-38	6 150	1 25	— —	1⅝-1 15/16 41-51
	1 25	— —	1 3/16-1½ 30-38		1½ 40	1½ 40	1⅝-1 15/16 41-51
	— —	1¼ 32	1 3/16-1½ 30-38		— —	2 50	1⅝-1 15/16 41-51
	— —	1½ 40	1 3/16-1½ 30-38				

FLOW DATA – FRICTIONAL RESISTANCE (EXPRESSED AS EQUIVALENT STRAIGHT PIPE)

Nominal Size	O.D.	Pipe Wall Thickness	Elbow		Tee	
			90°	45°	Branch	Run
In./DN(mm)	*In./mm*	*In./mm*	*Ft./m*	*Ft./m*	*Ft./m*	*Ft./m*
1 *25*	1.315 *33.4*	0.133 *3.4*	1.7 *0.5*	0.9 *0.3*	4.4 *1.3*	1.7 *0.5*
1¼ *32*	1.660 *42.2*	0.140 *3.6*	2.3 *0.7*	1.2 *0.4*	5.8 *1.8*	2.3 *0.7*
1½ *40*	1.900 *48.3*	0.145 *3.7*	2.7 *0.8*	1.3 *0.4*	6.7 *2.0*	2.7 *0.8*
2 *50*	2.375 *60.3*	0.154 *3.9*	3.4 *1.0*	1.7 *0.5*	8.6 *2.6*	3.4 *1.0*
2½ *65*	2.875 *73.0*	0.203 *5.2*	4.1 *1.2*	2.1 *0.6*	10.3 *3.1*	4.1 *1.2*
3 O.D. 76.1	*2.996* 76.1	*0.197* 5.0	*4.3* 1.3	*2.2* 0.7	*10.8* 3.3	*4.3* 1.3
3 *80*	3.500 *88.9*	0.216 *5.5*	5.1 *1.6*	2.6 *0.8*	12.8 *3.9*	5.1 *1.6*
4¼ O.D. 108.0	*4.250* 108.0	*0.220* 5.6	*6.4* 2.0	*3.2* 1.0	*16.1* 4.9	*6.4* 2.0
4 *100*	4.500 *114.3*	0.237 *6.0*	6.7 *2.0*	3.4 *1.0*	16.8 *5.1*	6.7 *2.0*
5¼ O.D. 133.0	*5.236* 133.0	*0.248* 6.3	*8.0* 2.4	*4.0* 1.2	*20.1* 6.1	*8.0* 2.4
5½ O.D. 139.7	*5.500* 139.7	*0.248* 6.3	*8.3* 2.5	*4.2* 1.3	*20.9* 6.4	*8.3* 2.5
5 *125*	5.563 *141.3*	0.258 *6.6*	8.4 *2.6*	4.2 *1.3*	21.0 *6.4*	8.4 *2.6*
6¼ O.D. 159.0	*6.259* 159.0	*0.280* 7.1	*9.7* 3.0	*4.9* 1.5	*24.3* 7.4	*9.7* 3.0
6½ O.D. 165.1	*6.500* 165.1	*0.280* 7.1	*10.0* 3.0	*5.0* 1.5	*24.9* 7.6	*10.0* 3.0
6 *150*	6.625 *168.3*	0.280 *7.1*	10.1 *3.1*	5.1 *1.6*	25.3 *7.7*	10.1 *3.1*
8 *200*	8.625 *219.1*	0.322 *8.2*	13.3 *4.1*	6.7 *2.0*	33.3 *10.1*	13.3 *4.1*
10 *250*	10.750 *273.1*	0.365 *9.3*	16.7 *5.1*	8.4 *2.6*	41.8 *12.7*	16.7 *5.1*
12 *300*	12.750 *323.9*	0.375 *9.5*	20.0 *6.1*	10.0 *3.0*	50.0 *15.2*	20.0 *6.1*
14 *350*	14.000 *355.6*	0.375 *9.5*	22.2 *6.8*	17.7 *5.4*	64.2 *19.6*	22.9 *7.0*
16 *400*	16.000 *406.4*	0.375 *9.5*	25.5 *7.8*	20.4 *6.2*	73.9 *22.5*	26.4 *8.0*
18 *450*	18.000 *457.2*	0.375 *9.5*	28.9 *8.8*	23.1 *7.0*	87.2 *26.6*	31.1 *9.5*
20 *500*	20.000 *508.0*	0.375 *9.5*	32.2 *9.8*	25.7 *7.8*	97.3 *29.7*	34.8 *10.6*
24 *600*	24.000 *609.6*	0.375 *9.5*	38.9 *11.9*	31.1 *9.5*	113.0 *34.4*	40.4 *12.3*

For the reducing tee and branches, use the value that is corresponding to the branch size. For example: for 6" x 6" x 3" tee, the branch value of 3" is 12.8 ft (3.9).

GRUVLOK® FITTING FOR GROOVED-END PIPE

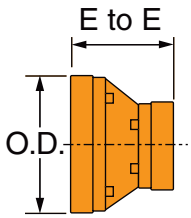


GRUVLOK FITTINGS

Nominal Size	O.D.	Center to End Dimensions		
		FIG. 7050 90° ELBOW	FIG. 7051 45° ELBOW	FIG. 7060 TEE
In./DN(mm)	*In./mm*	*In./mm*	*In./mm*	*In./mm*
1 *25*	1.315 *33.4*	2¼ C *57*	1¾ C *44*	2¼ C *57*
1¼ *32*	1.660 *42.2*	2¾ C *70*	1¾ C *44*	2¾ C *70*
1½ *40*	1.900 *48.3*	2¾ C *70*	1¾ C *44*	2¾ C *70*
2 *50*	2.375 *60.3*	3¼ C *83*	2 C *51*	3¼ C *83*
2½ *65*	2.875 *73.0*	3¾ C *95*	2¼ C *57*	3¾ C *95*
3 O.D. 76.1	*2.996* 76.1	*4 C* 102	*2½ C* 64	*4 C* 101
3 *80*	3.500 *88.9*	4¼ C *108*	2½ C *64*	4¼ C *108*
3½ *90*	4.000 *101.6*	4½ C *114*	2¾ C *70*	4½ C *114*
4¼ O.D. 108.0	*4.250* 108.0	*4¾ C* 121	*2⅞ C* 83	*4¾ C* 121
4 *100*	4.500 *114.3*	5 C *127*	3 C *76*	5 C *127*
5¼ O.D. 133.0	*5.236* 133.0	*5¼ C* 133	*3¼ C* 83	*5¼ C* 133
5½ O.D. 139.7	*5.500* 139.7	*5¼ C* 133	*3¼ C* 83	*5½ C* 140
5 *125*	5.563 *141.3*	5½ C *140*	3¼ C *83*	5½ C *140*
6¼ O.D. 159.0	*6.259* 159.0	*6 C* 152	*3½ C* 89	*6 C* 152
6½ O.D. 165.1	*6.500* 165.1	*6½ C* 165	*3½ C* 89	*6½ C* 165
6 *150*	6.625 *168.3*	6½ C *165*	3½ C *89*	6½ C *165*
8 *200*	8.625 *219.1*	7¾ C *197*	4¼ C *108*	7¾ C *197*
10 *250*	10.750 *273.1*	9 C *229*	4¾ C *121*	9 C *229*
12 *300*	12.750 *323.9*	10 C *254*	5¼ C *133*	10 C *254*

C - Cast malleable or ductile iron, all others are fabricated steel.
Center to end dimensions may differ from those shown in chart, contact an Anvil Rep. for more information.

GRUVLOK® FITTING FOR GROOVED-END PIPE



GRUVLOK FITTINGS

FIG. 7072 CONCENTRIC REDUCER

Nominal Size	End to End
In./DN(mm)	*In./mm*
1¼ x 1 *32 x 25*	2½ *64*
1½ x 1, 1¼ *40 x 25, 32*	2½ *64*
2 x 1, 1¼*, 1½* *50 x 25, 32, 40*	2½ *64*
2½ x 1, 1¼, 1½, 2* *65 x 25, 32, 40, 50*	2½ *64*
3 x 1, 1¼, 1½, 2*, 2½* *80 x 25, 32, 40, 50, 65*	2½ *64*
3½ x 3 *90 x 80*	3 *76*

FIG. 7072 CONCENTRIC REDUCER

Nominal Size	End to End
In./DN(mm)	*In./mm*
4 x 1, 1¼, 1½, 2*, 2½*, 3*, 3½ *100 x 25, 32, 40, 50, 65, 80, 90*	3 *76*
5 x 2, 2½, 3, 4* *125 x 50, 65, 80, 100*	3½ *89*
6 x 1, 1½, 2*, 2½, 3*, 4*, 5* *150 x 25, 40, 50, 65, 80, 100, 125*	4 *102*
8 x 3, 4*, 5, 6* *200 x 80, 100, 125, 150*	5 *127*
10 x 4, 5, 6*, 8 *250 x 100, 125, 150, 200*	6 *152*
12 x 4, 6, 8, 10 *300 x 100, 150, 200, 250*	7 *178*

* - Cast malleable or ductile iron, all others are fabricated steel.

STANDARD WEIGHT PIPE DATA					
Nominal Pipe Diameter (Inches)	Actual Inside Diameter (Inches)	Actual Outside Diameter (Inches)	Weight per Foot (Pounds)	Length in Feet containing One Cubic Foot (Feet)	Gallons in One Linear Foot (Gallons)
1/8	0.269	0.405	0.245	2,526.000	0.0030
1/4	0.364	0.540	0.425	1,383.800	0.0054
3/8	0.493	0.675	0.568	754.360	0.0099
1/2	0.622	0.840	0.851	473.910	0.0158
3/4	0.824	1.050	1.131	270.030	0.0277
1	1.049	1.315	1.679	166.620	0.0449
1 1/4	1.380	1.660	2.273	96.275	0.0777
1 1/2	1.610	1.900	2.718	70.733	0.1058
2	2.067	2.375	3.653	49.913	0.1743
2 1/2	2.469	2.875	5.793	30.077	0.2487
3	3.068	3.500	7.580	19.479	0.3840
3 1/2	3.548	4.000	9.110	14.565	0.5136
4	4.026	4.500	10.790	11.312	0.6613
5	5.047	5.563	14.620	7.198	1.0393
6	6.065	6.625	18.970	4.984	1.5008
8	7.981	8.625	28.550	2.878	2.5988
10	10.020	10.750	40.480	1.826	4.0963

Barlow's Formula

Barlow's Formula is a safe, easy method for finding the relationship between internal fluid pressure and stress in the pipe wall. The formula predicts bursting pressures that have been found to be safely within the actual test bursting pressures.

It is interesting to note that the formula uses the "outside diameter" of pipe and is sometimes referred to as the "outside diameter formula."

$$P = (2 \bullet t \bullet S) / D$$

Where:

P = internal units pressure, in psi
S = unit stress, in psi
D = outside diameter of pipe, in inches
t = wall thickness, in inches

Commercial Pipe Sizes and Wall Thicknesses

This table lists standard pipe sizes and wall thicknesses, or specifically:

1. Traditional standard weight, extra strong & durable extra strong pipe.

2. Pipe wall thickness in ASME B36.10 for carbon steel.

COMMERCIAL PIPE SIZES AND WALL THICKNESSES

Nom. Pipe Size	Outside Dia. (IN)	NOMINAL WALL THICKNESS FOR																
		Sch 5S	Sch 10	Sch 10S	Sch 20	Sch 30	Sch Std.	Sch 40	Sch 40S	Sch 60	Sch 80	Sch 80S	Sch 100	Sch 120	Sch. 140	Sch. 160	X Strong	XX Strong
1/8	0.405	-	0.049	0.049	-	-	0.068	0.068	0.068	-	0.095	0.095	-	-	-	-	0.095	-
1/4	0.540	-	0.065	0.065	-	-	0.088	0.088	0.088	-	0.119	0.119	-	-	-	-	0.119	-
3/8	0.675	-	0.065	0.065	-	-	0.091	0.091	0.091	-	0.126	0.126	-	-	-	-	0.126	-
1/2	0.840	0.065	0.083	0.083	-	-	0.109	0.109	0.109	-	0.147	0.147	-	-	-	0.187	0.147	0.294
3/4	1.050	0.065	0.083	0.083	-	-	0.113	0.113	0.113	-	0.154	0.154	-	-	-	0.219	0.154	0.308
1	1.315	0.065	0.109	0.109	-	-	0.133	0.133	0.133	-	0.179	0.179	-	-	-	0.250	0.179	0.358
1 1/4	1.660	0.065	0.109	0.109	-	-	0.140	0.140	0.140	-	0.191	0.191	-	-	-	0.250	0.191	0.382
1 1/2	1.900	0.065	0.109	0.109	-	-	0.145	0.145	0.145	-	0.200	0.200	-	-	-	0.281	0.200	0.400
2	2.375	0.065	0.109	0.109	-	-	0.154	0.154	0.154	-	0.218	0.218	-	-	-	0.344	0.218	0.436
2 1/2	2.875	0.083	0.120	0.120	-	-	0.203	0.203	0.203	-	0.276	0.276	-	-	-	0.375	0.276	0.552
3	3.500	0.083	0.120	0.120	-	-	0.216	0.216	0.216	-	0.300	0.300	-	-	-	0.437	0.300	0.600
3 1/2	4.000	0.083	0.120	0.120	-	-	0.226	0.226	0.226	-	0.318	0.318	-	-	-	-	0.318	0.636
4	4.500	0.083	0.120	0.120	-	-	0.237	0.237	0.237	-	0.337	0.337	-	0.438	-	0.531	0.337	0.674
5	5.563	0.109	0.134	0.134	-	-	0.258	0.258	0.258	-	0.375	0.375	-	0.500	-	0.625	0.375	0.750

3. Pipe wall thickness in ASTM Specification A409 & ASME B36.19 & applicable only to corrosion resistant materials.

NOTE: All dimensions in inches & thicknesses are nominal or average wall thickness. Actual thickness may be as much as 12.5% under nominal due to mill tolerance.

6	6.625	0.109	0.134	0.134	-	-	0.280	0.280	0.280	-	0.432	0.432	-	0.562	-	0.719	0.432	0.864
8	8.625	0.109	0.148	0.148	0.250	0.277	0.322	0.322	0.322	0.406	0.500	0.500	0.594	0.719	0.812	0.906	0.500	0.875
10	10.750	0.134	0.165	0.165	0.250	0.307	0.365	0.365	0.365	0.500	0.594	0.500	0.719	0.844	1.000	1.125	0.500	1.000
12	12.750	0.156	0.180	0.180	0.250	0.330	0.375	0.406	0.375	0.562	0.688	0.500	0.844	1.000	1.125	1.312	0.500	1.000
14	14.000	0.156	0.250	0.188	0.312	0.375	0.375	0.438	-	0.594	0.750	-	0.938	1.094	1.250	1.406	0.500	-
16	16.000	0.165	0.250	0.188	0.312	0.375	0.375	0.500	-	0.656	0.844	-	1.031	1.219	1.438	1.594	0.500	-
18	18.000	0.165	0.250	0.188	0.312	0.438	0.375	0.562	-	0.750	0.938	-	1.156	1.375	1.562	1.781	0.500	-
20	20.000	0.188	0.250	0.218	0.375	0.500	0.375	0.594	-	0.812	1.031	-	1.281	1.500	1.750	1.969	0.500	-
22	22.000	0.188	0.250	0.218	0.375	0.500	0.375	-	-	0.875	1.125	-	1.375	1.625	1.875	2.125	0.500	-
24	24.000	0.218	0.250	-	0.375	0.562	0.375	0.688	-	0.969	1.219	-	1.531	1.812	2.062	2.344	0.500	-
26	26.000	-	0.312	-	0.500	-	0.375	-	-	-	-	-	-	-	-	-	0.500	-
28	28.000	-	0.312	-	0.500	0.625	0.375	-	-	-	-	-	-	-	-	-	0.500	-
30	30.000	0.250	0.312	0.312	0.500	0.625	0.375	-	-	-	-	-	-	-	-	-	0.500	-
32	32.000	-	0.312	-	0.500	0.625	0.375	0.688	-	-	-	-	-	-	-	-	0.500	-
34	34.000	-	0.312	-	0.500	0.625	0.375	0.688	-	-	-	-	-	-	-	-	0.500	-
36	36.000	-	0.312	-	0.500	0.625	0.375	0.750	-	-	-	-	-	-	-	-	0.500	-
42	42.000	-		-	0.500	0.625	0.375	0.750	-	-	-	-	-	-	-	-	0.500	-

All dimensions shown are in inches.

Steel Pipe Data

SCHEDULE NO. 40 & 80					
Pipe Size	O.D.	Schedule No.	Wall Thickness	Weight per Foot	Weight of Water per Foot
In.	*In.*	-	*In.*	*Lbs.*	*Lbs.*
⅜	0.675	40	0.091	0.567	0.083
		80	0.126	0.738	0.061
½	0.840	40	0.109	0.850	0.132
		80	0.147	1.087	0.101
¾	1.050	40	0.113	1.130	0.230
		80	0.154	1.473	0.186
1	1.315	40	0.133	1.678	0.374
		80	0.179	2.171	0.311
1¼	1.660	40	0.140	2.272	0.647
		80	0.191	2.996	0.555
1½	1.900	40	0.145	2.717	0.882
		80	0.200	3.631	0.765
2	2.375	40	0.154	3.652	1.452
		80	0.218	5.022	1.279
2½	2.875	40	0.203	5.790	2.072
		80	0.276	7.660	1.834
3	3.500	40	0.216	7.570	3.200
		80	0.300	10.250	2.860
3½	4.000	40	0.226	9.110	4.280
		80	0.318	12.510	3.850
4	4.500	40	0.237	10.790	5.510
		80	0.337	14.980	4.980
5	5.563	40	0.258	14.620	8.660
		80	0.375	20.780	7.870
6	6.625	40	0.280	18.970	12.510
		80	0.432	28.570	11.290
8	8.625	40	0.322	28.550	21.600
		80	0.500	43.390	19.800
10	10.750	40	0.365	40.480	34.100
		80	0.593	64.400	31.100
12	12.75	40	0.406	53.600	48.500
		80	0.687	88.600	44.000
14	14.000	40	0.437	63.000	58.500
		80	0.750	107.000	51.200
16	16.000	40	0.500	83.000	76.500
		80	0.843	137.000	69.700
18	18.000	40	0.563	105.000	97.200
		80	0.937	171.000	88.500
20	20.000	40	0.593	123.000	120.400
		80	1.031	209.000	109.400
24	24.000	40	0.687	171.000	174.200
		80	1.218	297.000	158.200
30	30.000	20	0.500	158.000	286.000
36	36.000	API	0.500	190.000	417.000

Copper Tube Data

TYPE L					
Tube Size	O.D. Tubing	O.D.	Wall Thickness	Weight per Foot	Weight of Water per Foot
In.	*In.*	*In.*	*In.*	*Lbs.*	*Lbs.*
¼	⅜	0.375	0.030	0.126	0.034
⅜	½	0.500	0.035	0.198	0.062
½	⅝	0.625	0.040	0.285	0.100
⅝	¾	0.750	0.042	0.362	0.151
¾	⅞	0.875	0.045	0.455	0.209
1	1⅛	1.125	0.050	0.655	0.357
1¼	1⅜	1.375	0.055	0.884	0.546
1½	1⅝	1.625	0.060	1.140	0.767
2	2⅛	2.125	0.070	1.750	1.341
2½	2⅝	2.625	0.080	2.480	2.064
3	3⅛	3.125	0.090	3.330	2.949
3½	3⅝	3.625	0.100	4.290	3.989
4	4⅛	4.125	0.110	5.380	5.188
5	5⅛	5.125	0.125	7.610	8.081
6	6⅛	6.125	0.140	10.200	11.616
8	8⅛	8.125	0.200	19.290	20.289
10	10⅛	10.125	0.250	30.100	31.590
12	12⅛	12.125	0.280	40.400	45.426

TYPE K					
Tube Size	O.D. Tubing	O.D.	Wall Thickness	Weight per Foot	Weight of Water per Foot
In.	*In.*	*In.*	*In.*	*Lbs.*	*Lbs.*
¼	⅜	0.375	0.035	0.145	0.032
⅜	½	0.500	0.049	0.269	0.055
½	⅝	0.625	0.049	0.344	0.094
⅝	¾	0.750	0.049	0.418	0.144
¾	⅞	0.875	0.065	0.641	0.188
1	1⅛	1.125	0.065	0.839	0.337
1¼	1⅜	1.375	0.065	1.040	0.527
1½	1⅝	1.625	0.072	1.360	0.743
2	2⅛	2.125	0.083	2.060	1.310
2½	2⅝	2.625	0.095	2.920	2.000
3	3⅛	3.125	0.109	4.000	2.960
3½	3⅝	3.625	0.120	5.120	3.900
4	4⅛	4.125	0.134	6.510	5.060
5	5⅛	5.125	0.160	9.670	8.000
6	6⅛	6.125	0.192	13.870	11.200
8	8⅛	8.125	0.271	25.900	19.500
10	10⅛	10.125	0.338	40.300	30.423
12	12⅛	12.125	0.405	57.800	43.675

ASTM CARBON STEEL PIPE AND FLANGE SPECIFICATIONS

Description and Applications	Spec No.	ASTM or Type	Grade Strength PSI	Yield Point or Strength PSI	Elongation (% in 2")				Chemical Composition, %			
					STD Round	Rectangular			C	MN	P	S
						t	5/16"	5/16"				
PIPE AND TUBING												
Seamless milled steel pipe for high-temperature service, suitable for bending, flanging & similar forming operations.	(1) A106	A	48,000	30,000	28 long. OR (4) 20 trans.	17.5+ or 12.5+	56t 40t	35 25	.25 max	.27 to.93	.048 max	.058 max
As above, except use Grade A for close coiling, cold bending or forge welding.	(1) A106	B	60,000	35,000	28 long. OR (4) 12 trans.	17.5+ or 6.5+	56t 32t	35 16.5	.30 max	.27 to 1.06	.048 max	.058 max
Black or hot-dip galvanize seamless or res-welded steel pipe suitable for coiling, bending, flanging, & other special purposes, suitable for welding.	A 53	A	48,000	30,000	28	17.5+	56t	35	(2)	–	(3)	–
As above, except use Grade A for close coiling, cold bending or forge welding.	A 53	B	60,000	35,000	22	15+	48t	30	(2)	–	(3)	–
Black or hot-dip galvanize seamless or res. welded steel pipe suitable for ordinary uses. (When tension, flattening or bend test required, order to A-53).	A 120 (obsolete)	–	–	–	–	–	–	–	–	–	–	–
Resistance welded steel pipe for liquid, gas or vapor.	A 135	A	48,000	30,000	–	17.5+	56t	35	–	–	.050 max	.060 max

As above, except use Grade A for flanging & bending.	A 135	B	60,000	35,000	–	15+	48t	30	–	–	.050 max	.060 max
FORGED PIPE, FLANGES												
Forged or rolled steel pipe flanges, fittings (6) values and parts for high temperature service. Heat treatment required; may be annealed or normalized.	A105	I	60,000	30,000	25		–	–	.35 (5) max	.90 max	.05 max	.05 max
As above	A 105	II	70,000	36,000	22		–	–	.35 (5) max	.90 max	.05 max	.05 max
As above except for general service. Heat treatment is not required.	A 181	I	60,000	30,000	22		–	–	.35 (5) max	.90 max	.05 max	.05 max
As above	A 181	II	70,000	36,000	18		–	–	.35 (5) max	.90 max	.05 max	.05 max

(1) 0.10% silicon minimum.

(2) Open hearth, 0.13 max for ⅛" and ¼" size resistance welded pipe only

(3) Seamless: open hearth 0.048 max, acid bessemar 0.11 max; Res. welded: open hearth 0.050 max.

(4) Longitudinal or transverse direction of test specimen with respect to pipe axis

(5) When flanges will be subject to fusion welding, carbon content shall be ≤0.35%. If carbon is ≤0.35%, it may be necessary to add silicon to meet required tensile properties. The silicon content shall be ≤0.35%.

(6) Factor-made Wrought Carbon Steel and Ferritic Alloy Steel Welding Fitting Specifications are covered under ASTM A234.

Pipe Thread Standards | Drop Nipple and Tee-Let Installation | Conversions | General Welding Information | Bolt Templates | Weld Fitting and Steel Flange Data | **Pipe and Flange Data** | Gruvlok Tech. Data | Gruvlok Installation | Table of Contents

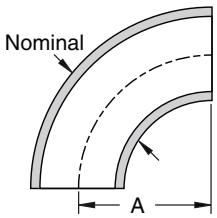
PIPE AND WATER WEIGHT PER LINE FOOT

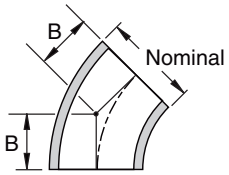
Nominal Pipe Size	Weight of:		Weight of:	
	Std. Pipe	Water	XS Pipe	Water
In.	*Lbs.*		*Lbs.*	
½	0.851	0.132	1.088	0.101
¾	1.131	0.230	1.474	0.188
1	1.679	0.374	2.172	0.311
1¼	2.273	0.648	2.997	0.555
1½	2.718	0.882	3.631	0.765
2	3.653	1.455	5.022	1.280
2½	5.793	2.076	7.661	1.837
3	7.580	3.200	10.250	2.864
3½	9.110	4.280	12.510	3.850
4	10.790	5.510	14.980	4.980
5	14.620	8.660	20.780	7.890
6	18.970	12.510	28.570	11.290
8	28.550	21.690	43.390	19.800
10	40.480	34.100	54.740	32.300
12	49.580	49.000	65.420	47.000
14	54.570	59.700	72.090	57.500
16	62.580	79.100	82.770	76.500
18	70.590	101.200	93.450	98.400
20	78.600	126.000	104.130	122.800
24	94.620	183.800	125.490	180.100
30	119.000	291.200	158.000	286.200

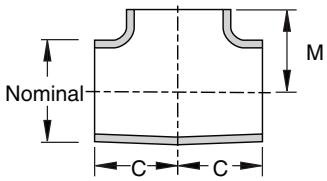
WEIGHT PER FOOT OF SEAMLESS BRASS AND COPPER PIPE

Nominal Pipe Size	Regular			Extra Strong		
	Yellow Brass	Red Brass	Copper	Yellow Brass	Red Brass	Copper
In.	*Lbs.*			*Lbs.*		
½	0.91	0.93	0.96	1.19	1.23	1.25
¾	1.23	1.27	1.30	1.62	1.67	1.71
1	1.73	1.78	1.82	2.39	2.49	2.51
1¼	2.56	2.63	2.69	3.29	3.39	3.46
1½	3.04	3.13	3.20	3.99	4.10	4.19
2	4.01	4.12	4.22	5.51	5.67	5.80

Weld Fittings — 90˚ Elbow, 45˚ Elbow, Tee, Conc. Reducer



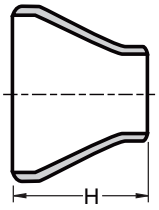




WELD FITTINGS

Nom. Pipe Size	90˚ ELBOWS		45˚ ELBOWS	STRAIGHT TEES
	Long R A	Short R A	B	C & M
½	1½	—	⅝	1
¾	1⅛	—	7/16	1⅛
1	1½	1	⅞	1½
1¼	1⅞	1¼	1	1⅞
1½	2¼	1½	1⅛	2¼
2	3	2	1⅜	2½
2½	3¾	2½	1¾	3
3	4½	3	2	3⅜
3½	5¼	3½	2¼	3¾
4	6	4	2½	4⅛
5	7½	5	3⅛	4⅞
6	9	6	3¾	5⅝
8	12	8	5	7
10	15	10	6¼	8½
12	18	12	7½	10

All dimensions shown are in inches.

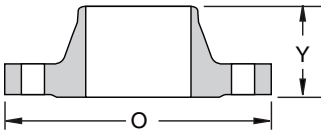


WELD FITTINGS

CONCENTRIC REDUCERS	
Nom. Pipe Size	H
¾ x ⅜, ½	1½
1 x ⅜, ½, ¾,	2
1¼ x ½, ¾, 1	2
1½ x ½, ¾, 1, 1¼	2½
2 x ¾, 1, 1¼, 1½	3
2½ x 1, 1¼, 1½, 2	3½
3 x 1¼, 1½, 2, 2½	3½

CONCENTRIC REDUCERS	
Nom. Pipe Size	H
3½ x 1¼, 1½, 2, 2½, 3	4
4 x 1½, 2, 2½, 3, 3½	4
5 x 2, 2½, 3, 3½, 4	5
6 x 2½, 3, 3½, 4, 5	5½
8 x 3½, 4, 5, 6	6
10 x 4, 5, 6, 8	7
12 x 5, 6, 8, 10	8

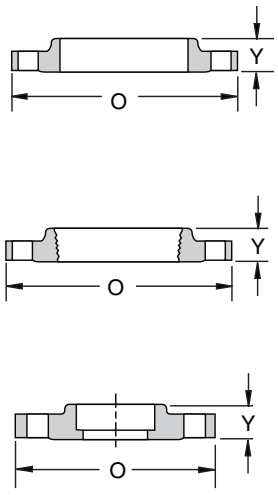
All dimensions shown are in inches.



WELDING NECK FLANGES

Nom. Pipe Size	150 LB.		300 LB.		400 LB.		600 LB.	
	O	Y(1)	O	Y(1)	O	Y(2)	O	Y(2)
½	3½	1⅞	3¾	2 1/16	3¾	2 1/16	3¾	2 1/16
¾	3⅞	2 1/16	4⅝	2¼	4⅝	2¼	4⅝	2¼
1	4¼	2 3/16	4⅞	2 7/16	4⅞	2 7/16	4⅞	2 7/16
1¼	4⅝	2¼	5¼	2 9/16	5¼	2⅝	5¼	2⅝
1½	5	2 7/16	6⅛	2 11/16	6⅛	2¾	6⅛	2¾
2	6	2½	6½	2¾	6½	2⅞	6½	2⅞
2½	7	2¾	7½	3	7½	3⅛	7½	3⅛
3	7½	2¾	8¼	3⅛	8¼	3¼	8¼	3¼
3½	8½	2 13/16	9	3 3/16	9	3⅜	9	3⅜
4	9	3	10	3⅜	10	3½	10¾	4
5	10	3½	11	3⅞	11	4	13	4½
6	11	3½	12½	3⅞	12½	4 1/16	14	4⅝
8	13½	4	15	4⅜	15	4⅝	16½	5¼
10	16	4	17½	4⅝	17½	4⅞	20	6
12	19	4½	20½	5⅛	20½	5⅜	22	6⅛

(1) The 1/16" raised face **is** included in length thru Hub, "Y".
(2) The ¼" raised face **is not** included in length thru Hub, "Y".
All dimensions shown are in inches.

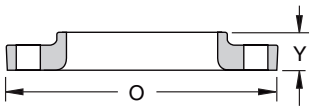


SLIP-ON, THREADED AND SOCKET FLANGES

Nom. Pipe Size	150 LB.		300 LB.		400 LB.†		600 LB.	
	O	Y(1)	O	Y(1)	O	Y(2)	O	Y(2)
½	3½	⅝	3¾	⅞	3¾	⅞	3¾	⅞
¾	3⅞	⅝	4⅝	1	4⅝	1	4⅝	1
1	4¼	11/16	4⅞	1 1/16	4⅞	1 1/16	4⅞	1 1/16
1¼	4⅝	13/16	5¼	1 1/16	5¼	1⅛	5¼	1⅛
1½	5	⅞	6⅛	1 3/16	6⅛	1¼	6⅛	1¼
2	6	1	6½	1 5/16	6½	1 7/16	6½	1 7/16
2½	7	1⅛	7½	1½	7½	1⅝	7½	1⅝
3	7½	1 3/16	8¼	1 11/16	8¼	1 13/16	8¼	1 13/16
3½	8½	1¼†	9	1¾†	9	1 15/16	9	1 15/16†
4	9	1 5/16†	10	1⅞†	10	2	10¾	2⅛†
5	10	1 7/16†	11	2†	11	2⅛	13	2⅜*†
6	11	1 9/16†	12½	2 1/16†	12½	2¼	14	2⅝ †
8	13½	1¾†	15	2 7/16†	15	2 11/16	16½	3†
10	16	1 15/16†	17½	2⅝†	17½	2⅞	20	3⅜†
12	19	2 3/16†	20½	2⅞†	20½	3⅛	22	3⅝†

* Not available in Threaded type
† Not available in Socket type
(1) The 1/16" raised face **is** included in length thru Hub, "Y".
(2) The ¼" raised face **is not** included in length thru Hub, "Y".
All dimensions shown are in inches.

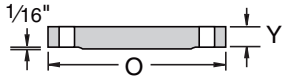
Lap Joint Flanges



LAP JOINT FLANGES

Nom. Pipe Size	150 LB.		300 LB.		400 LB.		600 LB.	
	O	Y	O	Y	O	Y	O	Y
½	3½	5/8	3¾	7/8	3¾	7/8	3¾	7/8
¾	3⅞	5/8	4⅝	1	4⅝	1	4⅝	1
1	4¼	11/16	4⅞	1 1/16	4⅞	1 1/16	4⅞	1 1/16
1¼	4⅝	13/16	5¼	1 1/16	5¼	1⅛	5¼	1⅛
1½	5	7/8	6⅛	1 3/16	6⅛	1¼	6⅛	1¼
2	6	1	6½	1 5/16	6½	1 7/16	6½	1 7/16
2½	7	1⅛	7½	1½	7½	1⅝	7½	1⅝
3	7½	1 3/16	8¼	1 11/16	8¼	1 13/16	8¼	1 13/16
3½	8½	1¼	9	1¾	9	1 15/16	9	1 15/16
4	9	1 5/16	10	1⅞	10	2	10¾	2⅛
5	10	1 7/16	11	2	11	2⅛	13	2⅜
6	11	1 9/16	12½	2 1/16	12½	2¼	14	2⅝
8	13½	1¾	15	2 7/16	15	2 11/16	16½	3
10	16	1 15/16	17½	3¾	17½	4	20	4⅜
12	19	2 3/16	20½	4	20½	4¼	22	4⅝

All dimensions shown are in inches.



BLIND FLANGES

Nom. Pipe Size	150 LB.		300 LB.		400 LB.		600 LB.	
	O	Y(1)	O	Y(1)	O	Y(2)	O	Y(2)
½	3½	7/16	3¾	9/16	For Sizes 3½ and Smaller use 600 LB. Standard		3¾	9/16
¾	3⅞	½	4⅝	5/8			4⅝	5/8
1	4¼	9/16	4⅞	1 1/16			4⅞	1 1/16
1¼	4⅝	5/8	5¼	¾			5¼	1 3/16
1½	5	1 1/16	6⅛	1 3/16			6⅛	7/8
2	6	¾	6½	7/8			6½	1
2½	7	7/8	7½	1			7½	1⅛
3	7½	1 5/16	8¼	1⅛			8¼	1¼
3½	8½	1 5/16	9	1 3/16			9	1⅜
4	9	1 5/16	10	1¼	10	1⅜	10¾	1½
5	10	1 5/16	11	1⅜	11	1½	13	1¾
6	11	1	12½	1 7/16	12½	1 5/8	14	1⅞
8	13½	1⅛	15	1 5/8	15	1⅞	16½	2 3/16
10	16	1 3/16	17½	1⅞	17½	2⅛	20	2½
12	19	1¼	20½	2	20½	2¼	22	2⅝

(1) The 1/16" raised face **is** included in Thickness, "Y".
(2) The ¼" raised face **is not** included in Thickness, "Y".
All dimensions shown are in inches.

STANDARD CAST IRON COMPANION FLANGES AND BOLTS
(for working pressures up to 125 psi steam, 175 psi WOG)

Size	Flange Dia.	Bolt Circle	No. of Bolts	Bolt Size	Bolt Length
3/4	3 1/2	2 1/2	4	3/8	2
1	4 1/4	3 1/8	4	1/2	2 1/4
1 1/4	4 5/8	3 1/2	4	1/2	2 1/4
1 1/2	5	3 7/8	4	1/2	2 1/2
2	6	4 3/4	4	5/8	2 3/4
2 1/2	7	5 1/2	4	5/8	3
3	7 1/2	6	4	5/8	3
3 1/2	8 1/2	7	8	5/8	3
4	9	7 1/2	8	5/8	3
5	10	8 1/2	8	3/4	3 1/4
6	11	9 1/2	8	3/4	3 1/4
8	13 1/2	11 3/4	8	3/4	3 1/2
10	16	14 1/4	12	7/8	4
12	19	17	12	7/8	4
14	21	18 3/4	12	1	4 1/2
16	23 1/2	21 1/4	16	1	4 1/2

All dimensions shown are in inches.

EXTRA HEAVY CAST IRON COMPANION FLANGES AND BOLTS
(for working pressures up to 250 psi steam, 400 psi WOG)

Size	Flange Dia.	Bolt Circle	No. of Bolts	Bolt Size	Bolt Length
1	4 7/8	3 1/2	4	5/8	2 1/2
1 1/4	5 1/4	3 7/8	4	5/8	2 3/4
1 1/2	6 1/8	4 1/2	4	3/4	3
2	6 1/2	5	8	5/8	3
2 1/2	7 1/2	5 7/8	8	3/4	3 1/4
3	8 1/4	6 5/8	8	3/4	3 1/2
3 1/2	9	7 1/4	8	3/4	3 3/4
4	10	7 7/8	8	3/4	3 3/4
5	11	9 1/4	8	3/4	4 1/4
6	12 1/2	10 5/8	12	3/4	4 1/4
8	15	13	12	7/8	4 3/4
10	17 1/2	15 1/4	16	1	5 1/2
12	20 1/2	17 3/4	16	1 1/8	5 3/4
14 O.D.	23	20 1/4	20	1 1/8	6 1/2
16 O.D.	25 1/2	22 1/2	20	1 1/4	6 1/2
18 O.D.	28	24 3/4	24	1 1/4	6 3/4
20 O.D.	30 1/2	27	24	1 1/4	7 1/8
24 O.D.	36	32	24	1 1/2	8

All dimensions shown are in inches.

BOLT DIMENSIONS FOR 150 TO 300 LB. STEEL FLANGE

Nom. Pipe Size	125/150 LB. Flange					250/300 LB. Flange				
	Bolt Circle Diameter	Bolt Diameter	No. of Bolts	* Stud Length	Bolt Length	Bolt Circle Diameter	Bolt Diameter	No. of Bolts	* Stud Length	Bolt Length
1/2	2 3/8	1/2	4	2 1/4	1 3/4	2 5/8	1/2	4	2 1/2	2
3/4	2 3/4	1/2	4	2 1/4	2	3 1/4	5/8	4	2 3/4	2 1/2
1	3 1/8	1/2	4	2 1/2	2	3 1/2	5/8	4	3	2 1/2
1 1/4	3 1/2	1/2	4	2 1/2	2 1/4	3 7/8	5/8	4	3	2 3/4
1 1/2	3 7/8	1/2	4	2 3/4	2 1/4	4 1/2	3/4	4	3 1/2	3
2	4 3/4	5/8	4	3	2 3/4	5	5/8	8	3 1/4	3
2 1/2	5 1/2	5/8	4	3 1/4	3	5 7/8	3/4	8	3 3/4	3 1/4
3	6	5/8	4	3 1/2	3	6 5/8	3/4	8	4	3 1/2
3 1/2	7	5/8	8	3 1/2	3	7 1/4	3/4	8	4 1/4	3 3/4
4	7 1/2	5/8	8	3 1/2	3	7 7/8	3/4	8	4 1/4	3 3/4
5	8 1/2	3/4	8	3 3/4	3 1/4	9 1/4	3/4	8	4 1/2	4
6	9 1/2	3/4	8	3 3/4	3 1/4	10 5/8	3/4	12	4 3/4	4 1/4
8	11 3/4	3/4	8	4	3 1/2	13	7/8	12	5 1/4	4 3/4
10	14 1/8	7/8	12	4 1/2	3 3/4	15 1/4	1	16	6	5 1/4
12	17	7/8	12	4 1/2	4	17 3/4	1 1/8	16	6 1/2	5 3/4
14	18 3/4	1	12	5	4 1/4	20 1/4	1 1/8	20	6 3/4	6
16	21 1/4	1	16	5 1/4	4 1/2	22 1/2	1 1/4	20	7 1/4	6 1/2
18	22 3/4	1 1/8	16	5 3/4	4 3/4	24 3/4	1 1/4	24	7 1/2	6 3/4
20	25	1 1/8	20	6	5 1/4	27	1 1/4	24	8	7
22	27 1/4	1 1/4	20	6 1/2	5 1/2	29 1/4	1 1/2	24	8 3/4	7 1/2
24	29 1/2	1 1/4	20	6 3/4	5 3/4	32	1 1/2	24	9	7 3/4
26	31 3/4	1 1/4	24	7	6	34 1/2	1 5/8	28	10	8 3/4
30	36	1 1/4	28	7 1/4	6 1/4	39 1/4	1 3/4	28	11 1/4	10
34	40 1/2	1 1/2	32	8	7	43 1/2	1 7/8	28	12 1/4	10 3/4
36	42 3/4	1 1/2	32	8 1/4	7	46	2	32	12 3/4	11 1/4
42	49 1/2	1 1/2	36	8 3/4	7 1/4	52 3/4	2	36	13 3/4	13 1/2

*1/16" Raised Face
Stud lengths for lap joint flanges are equal to lengths shown plus the thickness of two laps of the stub ends.

BOLT DIMENSIONS FOR 400 AND 600 LB. STEEL FLANGE

Nom. Pipe Size	400 LB. Flange				600 LB. Flange			
	Bolt Circle Diameter	Bolt Diameter	Number of Bolts	* Stud Length	Bolt Circle Diameter	Bolt Diameter	Number of Bolts	* Stud Length
½	2⅝	½	4	3	2⅝	½	4	3
¾	3¼	⅝	4	3¼	3¼	⅝	4	3¼
1	3½	⅝	4	3½	3½	⅝	4	3½
1¼	3⅞	⅝	4	3¾	3⅞	⅝	4	3¾
1½	4½	¾	4	4	4½	¾	4	4
2	5	⅝	8	4	5	⅝	8	4
2½	5⅞	¾	8	4½	5⅞	¾	8	4¼
3	6⅝	¾	8	4¾	6⅝	¾	8	4¾
3½	7¼	⅞	8	5¼	7¼	⅞	8	5¼
4	7⅞	⅞	8	5¼	8½	⅞	8	5½
5	9¼	⅞	8	6½	10½	1	8	6¼
6	10⅝	⅞	12	5¾	11½	1	12	6½
8	13	1	12	6½	13¾	1⅛	12	7½
10	15¼	1⅛	16	7¼	17	1¼	16	8¼
12	17¾	1¼	16	7¾	19¼	1¼	20	8½
14	20¼	1¼	20	8	20¾	1⅜	20	9
16	22½	1⅜	20	8½	23¾	1½	20	9¾
18	24¾	1⅜	24	8¾	25¾	1⅝	20	10½
20	27	1½	24	9½	28½	1⅝	24	11¼
22	29¼	1⅝	24	10	30⅝	1¾	24	12
24	32	1¾	24	10½	33	1⅞	24	12¾
26	34½	1¾	28	11½	36	1⅞	28	13¼
30	39¼	2	28	13	40¼	2	28	14
34	43½	2	28	13¾	44½	2¼	28	15
36	46	2	32	14	47	2½	28	15¾
42	52¾	2½	32	16¼	53¾	2¾	28	17½

*¼" Raised Face
Stud lengths for lap joint flanges are equal to lengths shown minus ½" plus the thickness of two laps of the stub ends.

BOLT TEMPLATE FOR DRILLING FLANGED FITTINGS

Pipe Size	Flange Dia.	Min. Flange Thickness	Bolt Circle Dia.	No. of Bolts	Bolt Hole Dia.	Dia. of Bolt	Length of Bolt	Ring Gasket I.D.	Ring Gasket O.D.
NPS/DN	*In./mm*	*In./mm*	*In./mm*		*In./mm*	*In./mm*	*In./mm*	*In./mm*	*In./mm*
3/4 *20*	3 7/8 *98*	7/16 *11*	2 3/4 *70*	4	5/8 *16*	1/2 *13*	1 3/4 *44*	1 1/16 *27*	2 1/4 *57*
1 *25*	4 1/4 *108*	7/16 *11*	3 1/8 *79*	4	5/8 *16*	1/2 *13*	1 3/4 *44*	1 5/16 *33*	2 5/8 *67*
1 1/4 *32*	4 5/8 *117*	1/2 *13*	3 1/2 *89*	4	5/8 *16*	1/2 *13*	2 *51*	1 21/32 *42*	3 *76*
1 1/2 *40*	5 *127*	9/16 *14*	3 7/8 *98*	4	5/8 *16*	1/2 *13*	2 *51*	1 29/32 *48*	3 3/8 *86*
2 *50*	6 *152*	5/8 *16*	4 3/4 *121*	4	3/4 *19*	5/8 *16*	2 1/4 *57*	2 3/8 *60*	4 1/8 *105*
2 1/2 *65*	7 *178*	11/16 *17*	5 1/2 *140*	4	3/4 *19*	5/8 *16*	2 1/2 *64*	2 7/8 *73*	4 7/8 *124*
3 *80*	7 1/2 *191*	3/4 *19*	6 *152*	4	3/4 *19*	5/8 *16*	2 1/2 *64*	3 1/2 *89*	5 3/8 *137*
3 1/2 *90*	8 1/2 *216*	13/16 *22*	7 *178*	8	3/4 *19*	5/8 *16*	2 3/4 *70*	4 *102*	6 3/8 *162*
4 *100*	9 *229*	15/16 *24*	7 1/2 *191*	8	3/4 *19*	5/8 *16*	3 *76*	4 1/2 *114*	6 7/8 *175*
5 *125*	10 *254*	15/16 *24*	8 1/2 *216*	8	7/8 *22*	3/4 *19*	3 *76*	5 9/16 *141*	7 3/4 *197*
6 *150*	11 *279*	1 *25*	9 1/2 *241*	8	7/8 *22*	3/4 *19*	3 1/4 *83*	6 5/8 *168*	8 3/4 *222*
8 *200*	13 1/2 *343*	1 1/8 *29*	11 3/4 *298*	8	7/8 *22*	3/4 *19*	3 1/2 *89*	8 5/8 *219*	11 *279*
10 *250*	16 *406*	1 3/16 *30*	14 1/4 *362*	12	1 *25*	7/8 *22*	3 3/4 *95*	10 3/4 *273*	13 3/8 *340*
12 *300*	19 *483*	1 1/4 *32*	17 *432*	12	1 *25*	7/8 *22*	3 3/4 *95*	12 3/4 *324*	16 1/8 *410*
14 O.D. *350 O.D.*	21 *533*	1 3/8 *35*	18 3/4 *476*	12	1 1/8 *29*	1 *25*	4 1/4 *108*	14 *356*	17 3/4 *451*
16 O.D. *400 O.D.*	23 1/2 *597*	1 7/16 *37*	21 1/4 *540*	16	1 1/8 *29*	1 *25*	4 1/2 *114*	16 *406*	20 1/4 *514*
18 O.D. *450 O.D.*	25 *635*	1 9/16 *40*	22 3/4 *578*	16	1 1/4 *32*	1 1/8 *29*	4 3/4 *121*	18 *457*	21 5/8 *549*
20 O.D. *500 O.D.*	27 1/2 *699*	1 11/16 *43*	25 *635*	20	1 1/4 *32*	1 1/8 *29*	5 *127*	20 *508*	23 7/8 *606*
24 O.D. *600 O.D.*	32 *813*	1 7/8 *48*	29 1/2 *749*	20	1 3/8 *35*	1 1/4 *32*	5 1/2 *140*	24 *610*	28 1/4 *718*

Drilling templates are in multiples of four, so that fittings may be made to face in any quarter. Bolt holes straddle the center line.

BOLT TEMPLATE FOR DRILLING EXTRA HEAVY FLANGED FITTINGS

Pipe Size	Flange Dia.	Min. Flange Thickness	Dia. of Raised Face	Bolt Circle Dia.	No. of Bolts	Dia. of Bolt Holes	Bolt Dia.	Bolt Length	Gasket I.D.	Ring Gasket O.D.
NPS/DN	*In./mm*	*In./mm*		*In./mm*		*In./mm*	*In./mm*	*In./mm*	*In./mm*	*In./mm*
1 *25*	4 7/8 *124*	11/16 *17*	2 11/16 *68*	3 1/2 *89*	4	3/4 *19*	5/8 *16*	2 1/2 *64*	1 5/16 *33*	2 7/8 *51*
1 1/4 *32*	5 1/4 *133*	3/4 *19*	3 1/16 *78*	3 7/8 *98*	4	3/4 *19*	5/8 *16*	2 1/2 *64*	1 21/32 *42*	3 1/4 *83*
1 1/2 *40*	6 1/8 *156*	13/16 *22*	3 9/16 *90*	4 1/2 *114*	4	7/8 *22*	3/4 *19*	2 3/4 *70*	1 29/32 *48*	3 3/4 *95*
2 *50*	6 1/2 *165*	7/8 *22*	4 3/16 *106*	5 *127*	8	3/4 *19*	5/8 *16*	2 3/4 *70*	2 3/8 *60*	4 3/8 *111*
2 1/2 *65*	7 1/2 *191*	1 *25*	4 15/16 *125*	5 7/8 *149*	8	7/8 *22*	3/4 *19*	3 1/4 *83*	2 7/8 *73*	5 1/8 *130*
3 *80*	8 1/4 *210*	1 1/8 *29*	5 11/16 *144*	6 5/8 *168*	8	7/8 *22*	3/4 *19*	3 1/2 *89*	3 1/2 *89*	5 7/8 *149*
3 1/2 *90*	9 *229*	1 3/16 *30*	6 5/16 *160*	7 1/4 *184*	8	7/8 *22*	3/4 *19*	3 1/2 *89*	4 *102*	6 1/2 *165*
4 *100*	10 *254*	1 1/4 *32*	6 15/16 *176*	7 7/8 *200*	8	7/8 *22*	3/4 *19*	3 3/4 *95*	4 1/2 *114*	7 1/8 *181*
5 *125*	11 *279*	1 3/8 *35*	8 5/16 *211*	9 1/4 *235*	8	7/8 *22*	3/4 *19*	4 *102*	5 9/16 *141*	8 1/2 *216*
6 *150*	12 1/2 *318*	1 7/16 *37*	9 11/16 *246*	10 5/8 *270*	12	7/8 *22*	3/4 *19*	4 *102*	6 5/8 *168*	9 7/8 *251*
8 *200*	15 *381*	1 5/8 *41*	11 15/16 *303*	13 *330*	12	1 *25*	7/8 *22*	4 1/2 *114*	8 5/8 *219*	12 1/8 *308*
10 *250*	17 1/2 *445*	1 7/8 *48*	14 1/16 *357*	15 1/4 *387*	16	1 1/8 *29*	1 *25*	5 1/4 *133*	10 3/4 *273*	14 1/4 *362*
12 *300*	20 1/2 *521*	2 *51*	16 7/16 *418*	17 3/4 *451*	16	1 1/4 *32*	1 1/8 *29*	5 1/2 *140*	12 3/4 *324*	16 5/8 *422*

Drilling templates are in multiples of four, so that fittings may be made to face in any quarter. Bolt holes straddle the center line.

Coated Arc Welding Electrodes – Types & Styles

A. W. S. Classification

E60**10** **Direct Current, Reverse polarity, All Positions.** All purpose. Moderately smooth finish. Good penetration. This is the electrode used for most carbon steel pipe welding.

E60**11** **Alternating Current, All Positions.** All purpose. Moderately smooth finish. Good penetration. AC or DC or DC Reverse Polarity

E60**12** **Direct Current, Straight Polarity, All Positions.** High bead. Smooth. Fast. "Cold rod".

E60**13** **Alternating Current, All Positions.** High bead. Smooth. Fast. "Cold rod". AC, DC Reverse, DC Straight

E60**18** **Direct Current, All Positions.** "Low hydrogen" iron powder electrodes. AC or DC Reverse Polarity

E60**20** **Direct Current, Straight Polarity, Flat & Horizontal Fillet.** Flat bead. Smooth. Fast. Deep penetration. Can be used with A.C. also. "Hot rod".

E60**27** "Iron powder electrodes". Flat and Horizontal Fillet, AC or DC Straight

NOTE: This information also applies to E70, E80, E90, and E100 Series.

The last two numbers **(in bold type)** designate the types or styles and the first two numbers the minimum specified tensile strength in 1,000 psi of the weld deposit as welded.

Physical Properties of E60 & E70 Series Electrodes

TYPICAL VALUES

AWS ASTM Electrode	Tensile Strength	Yield Strength	Elongation	Red. in Area Min. %
E6010	62,000–70,000	52,000–58,000	22 to 28%	35
E6011	62,000–73,000	52,000–61,000		
E6012	68,000–78,000	55,000–65,000	17 to 22%	25

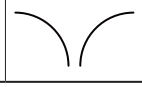
MINIMUM VALUES

AWS ASTM Electrode	Tensile Strength	Yield Strength	Elongation
E7010	70,000	57,000	22
E7011	70,000	57,000	22
E7015	70,000	57,000	22
E7016	70,000	57,000	22
E7020	70,000	52,000	25

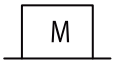
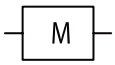
WELDING AND BRAZING TEMPERATURES

Carbon Steel Welding	2700–2790°F
Stainless Steel Welding	2490–2730°F
Cast Iron Welding	1920–2500°F
Copper Welding and Brazing	1980°F
Brazing Copper-Silicon with Phosphor-Bronze	1850–1900°F
Brazing Naval Bronze with Manganese Bronze	1600–1700°F
Silver Solder	1175–1600°F
Low Temperature Brazing	1175–1530°F
Soft Solder	200–730°F
Wrought Iron	2700–2750°F

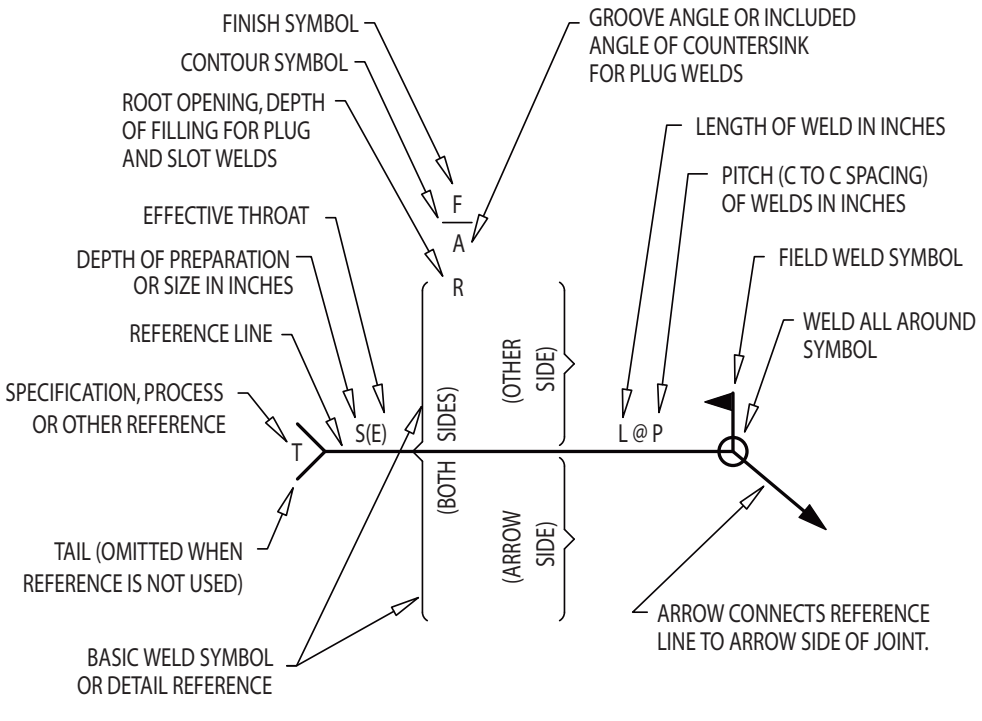
BASIC WELD SYMBOLS

Back	Fillet	Plug or Slot	GROOVE OR BUTT						
			Square	V	Bevel	U	J	Flare V	Flare Bevel
									

SUPPLEMENTARY WELD SYMBOLS

Backing	Spacer	Weld All-Around	Field Weld	CONTOUR		See AWS A2.4 for a detailed review of standard welding symbols
				Flush	Convex	
						

STANDARD LOCATION OF ELEMENTS OF A WELDING SYMBOL

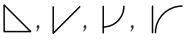


Basic Arc & Gas Welding Symbols Notes

NOTES:

1. In plan or elevation, near, far, and both sides, locations refer to nearest member parallel to plane of drawing and not to others farther behind.
2. In section or end views only, when weld is not drawn, the side to which arrow points is considered near side.
3. Welds on both sides are of same size unless otherwise shown.
4. Symbols govern to break in continuity of structure or to extent of hatching or dimension lines.
5. Tail of arrow used for specification reference.
6. All welds are continuous and of user's standard propertions and all except V-grooved and bevel-grooved welds are closed unless otherwise shown.
7. When welds are drawn in section or end views, obvious information is not given by symbol.
8. In joints in which one member only is to be grooved, arrows point to that member.

NOTES:

1. Size, weld symbol, length of weld and spacing must read in that order from left to right along the reference line. Neither orientation of reference line nor location of the arrow alter this rule.
2. The perpendicular leg of  , , , weld symbols must be at left.
3. Arrow and other side welds are of the same size unless otherwise shown. Dimensions of fillet welds must be shown on both the arrow side and other side symbol.
4. The point of the field weld symbol must point toward the tail.
5. Symbols apply between abrupt changes in direction of welding unless governed by the "All Around" symbol or otherwise dimensioned.

MINUTES CONVERTED TO DECIMALS OF A DEGREE

Minutes	Degree
1	.0166
2	.0333
3	.0500
4	.0666
5	.0833
6	.1000
7	.1166
8	.1333
9	.1500
10	.1666
11	.1833
12	.2000
13	.2106
14	.2333
15	.2500
16	.2666
17	.2833
18	.3000
19	.3166
20	.3333
21	.3500
22	.3666
23	.3833
24	.4000
25	.4166
26	.4333
27	.4500
28	.4666
29	.4833
30	.5000
31	.5166
32	.5333
33	.5500
34	.5666
35	.5833
36	.6000
37	.6166
38	.6333
39	.6500
40	.6666
41	.6833
42	.7000
43	.7166
44	.7333
45	.7500
46	.7666
47	.7833
48	.8000
49	.8166
50	.8333
51	.8500
52	.8666
53	.8833
54	.9000
55	.9166
56	.9333
57	.9500
58	.9666
59	.9833
60	1.0000

DECIMAL EQUIVALENTS OF FRACTIONS

Inches	Decimal of an Inch
1/64	.015625
1/32	.03125
3/64	.046875
1/16	.0625
5/64	.078125
3/32	.09375
7/64	.109375
1/8	.125
9/64	.140625
5/32	.15625
11/64	.171875
3/16	.1875
13/64	.203125
7/32	.21875
15/64	.234375
1/4	.25
17/64	.265625
9/32	.28125
19/64	.296875
5/16	.3125
21/64	.328125
1/3	.333
11/32	.34375
23/64	.359375
3/8	.375
25/64	.390625
13/32	.40625
27/64	.421875
7/16	.4375
29/64	.453125
15/32	.46875
31/64	.484375
1/2	.5
33/64	.515625
17/32	.53125
35/64	.546875
9/16	.5625
37/64	.578125
19/32	.59375
39/64	.609375
5/8	.625
41/64	.640625
21/32	.65625
43/64	.671875
11/16	.6875
45/64	.703125
23/32	.71875
47/64	.734375
3/4	.75
49/64	.765625
25/32	.78125
51/64	.796875
13/16	.8125
53/64	.828125
27/32	.84375
55/64	.859375
7/8	.875
57/64	.890625
29/32	.90625
59/64	.921875
15/16	.9375
61/64	.953125
31/32	.96875
63/64	.984375
1	1.0

STANDARD CONVERSIONS

To Change	To	Multiply By
Inches	Feet	0.0833
	Millimeters	25.4
Feet	Inches	12
	Yards	0.3333
Yards	Feet	3
Square Inches	Square feet	0.00694
Square feet	Square inches	144
	Square yards	0.11111
Square yards	Square feet	9
Cubic Inches	Cubic feet	0.00058
Cubic feet	Cubic inches	1728
	Cubic yards	0.03703
Cubic yards	Cubic feet	27
Cubic Inches	Gallons	0.00433
Cubic feet	Gallons	7.48
Gallons	Cubic inches	231
	Cubic feet	0.1337
	Pounds of water	8.33
Pounds of water	Gallons	0.12004
Ounces	Pounds	0.0625
Pounds	Ounces	16
Inches of water	Pounds per square inch	0.0361
	Inches of mercury	0.0735
	Ounces per square inch	0.578
	Pounds per square foot	5.2
Inches of mercury	Inches of water	13.6
	Feet of water	1.1333
	Pounds per square inch	0.4914
Ounces per square inch	Inches of mercury	0.127
	Inches of water	1.733
Pounds per square inch	Inches of water	27.72
	Feet of water	2.31
	Inches of mercury	2.04
	Atmospheres	0.0681
Feet of water	Pounds per square inch	0.434
	Pounds per square foot	62.5
	Inches of mercury	0.8824
Atmospheres	Pounds per square inch	14.696
	Inches of mercury	29.92
	Feet of water	34
Long tons	Pounds	2240
Short tons	Pounds	2000
	Long tons	0.89285

UNIT CONVERSION

FLOW	
1 gpm =	0.134 cu. ft. per min
	500 lb.per hr. x sp. gr.
500 lb. per hr. =	1 gpm / sp. gr.
1 cu. ft. per min. (cfm) =	448.8 gal. per hr. (gph)

POWER	
1 Btu per hr. =	0.293 watt
	12.96 ft. lb. per min.
	0.00039 hp
1 ton refrigeration = (U.S.)	288,000 Btu per 24 hr.
	12,000 Btu per hr.
	200 Btu per min.
	83.33 lb. ice melted per 24hr. from and at 32˚ F
	2,000 lb. ice melted per 24hr. from and at 32˚ F
1 hp =	550 ft. lb. per sec.
	746 watt
	2,545 Btu per hr.
1 boiler hp =	33,480 Btu per hr.
	34.5 lb. water evap. per hr. from & at 212°F
	9.8 kw.
1 kw. =	3,413 Btu per hr.

MASS	
1 lb. (avoir.) =	16 oz. (avoir.)
	7,000 grain
1 ton (short) =	2,000 lb.
1 ton (long) =	2,240 lb.

PRESSURE	
1 lb. per sq. in. =	3.13 ft. water at 60°F
	2.04 in. hg at 60°F
1 ft. water at 60°F =	.433 lb. per sq. in.
	.884 in. hg at 60°F
1 in. Hg at 60°F =	.49 lb. per sq. in.
	1.13 ft. water at 60°F
1 lb. per sq. in. = Absolute (psia)	lb. per sq. in gauge (psig)
	+14.7

TEMPERATURE	
°C =	(°F-32) x 5/9

VOLUME	
I gal. (U.S.) =	128 fl. oz. (U.S.)
	231 cu. in.
	.833 gal. (Brit.)
1 cu. ft. =	7.48 gal. (U.S.)

WEIGHT OF WATER	
1 cu. ft. at 50°F. =	62.41 lb.
1 gal. at 50°F. =	8.34 lb.
1 cu. ft. of ice =	57.2 lb.
1 cu. ft. at 39.2°F. =	62.43 lb.
Water is at its greatest density at 39.2°F	

WEIGHT OF LIQUID	
1 gal. (U.S.) =	8.34 lb. x sp. gr.
1 cu. ft. =	62.4 lb. x sp. gr.
1 lb. =	.12 U.S. gal. / sp. gr.
	.016 cu. ft. / sp. gr.

WORK	
1 Btu (mean) =	778 ft. lb.
	.293 watt hr.
	1/180 of heat required to change temp of 1 lb. water from 32°F to 212°F
1 hp-hr =	2545 Btu (mean)
	.746 kwhr
1 Kwhr =	3413 Btu (mean)
	1.34 hp-hr

INSTALLATION AND ASSEMBLY

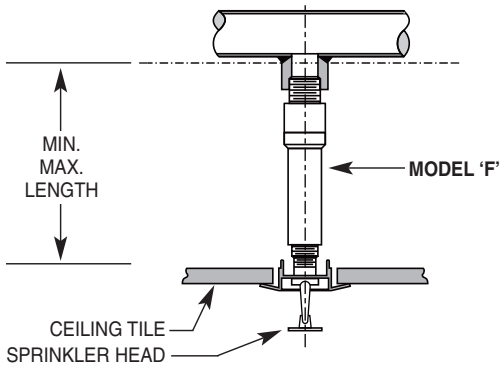
Merit® Eliminator Adjustable Drop Nipple

A) For use in wet and dry pipe automatic sprinkler systems installed in accordance with all applicable standards or codes.

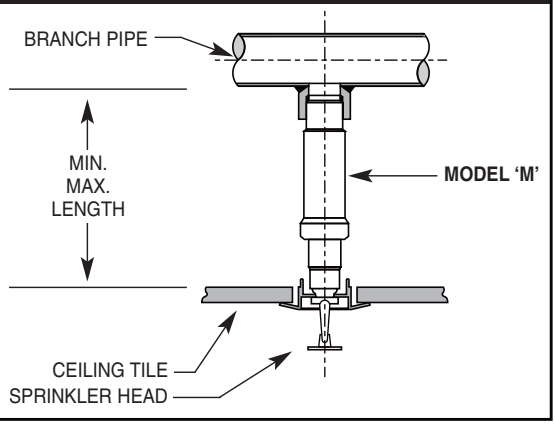
B) Before starting the job of making sprinklers into steel threads of the above fittings, count the number of fully developed male threads on the brand of sprinkler to be installed into the fittings. If seven (7) perfect threads are counted, the sprinkler should thread into the 1/2" or 3/4" thread from three (3) to four (4) threads hand tight. If five (5) to six (6) threads are counted, the sprinkler should thread into the 1/2" or 3/4" thread from two (2) to three (3) threads hand tight.

C) The use of an anaerobic pipe thread sealant is preferred for thread make up when connecting to another pipe fitting or nipple. If attaching a sprinkler head, please refer to the manufacturer's installation instructions and apply pipe thread sealant only to male threads of the sprinkler.

MODEL 'F' INSTALLATION



MODEL 'M' INSTALLATION



D) If either of the above fails to allow the sprinkler to make-up to a minimum of from five (5) to six (6) full threads, do not overtighten the sprinkler. Instead back the sprinkler out of the fitting. Clean any debris and/or pipe sealant from both the male and female threads. Gauge both the male threads of the sprinkler and the female threads of the Adjustable Drop Nipple for compliance with ANSI B1.20.1. Specification for Tapered Pipe Threads. The same procedure would apply if a leak has been detected. If within tolerance, reapply the anaerobic pipe sealant and make-on to the required length. Allow twenty-four hours for setting.

E) Connect the Adjustable Drop Nipple assembly to the sprinkler system by wrenching on the make-up area on the Drop Nipple. DO NOT WRENCH ON THE BARREL PORTION OF THE UNIT OR SPRINKLER. Damage to the Adjustable Drop Nipple or Sprinkler may result.

F) After the ceiling has been installed adjust the sprinkler to its final position by using the sprinkler wrench and assemble the escutcheon plate to the inner support ring. It is recommended that the system pressure be relieved when adjusting, however it is not necessary to drain the system.

⚠ WARNING Adjustable Drop Nipples described herein must be installed and maintained in compliance with this document as well as the applicable standards of the National Fire Protection Association in addition to the standards for any other authorities having jurisdiction. DO NOT USE ANY PETROLEUM BASED LUBRICANTS ON THE O-RING SEALS. Petroleum based lubricants are incompatible with EPDM and will impair serviceability of the unit.

Merit® Weld-Miser™ Tee-Let (Welding Outlet Fittings)

TEE-LET WELDED OUTLET FITTING (UL VIZU — EX6032, FM APPROVAL GUIDE CHAPTER 1 – PIPE FITTINGS)			
Outlet Model	Outlet Pipe Size (Inch)	Header Pipe Size (Inch)	Rated Pressure (psig)
Tee-Let Type A (F-Threaded End)	½, ¾, 1	½ - 8 (Sch.10, 40)	300
	1¼, 1½, 2, 2½, 3, 4	½ - 4 (Sch. 5, DynaFlow)	
	2	4 (EZ-Flow)	
	2, 4	6 (EZ-Flow)	
Tee-Let Type C (Grooved End)	1¼ - 8	1¼ - 8 (Sch.10, 40)	300
	2½ - 8	½ - 4 (Sch. 5, DynaFlow)	
Tee-Let Type C/R (Roll Grooved End)	1¼ - 6	1¼ - 8 (All Schedules)	300

1) Size-on-size (i.e. 2 x 2) Tee-Lets are not FM Approved.
2) FM rated working pressure when welded on Sch. 5 or non-threadable lightwall pipe is 175 psi.

Note: Tee-Lets are manufactured to fit size-on-size, that is the contoured shape on a given Tee-Let is made to fit perfectly on the first listed header size. If installed on the second header size marked on the fitting, a slight gap of approximately 1/32" will appear along the longitudinal centerline of the header. For example, a 1" x 2 - 2 1/2" Tee-Let, is a 1" outlet fitting manufactured to fit perfectly on the 2" header size listed, while leaving a 1/32" gap along the longitudinal centerline of the 2 1/2" size. If a perfect fit is required for a 2 1/2" header pipe, then a 1" x 2 1/2 - 3" Tee-Let would be ordered. Size consolidations are employed to reduce inventory and provide for greater flexibility.

Thread Make-up and Installation

A) For use in systems installed in accordance with all applicable standards or codes. (See Section III, Item C)

B) Before starting the job of making nipples or sprinklers into steel threads of the above fittings, insure that no dirt or weld spatter is in the threads and no burn-through damaged the threads. Then count the number of fully developed male threads on the nipple or sprinkler to be installed into the fittings. Compare number of threads counted to the number of required fully developed threads as shown in the thread chart located on the back of this sheet. If thread count is correct, proceed with installation (Step C), if thread count does not match, check nipple or sprinkler for proper thread gage measurement and discard if not to ANSI B1.20.1 / ISO-7R/RC specification.

C) The use of an anaerobic pipe thread sealant is preferred for thread make up when connecting to another pipe fitting or nipple. If attaching a sprinkler head, please refer to the manufacturer's installation instructions and apply pipe thread sealant only to male threads of the sprinkler.

D) If either of the above fails to allow the sprinkler or nipple to make-up to a minimum of full threads, do not over tighten. Instead back the sprinkler or nipple out of the fitting. Clean any debris and/or pipe sealant from both the male and female threads. Gauge both the male threads of the sprinkler or nipple and the female threads of the Tee-Let with ANSI B1.20.1 / ISO-7R/RC. Specification for Tapered Pipe Threads. The same procedure would apply if a leak has been detected.

If within tolerance, reapply the anaerobic pipe sealant or Teflon™ tape and make-on to the required length. Allow twenty-four hours for setting.

Merit® Weld-Miser™ Tee-Let (Welding Outlet Fittings)

Recommended Hole Sizes

The hole cut in the branch or header pipe can be cut prior or subsequent to attachment of the Tee-Let. One advantage of cutting the hole after welding is that the pipe is left intact during welding thereby reducing shrinkage and possible distortion. If holes are cut prior to welding, as some codes require, then the following hole sizes are recommended. Note that the same hole diameter for a given outlet size is required for both Type A and Type C Tee-Lets 1-1$^1/_2$" larger.

Holes may be cut employing mechanical means—including hole sawing, mechanical flame cutting (oxy-acetylene or propane), and air plasma cutting (constricted tungsten arc) machines. Merit offers a simple approach to cutting the hole. Hand-held templates are sized to match your plasma cutter.

RECOMMENDED TEE-LET HOLE SIZES

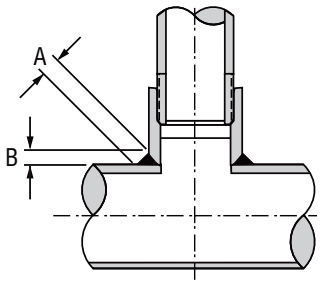
Tee-Let Size	Type	Recommended Hole Size
In./mm		*In./mm*
½ *(13)*	Type A	⅝ *(16)*
¾ *(19)*	Type A	⅞ *(22)*
1 *(25)*	Type A	1⅛ *(28)*
1¼ *(31)*	Type A	1½ *(38)*
1¼ *(31)*	Type C	1⅜ *(35)*
1½ *(38)*	Type A or C	1⅝ *(41)*
2 *(50)*	Type A or C	2 *(50)*
2½ *(63)*	Type A or C	2 7/16 *(61)*
3 *(75)*	Type A or C	3 *(75)*
4 *(100)*	Type A or C	4 *(100)*

Recommended Welding Procedures

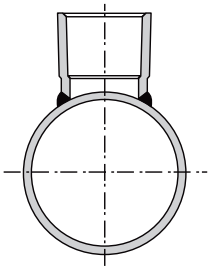
As a general rule, the weld should be only as hot as required to allow the weld to penetrate the materials being welded while concomitantly allowing gases developed in the welding process to escape. Every effort must be made to avoid welding too hot or overheating both the pipe and the Tee-Let. **Excessive heat may cause the wrench tight threads (those in the bottom of the Tee-Let near the weld zone) to distort while also causing the branch pipe to bend.** It should be noted that Merit Tee-Lets have been subjected to exhaustive testing and evaluation, and only negligibly distort when subjected to excessive heat. The threads, on the other hand, may not return to their gauged form after cooling if excessive heat causes them to expand. The following is intended only as a guide, and assumes that the welding equipment is properly calibrated and functioning normally and the operator is qualified.

RECOMMENDED AMOUNT OF WELD

Outlet Size	A	B
In./mm	*In./mm*	*In./mm*
½ *(13)*	¼ *(7)*	3/16 *(5)*
¾ *(19)*	¼ *(7)*	3/16 *(5)*
1 *(25)*	¼ *(7)*	3/16 *(5)*
1¼ *(31)*	¼ *(7)*	3/16 *(5)*
1½ *(38)*	5/16 *(8)*	¼ *(7)*
2 *(50)*	5/16 *(8)*	¼ *(7)*
2½ *(63)*	5/16 *(8)*	¼ *(7)*
3 *(75)*	⅜ *(10)*	5/16 *(5)*
4 *(100)*	⅜ *(10)*	5/16 *(5)*



½, ¾ & 1 Outlet


1¼ - 2½ Outlet

Merit® Weld-Miser™ Tee-Let (Welding Outlet Fittings)

RECOMMENDED SETTINGS FOR MICROWIRE WELDING PROCESS

Header Size	Pipe Wall Thickness	Tee-Let Types A, B, C	Electrode Size	Welding Current	Arc. Volts	Wire Feed	Travel Speed
In./mm	*In./mm*	*In./mm*		*AMPS-DC*	*POS.*	*IPM*	*IPM*
1¼ - 2 *31-50*	0.065 *2*	½ - 2 *13-50*	0.035	100-130	16-20	210	25-30
		2½ - 4 *63-100*	0.035	115-150	17-21	270	20-25
	0.109 *3*	½ - 2 *13-50*	0.035	110-140	18-22	220	25-30
		2½ - 4 *63-100*	0.035	120-160	19-22	290	20-25
2½ - 4 *63-100*	0.083 *2.5*	½ - 2 *13-50*	0.035	110-140	17-20	210	20-25
		2½ - 4 *63-100*	0.035	120-150	17-20	270	20-25
	0.120 *3*	½ - 2 *13-50*	0.035	120-160	19-22	290	20-25
		2½ - 4 *63-100*	0.035	130-160	19-22	240	20-25
5-6 *125-150*	0.109 *3*	½ - 2 *13-50*	0.035	120-150	17-20	210	20-25
		2½ - 4 *63-100*	0.035	130-150	18-20	270	15-20
	0.134 *3.5*	½ - 2 *13-50*	0.035	130-160	19-22	290	20-25
		2½ - 4 *63-100*	0.035	140-160	20-22	270	15-20
		2½ - 4 *63-100*	0.045	180-205	20-24	245	27-32
8 *200*	0.109 *3*	½ - 2 *13-50*	0.035	120-150	17-20	240	20-25
		2½ - 4 *63-100*	0.035	130-150	18-20	260	15-20
		2½ - 4 *63-100*	0.045	170-220	18-22	290	12-18
	0.148 *3.5*	½ - 2 *13-50*	0.035	130-160	19-22	240	20-25
		2½ - 4 *63-100*	0.035	140-160	20-22	260	15-20
		2½ - 4 *63-100*	0.045	180-225	20-24	290	12-18

Shielding Gas Flow (for all sizes) 20-25 CFH

1.) Co_2 - Deeper penetration, faster welding, low cost.

2.) 25% - Argon, 75% - Co_2, Recommended for .134 wall and lighter, high welding speeds without melt through, minimum distortion and spatter, good penetration.

Merit assumes no liability for any consequential damages resulting from the improper use of its Tee-Let Welding Outlet Fittings, nor for any recommendations made with respect to installation procedures.

INSTALLATION AND ASSEMBLY

General Assembly of Threaded Fittings

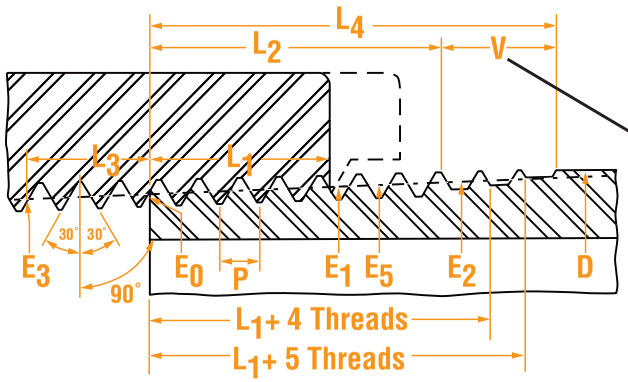
1) Inspect both male and female components prior to assembly.
   - Threads should be free from mechanical damage, dirt, chips and excess cutting oil.
   - Clean or replace components as necessary.

2) Application of pipe dope
   - Use a pipe dope that is fast drying, sets-up to a semi hard condition and is vibration resistant. Alternately, an anaerobic sealant may be utilized.
   - Thoroughly mix the thread sealant prior to application.
   - Apply a thick even coat to the male threads only. Best application is achieved with a brush stiff enough to force sealant down to the root of the threads.

3) Joint Makeup
   - For sizes up to and including 2" pipe, wrench tight makeup is considered three full turns past handtight. Handtight engagement for 1/2" through 2" thread varies from 4 1/2 turns to 5 turns.
   - For 2 1/2" through 4" sizes, wrench tight makeup is considered two full turns past handtight. Handtight engagement for 2 1/2" through 4" thread varies from 5 1/2 turns to 6 3/4 turns.

PIPE NIPPLE THREAD ENGAGEMENT
(Normal for Tight Joints)

Pipe Size	Length
1/8	1/4
1/4	3/8
3/8	3/8
1/2	1/2
3/4	9/16
1	11/16
1 1/4	11/16
1 1/2	11/16
2	3/4
2 1/2	15/16
3	1
3 1/2	1 1/16
4	1 1/8
5	1 1/4
6	1 5/16

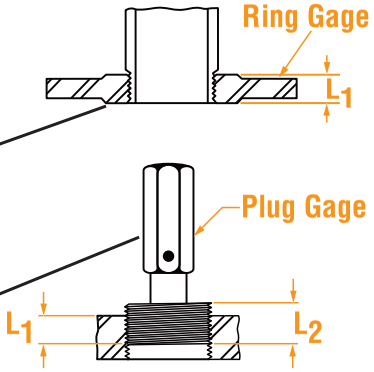


0.8P = Thread Depth - Amer. Std.
0.760P = Thead Depth - A.P.I. Std.
Total Taper 3/4" per Foot (Measured on Diameter)

Imperfect threads due to lead or die

Gage to go on flush by hand – standard tolerance is ± one turn.

Plug gage to enter until notch is flush with first thread – standard tolerance is ± one thread.



NATIONAL PIPE THREAD STANDARDS

Nominal Pipe Size	Outside Diameter of pipe	Threads per Inch	Pitch of Thread	Pitch Diameter at Beginning of External Threads	Handtight Engagement		Effective Thread External		Wrench Make-up Length for Internal Thread		Overall Length External Thread
					Length	Pitch Diameter	Length	Pitch Diameter	Length	Pitch Diameter	
	D	N	P	E_0	L_1 ††	E_1	L_2 †	E_2	L_3	E_3	L_4
1/8	.405	27	.0370	.3635	.180**	.3748**	.2639	.3800	.1111	.3566	.3924
1/4	.540	18	.0556	.4774	.200**	.4899**	.4018	.5025	.1667	.4670	.5946
3/8	.675	18	.0556	.6120	.240	.6270	.4078	.6375	.1667	.6016	.6006
1/2	.840	14	.0714	.7584	.320	.7784	.5337	.07918	.2143	.7450	.7815
3/4	1.050	14	.0714	.9677	.339	.9889	.5457	1.0018	.2143	.9543	.7935
1	1.315	11 1/2	.0870	1.2136	.400	1.2386	.6828	1.2563	.2609	1.1973	.9845
1 1/4	1.660	11 1/2	.0870	1.5571	.420	1.5834	.7068	1.6013	.2609	1.5408	1.0085
1 1/2	1.900	11 1/2	.0870	1.7961	.420	1.8223	.7235	1.8413	.2609	1.7798	1.0252
2	2.375	11 1/2	.0870	2.2690	.436	2.2963	.7565	2.3163	.2609	2.2527	1.0582

2½	2.875	8	.1250	2.7195	.682	2.7622	1.1375	2.7906	.2500	2.7039	1.5712
3	3.500	8	.1250	3.3406	.766	3.3885	1.2000	3.4156	.2500	3.3250	1.6337
3½	4.000	8	.1250	3.8375	.821	3.8888	1.2500	3.9156	.2500	3.8219	1.6837
4	4.500	8	.1250	4.3344	.844	4.3871	1.3000	4.4156	.2500	4.3188	1.7337
*4½	5.000	8	.1250	4.8313	.875	4.8859	1.3500	4.8418	—	—	—
5	5.563	8	.1250	5.3907	.937	5.4493	1.4063	5.4786	.2500	5.3751	1.8400
6	6.625	8	.1250	6.4461	.958	6.5060	1.5125	6.5406	.2500	6.4305	1.9462
*7	7.625	8	.1250	7.4398	1.000	7.5023	1.6125	7.4524	—	—	—
8	8.625	8	.1250	8.4336	1.063	8.5000	1.7125	8.5406	.2500	8.4180	2.1462
*9	9.625	8	.1250	9.4273	1.130	9.4980	1.8125	9.4415	—	—	—
10	10.750	8	.1250	10.5453	1.210	10.6209	1.9250	10.6656	.2500	10.5297	2.3587
*11	11.750	8	.1250	11.5391	1.285	11.6194	2.0250	11.5549	—	—	—
12	12.750	8	.1250	12.5328	1.360	12.6178	2.1250	12.6656	.2500	12.5172	2.5587
14	14.000	8	.1250	13.7750	1.562	13.8726	2.2500	13.9156	.2500	13.7594	2.6837
*15	15.000	8	.1250	14.7688	1.687	14.8742	2.3500	14.7872	—	—	—
16	16.000	8	.1250	15.7625	1.812	15.8758	2.4500	15.9156	.2500	15.7469	2.8837
*17	17.000	8	.1250	16.7563	1.900	16.8750	2.5500	16.7762	—	—	—
18	18.000	8	.1250	17.7500	2.000	17.8750	2.6500	17.9156	.2500	17.7344	3.0837
20	20.000	8	.1250	19.7375	2.125	19.8703	2.8500	19.9156	.2500	19.7219	3.2837
*22	22.000	8	.1250	21.7250	2.250	21.8656	3.0500	21.7488	—	—	—
24	24.000	8	.1250	23.7125	2.375	23.8609	3.2500	23.9156	.2500	23.6969	3.6837

Data per ANSI B1.20.1 - 1983 (R2006) (for Taper Pipe Thread) and API Standard 5-B (for Line Pipe Threads).

*Sizes discontinued in ANSI B1.20.1, listed for reference only.

**Not according to ANSI B1.20.1 - 1983 (R2006).

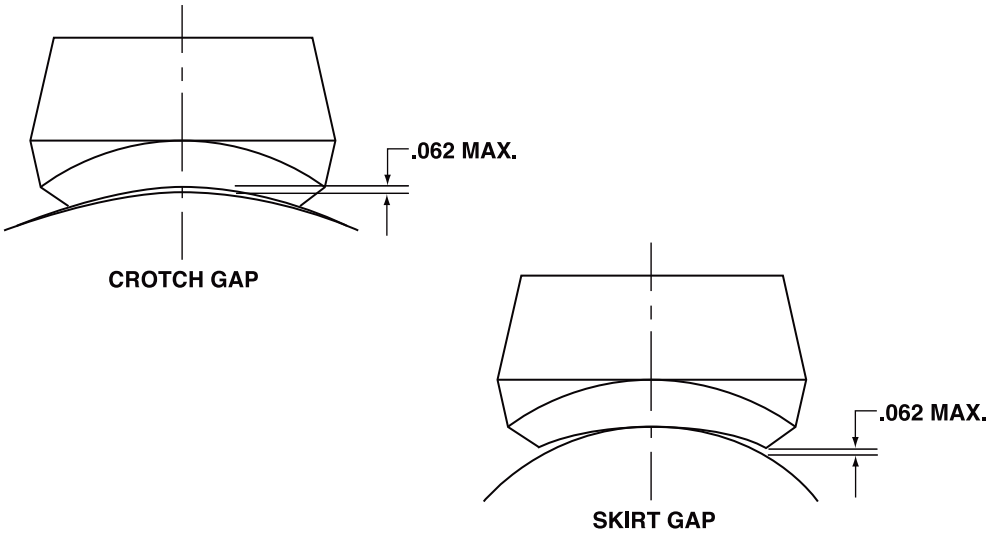
†Also length of plug gage.

††Also length of ring gage and length from gaging notch to small end of pluge gage.

The ANSI B1.20.1 National Pipe Thread Taper and the API Standard Line Pipe Thread are interchangeable. Reprinted by permission from Catalog No. 55, Ladish Co.

INSTALLATION NOTE

Anvil Anvilets are designed to have no more than a 1/16" gap *(1.6mm)* between the base or skirt of the Anvilet when it is seated directly upon the appropriate run pipe. However, it is recommended that the skirt of Anvilets be held slightly above the run pipe and tack welded to provide a small continuous root gap between the skirt and run pipe before completing the all-around welding beads or fillet.



PRESSURE TEMPERATURE RATINGS

MSS standard Practice SP-97 gives the following correlation between fitting pressure class and pipe schedule number/wall thickness designation for calculation of pressure-temperature ratings:

FORGED STEEL ANVILETS PRESSURE TEMPERATURE RATINGS

Branch Connection Type	Pressure Class of Fitting	Branch Connection Size		Pipe Wall for Rating Basis
		NPS	DN	
Buttweld	STD	1/8 - 24	6 - 600	STD
	XS/XH	1/8 - 24	6 - 600	XS/XH
	SCH 160	1/2- 6	15 - 150	SCH 160
Threaded	3,000	1/4 - 4	8 - 100	XS/XH
	6,000	1/2- 2	15 - 50	SCH 160
Socket-Welding	3,000	1/2- 2	15 - 50	XS/XH
	6,000	1/2- 2	15 - 50	SCH 160

The maximum allowable pressure of a fitting is computed in accordance with the applicable piping code or regulation for straight seamless header (run) pipe or for material of equivalent composition and mechanical properties to the fitting. Any corrosion or mechanical allowances and any reduction in allowable stress due to temperature or other service conditions, must be applied to the pipe and fitting alike.

Forged Steel Fittings

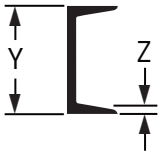
In accordance with ASME standard B16.11 - "Forged Fittings, Socket-Welding and Threaded" this table shows the schedule of pipe corresponding to each class of fitting for rating purposes.

FORGED STEEL FITTINGS PRESSURE RATINGS		
Class	Schedule	
	N.P.T.	S.W.
2000	80	–
3000	160	80
6000	XXS/XXH	160

ASME B16.11 provides that the maximum allowable pressure of a fitting be computed in accordance with the applicable piping code or regulation for straight seamless pipe or for material of equivalent composition and mechanical properties to the fitting. Any corrosion or mechanical allowances and any reduction in allowable stress due to temperature or other service conditions must be applied to the pipe and fitting alike.

OIL COUNTRY FITTINGS							
CURRENT API THREAD STANDARDS							
Nominal Size	O.D. Size	Pipe	Tubing & Casing	Nominal Size	O.D. Size	Pipe	Tubing & Casing
¾	1.050	14	—	—	5	—	8 Rd.
¾ EUE	1.050	—	10 Rd.	—	5½	—	8 Rd.
1	1.315	11½	10 Rd.	5	5⁹⁄₁₆	8V	—
1 EUE	1.315	—	10 Rd.	—	6	—	8 Rd.
1¼	1.660	11½	10 Rd.	6	6⅝	8V	8 Rd.
1¼ EUE	1.660	—	10 Rd.	—	7	—	8 Rd.
1½	1.900	11½	10 Rd.	—	7⅝	—	8 Rd.
1½ EUE	1.900	—	10 Rd.	8	8⅝	8V	8 Rd.
2	2⅜	11½	10 Rd.	—	9⅝	—	8 Rd.
2 EUE	2⅜	—	8 Rd.	10	10¾	8V	8 Rd.
2½	2⅞	8V	10 Rd.	—	11¾	—	8 Rd.
2½ EUE	2⅞	—	8 Rd.	12	12¾	8V	—
3	3½	8V	10 Rd.	—	13⅜	—	8 Rd.
3 EUE	3½	—	8 Rd.	—	14	8V	—
3½	4	8V	8 Rd.	—	16	8V	8 Rd.
3½ EUE	4	8V	8 Rd.	—	18	8V	—
4	4½	8V	8 Rd.	—	20	8V	8 Rd.
4 EUE	4½	—	8 Rd.	—	—	—	—

Beam Dimensions



AMERICAN STANDARD CHANNELS

Depth of Section Y	Weight per Ft.	Flange Width	Mean Thickness of Flange Z
In.	*Lbs.*	*In.*	*In.*
3	4.1 5.0 6.0	1⅜ 1½ 1⅝	0.250
4	5.4 7.25	1⅝ 1¾	0.313
5	6.7 9.0	1¾ 1⅞	0.313
6	8.2 10.5 13.0	1⅞ 2 2⅛	0.375
7	9.8 12.25 14.75	2⅛ 2¼ 2¼	0.375
8	11.75 13.75 18.75	2¼ 2⅜ 2½	0.375
9	13.4 15.0 20.0	2⅜ 2½ 2⅝	0.438
10	15.3 20.0 25.0 30.0	2⅝ 2¾ 2⅞ 3	0.438
12	20.7 25.0 30.0	3 3 3⅛	0.500
15	33.9 40.0 50.0	3⅜ 3½ 3¾	0.625
18	42.7 45.8 51.9 58.0	4 4 4⅛ 4¼	0.625

S SHAPES

Depth of Section Y	Weight per Ft.	Flange Width	Mean Thickness of Flange Z
In.	*Lbs.*	*In.*	*In.*
3	5.7 7.5	2⅜ 2½	0.250
4	7.7 9.5	2⅝ 2¾	0.313
5	10.0 14.75	3 3¼	0.313
6	12.5 17.25	3⅜ 3⅝	0.375
7	15.3 20.0	3⅝ 3⅞	0.375
8	18.4 23.0	4 4⅛	0.438
10	25.4 35.0	4⅝ 5	0.500
12	31.8 35.0 40.8 50.0	5 5⅛ 5¼ 5½	0.563 0.688
15	42.9 50.0	5½ 5⅝	0.625
18	54.7 70.0	6 6¼	0.688
20	66.0 75.0	6¼ 6⅜	0.813
20.3	86.0 96.0	7 7¼	0.938
24	80.0 90.0 100.0	7 7⅛ 7½	0.875

W SHAPES

Depth of Section Y	Weight per Ft.	Flange Width	Mean Thick. of Flange Z
In.	*Lbs.*	*In.*	*In.*
5	19	5	0.430
6	25	6 1/8	0.455
8	18	5 1/4	0.330
	21	5 1/4	0.400
	24	6 1/2	0.400
	28	6 1/2	0.465
	31	8	0.435
	35	8	0.495
	40	8 1/8	0.560
	48	8 1/8	0.685
	58	8 1/4	0.810
	67	8 1/4	0.935
10	22	5 3/4	0.360
	26	5 3/4	0.440
	30	5 3/4	0.510
	33	8	0.435
	39	8	0.530
	45	8	0.620
	49	10	0.560
	54	10	0.615
	60	10 1/8	0.680
	68	10 1/8	0.770
	77	10 1/4	0.870
	88	10 1/4	0.990
12	26	6 1/2	0.380
	30	6 1/2	0.440
	35	6 1/2	0.520
	40	8	0.515
	45	8	0.575
	50	8 1/8	0.640
	53	10	0.575
	58	10	0.640
	65	12	0.605
	72	12	0.670
	79	12 1/8	0.735
	87	12 1/8	0.810
	96	12 1/8	0.900
	106	12 1/4	0.990
14	30	6 3/4	0.385
	34	6 3/4	0.455
	38	6 3/4	0.515
	43	8	0.530
	48	8	0.595
	53	8	0.660
	61	10	0.645
	68	10	0.720
	74	10 1/8	0.785
	82	10 1/8	0.855
	90	14 1/2	0.710
	99	14 5/8	0.780
	109	14 5/8	0.860
	120	14 5/8	0.940
	132	14 3/4	1.030
16	36	7	0.430
	40	7	0.505
	45	7	0.565
	50	7 1/8	0.63
	57	7 1/8	0.715
	67	10 1/4	0.665
	77	10 1/4	0.760
	89	10 3/8	0.875
	100	10 3/8	0.985
18	50	7 1/2	0.570
	55	7 1/2	0.630
	60	7 1/2	0.695
	65	7 5/8	0.750
	71	7 5/8	0.810
	76	11	0.680
	86	11 1/8	0.770
	97	11 1/8	0.870
	106	11 1/4	0.940
21	62	8 1/4	0.615
	68	8 1/4	0.685
	73	8 1/4	0.740
	83	8 3/8	0.835
	93	8 3/8	0.930
	101	12 1/4	0.800
	111	12 3/8	0.875
	122	12 3/8	0.960
24	76	9	0.680
	84	9	0.770
	94	9 1/8	0.875
	104	12 3/4	0.750
	117	12 3/4	0.850
	131	12 7/8	0.960
27	94	10	0.745
	102	10	0.830
	114	10 1/8	0.930
	146	14	0.975
30	108	10 1/2	0.760
	116	10 1/2	0.850
	124	10 1/2	0.930
	132	10 1/2	1.000
33	118	11 1/2	0.740
	130	11 1/2	0.855
	141	11 1/2	0.960
36	135	12	0.790
	150	12	0.940
	160	12	1.020

A Typical Pipe Hanger Specification

TABLE 1: Maximum Horizontal Spacing Between Pipe Supports for Standard Weight Steel Pipe*

	Nominal Pipe Size (in)																			
	½	¾	1	1½	2	2½	3	3½	4	5	6	8	10	12	14	16	18	20	24	30
Max. Span (Ft) Water Service	7	7	7	9	10	11	12	13	14	16	17	19	22	23	25	27	28	30	32	33
Max. Span (Ft) Vapor Service	8	9	9	12	13	14	15	16	17	19	21	24	26	30	32	35	37	39	42	34
Recommended Hanger Rod Sizes	⅜					½			⅝		¾		⅞		1		1	1¼	1½	1½
																	or trapeze			

The above spacing and capacities are based on pipe filled with water. Additional valves and fittings increase the load and therefore closer hanger spacing is required.
*Many codes and specifications state "pipe hangers must be spaced every 10ft. regardless of size." This local specification must be followed.

TABLE 2: Maximum Horizontal Spacing Between Copper Tubing Supports

	Nominal Tubing Size (in)									
	½	¾	1	1¼	1½	2	2½	3	3½	4
Max. Span (Ft) Water Service	5	5	6	7	8	8	9	10	11	12
Max. Span (Ft) Vapor Service	6	7	8	9	10	11	13	14	15	16

NOTE: Spans shown in Tables 1 and 2 do not apply where there are concentrated loads between supports or where temperatures exceed 750°F.

TABLE 3: Load Carrying Capacities of Threaded Hanger Rods. Materials Carbon Steel with Minimum Actual Tensile Strength of 50 Ksi.

Rod Diameter (in)	Threads per Inch	Root Area of Coarse Thread (in^2)	Maximum Safe Load (lbs) Rod Temperature, 650° F	Maximum Safe Load (lbs) Rod Temperature, 750° F
⅜	16 UNC	0.0678	730	572
½	13 UNC	0.126	1,350	1,057
⅝	11 UNC	0.202	2,160	1,692
¾	10 UNC	0.302	3,230	2,530
⅞	9 UNC	0.419	4,480	3,508
1	8 UNC	0.551	5,900	4,620
1¼	7 UNC	0.890	9,500	7,440
1½	6 UNC	1.29	13,800	10,807
1¾	5 UNC	1.74	18,600	14,566
2	4½ UNC	2.30	24,600	19,265
2¼	4½ UNC	3.02	32,300	25,295
2½	4 UNC	3.72	39,800	31,169
2¾	4 UNC	4.62	49,400	38,687
3	4 UNC	5.62	60,100	47,066
3¼	4 UNC	6.72	71,900	56,307
3½	4 UNC	7.92	84,700	66,331
3¾	4 UNC	9.21	98,500	77,139
4	4 UNC	10.6	114,000	88,807
4¼	4 UN	12.1	129,000	101,337
4½	4 UN	13.7	146,000	114,807
4¾	4 UN	15.4	165,000	128,982
5	4 UN	17.2	184,000	144,096

Standard UNC thread thru 4" diameter and 4-UN-2A thread series for 4¼" diameter and larger.

Gruvlok® Pipe Support

When designing the hangers, supports and anchors for a grooved-end pipe system, the piping designer must consider certain unique characteristics of the grooved type coupling in addition to many universal pipe hanger and support design factors. As with any pipe system, the hanger or support system must provide for

1) the weight of the pipe, couplings, fluid & pipe system components;

2) reduce stresses at pipe joints; and

3) permit required pipe system movement to relieve stress.

The following factors should be considered when designing hangers and supports for a grooved-end pipe system.

Pipe Hanger Spacing:

The following charts show the maximum span between pipe hangers for straight runs of standard weight steel pipe filled with water or other similar fluids.

Do not use these values where critical span calculations are made or where there are concentrated loads between supports.

For straight runs without concentrated loads and where full linear movement is ***NOT*** required use the table on right.

HANGER SPACING LINEAR MOVEMENT NOT REQUIRED

Nominal Pipe Size Range	Maximum Span Between Supports
In./DNmm	*Feet/meters*
1 *25*	7 *2.6*
1¼-2 *32-50*	10 *3.0*
2½-4 *65-100*	12 *3.7*
5-8 *125-200*	14 *4.3*
10-12 *250-300*	16 *4.9*
14-16 *350-400*	18 *5.5*
18-24 *450-600*	20 *6.1*

For straight runs without concentrated loads and where full linear movement ***IS*** required use the table below.

HANGER SPACING - FLEXIBLE SYSTEM, STEEL PIPE
FULL LINEAR MOVEMENT IS REQUIRED
AVERAGE HANGERS PER PIPE LENGTH EVENLY SPACED

Nominal Pipe Size Range	Pipe Length in Feet/Meters									
In. *DNmm*	7 *2.1*	10 *3.3*	12 *3.7*	15 *4.6*	20 *6.1*	22 *6.7*	25 *7.6*	30 *9.1*	35 *10.7*	40 *12.2*
1-2 *25-50*	1	2	2	2	3	3	4	4	5	6
2½-4 *65-100*	1	1	2	2	2	2	2	3	4	4
5-24 *125-600*	1	1	1	2	2	2	2	3	3	3

HANGER SPACING - RIGID SYSTEMS
SUGGESTED MAXIMUM SPAN BETWEEN SUPPORTS

Nominal Size	STEEL PIPE Suggested Maximum Span Between Supports-Feet/Meters						COPPER TUBE	
	Water Service			Air Service			Water Service	Gas & Air Service
In./*DNmm*	*	**	***	*	**	***	**	**
1 *25*	7 *2.1*	9 *2.7*	12 *3.7*	9 *2.7*	10 *3.0*	12 *3.7*	–	–
1¼ *32*	7 *2.1*	11 *3.4*	12 *3.7*	9 *2.7*	12 *3.6*	12 *3.7*	–	–
1½ *40*	7 *2.1*	12 *3.7*	15 *4.6*	9 *2.7*	13 *4*	15 *4.6*	–	–
2 *50*	10 *3*	13 *4*	15 *4.6*	13 *4*	15 *4.6*	15 *4.6*	9 *2.7*	12 *3.6*
2½ 65	11 3.4	15 4.6	15 4.6	14 4.3	17 5.1	15 4.6	9 2.7	12 3.6
3 O.D. 76.1	*11* 3.4	*15* 4.6	*15* 4.6	*14* 4.3	*17* 5.1	*15* 4.6	–	–
3 *80*	12 *3.7*	16 *4.8*	15 *4.6*	15 *4.6*	19 *5.7*	15 *4.6*	10 *3*	14 *4.2*
3½ *90*	13 *4*	18 *5.4*	15 *4.6*	15 *4.6*	21 *6.3*	15 *4.6*	–	–
4 *100*	14 *4.3*	18 *5.4*	15 *4.6*	17 *5.2*	21 *6.4*	15 *4.6*	12 *3.7*	17 *5.1*
4¼ O.D. 108.0	*14* 4.3	*18* 5.4	*15* 4.6	*17* 5.2	*19* 5.7	*15* 4.6	–	–
5 *125*	16 *4.9*	20 *6.0*	15 *4.6*	20 *6.1*	24 *7.3*	15 *4.6*	13 *4*	18 *5.7*
5¼ O.D. 133.0	*15* 4.6	*18* 5.5	*15* 4.6	*19* 5.2	*22* 6.6	*15* 4.6	–	–
5½ O.D. 139.7	*16* 4.9	*19* 5.8	*15* 4.6	*20* 6.1	*24* 7.3	*15* 4.6	–	–
6 *150*	17 *5.2*	21 *6.3*	15 *4.6*	21 *6.4*	26 *7.8*	15 *4.6*	14 *4.2*	21 *6.3*
6¼ O.D. 159.0	*16* 4.9	*20* 6.0	*15* 4.6	*20* 6.1	*24* 7.3	*15* 4.6	–	–
6½ O.D. 165.1	*17* 5.2	*21* 6.3	*15* 4.6	*21* 6.4	*25* 7.6	*15* 4.6	–	–
8 *200*	19 *5.8*	23 *6.9*	15 *4.6*	24 *7.3*	29 *8.7*	15 *4.6*	–	–
10 *250*	19 *5.8*	25 *7.5*	15 *4.6*	24 *7.3*	33 *9.9*	15 *4.6*	–	–
12 *300*	23 *7*	26 *7.8*	15 *4.6*	30 *9.1*	36 *10.8*	15 *4.6*	–	–
14 *350*	23 *7*	26 *7.8*	15 *4.6*	30 *9.1*	37 *11.1*	15 *4.6*	–	–
16 *400*	27 *8.2*	26 *7.8*	15 *4.6*	35 *10.7*	40 *12.0*	15 *4.6*	–	–
18 *450*	27 *8.2*	27 *8.1*	15 *4.6*	35 *10.7*	42 *12.6*	15 *4.6*	–	–
20 *500*	30 *9.1*	27 *8.1*	15 *4.6*	39 *11.9*	45 *13.5*	15 *4.6*	–	–
24 *600*	32 *9.8*	26 *7.8*	15 *4.6*	42 *12.8*	48 *14.7*	15 *4.6*	–	–

* Spacing by ANSI-B31.1 Power Piping Code.

** Spacing by ANSI-B31.9 Building Service Piping Code, (1996 Edition), Fig. 921.1.3c, Table a, 250 psi and Fig. 921.1.3D, table a

*** Spacing by NFPA-13 Installation of Sprinkler Systems, (1999 Edition), Table 6-2.2.

PVC Pipe Support Spacing

PVC PIPE SUPPORT SPACING

Pipe Size (in.)	SCHEDULE 40 Temperature (°F)					SCHEDULE 80 Temperature (°F)					SCHEDULE 120 Temperature (°F)				
	60	80	100	120	140	60	80	100	120	140	60	80	100	120	140
¼	4	3½	3½	2	2	4	4	3½	2½	2	–	–	–	–	–
⅜	4	4	3½	2½	2	4½	4½	4	2½	2½	–	–	–	–	–
½	4½	4½	4	2½	2½	5	4½	4½	3	2½	5	5	4½	3	2½
¾	5	4½	4	2½	2½	5½	5	4½	3	2½	5½	5	4½	3	3
1	5½	5	4½	3	2½	6	5½	5	3½	3	6	5½	5	3½	3
1¼	5½	5½	5	3	3	6	6	5½	3½	3	6½	6	5½	3½	3½
1½	6	5½	5	3½	3	6½	6	5½	3½	3½	6½	6½	6	4	3½
2	6	5½	5	3½	3	7	6½	6	4	3½	7½	7	6½	4	3½
2½	7	6½	6	4	3½	7½	7½	6½	4½	4	8	7½	7	4½	4
3	7	7	6	4	3½	8	7½	7	4½	4	8½	8	7½	5	4½
3½	7½	7	6½	4	4	8½	8	7½	5	4½	9	8½	7½	5	4½
4	7½	7	6½	4½	4	9	8½	7½	5	4½	9½	9	8½	5½	5
5	8	7½	7	4½	4	9½	9	8	5½	5	10½	10	9	6	5½
6	8½	8	7½	5	4½	10	9½	9	6	5	11½	10½	9½	6½	6
8	9	8½	8	5	4½	11	10½	9½	6½	5½	–	–	–	–	–
10	10	9	8½	5½	5	12	11	10	7	6	–	–	–	–	–
12	11½	10½	9½	6½	5½	13	12	10½	7½	6½	–	–	–	–	–
14	12	11	10	7	6	13½	13	11	8	7	–	–	–	–	–
16	12½	11½	10½	7½	6½	14	13½	11½	8½	7½	–	–	–	–	–
18	13	12	11	8	7	14½	14	12	11	9	–	–	–	–	–
20	14	12½	11½	10	8½	15½	14½	12½	11½	9½	–	–	–	–	–
24	15	13	12½	11	9½	17	15	14	12½	10½	–	–	–	–	–
	SDR 41					SDR 26									
18	13	12	11	8	7	14½	14	12	9	8					
20	13½	12½	11½	8½	7½	15	14½	12½	9½	8½					
24	14	13	12	9	8	15½	15	13	10	9					

NOTE: Although support spacing is shown at 140°F, consideration should be given to the use of CPVC or continuous support above 120°F.

The possibility of temperature overrides beyond regular working temperatures and cost may either make either of the alternatives more desirable.
This chart based on continuous spans and for un-insulated line carrying fluids of specific gravity up to 1.00.

The above table is meant as a general guideline, it is recommended that the pipe manufacturer be consulted for specific spacing recommendations relating to their pipe, load conditions, operating temperature and service conditions.

Local codes and specifications may also vary from the above recommended spacing and should be consulted for the applicable spacing requirements prior to installation.

CPVC Pipe Support Spacing

CPVC PIPE SUPPORT SPACING												
Pipe Size (in.)	SCHEDULE 40 Temperature (°F)						SCHEDULE 80 Temperature (°F)					
	73°	100°	120°	140°	160°	180°	73°	100°	120°	140°	160°	180°
½	5	4½	4½	4	2½	2½	5½	5	4½	4½	3	2½
¾	5	5	4½	4	2½	2½	5½	5½	5	4½	3	2½
1	5½	5½	5	4½	3	2½	6	6	5½	5	3½	3
1¼	5½	5½	5½	5	3	3	6½	6	6	5½	3½	3
1½	6	6	5½	5	3½	3	7	6½	6	5½	3½	3½
2	6	6	5½	5	3½	3	7	7	6½	6	4	3½
2½	7	7	6½	6	4	3½	8	7½	7½	6½	4½	4
3	7	7	7	6	4	3½	8	8	7½	7	4½	4
3½	7½	7½	7	6½	4	4	8½	8½	8	7½	5	4½
4	7½	7½	7	6½	4½	4	8½	9	8½	7½	5	4½
6	8½	8	7½	7	5	4½	10	9½	9	8	5½	5
8	9½	9	8½	7½	5½	5	11	10½	10	9	6	5½
10	10½	10	9½	8	6	5½	11½	11	10½	9½	6½	6
12	11½	10½	10	8½	6½	6	12½	12	11½	10½	7½	6½
14	12	11	10	9	8	6	15	13½	12½	11	9½	8
16	13	12	11	9½	8½	7	16	15	13½	12	10	8½

NOTE: Although support spacing is shown at 140°F, consideration should be given to the use of CPVC or continuous support above 120°F.

The possibility of temperature overrides beyond regular working temperatures and cost may either make either of the alternatives more desirable.
This chart based on continuous spans and for un-insulated line carrying fluids of specific gravity up to 1.00.

The above table is meant as a general guideline, it is recommended that the pipe manufacturer be consulted for specific spacing recommendations relating to their pipe, load conditions, operating temperature and service conditions.

Local codes and specifications may also vary from the above recommended spacing and should be consulted for the applicable spacing requirements prior to installation.

PIPE HANGERS

Copper Tubing Hangers • CPVC Pipe Hangers • Pipe Rings • Socket Clamps

COPPER TUBING HANGERS

Fig. CT-69
Adjustable Swivel Ring
Size Range: 1/2" thru 4"

Fig. CT-65
Light Duty
Adjustable Clevis
Size Range: 1/2" thru 4"

Fig. CT-138R
Extension Split
Tubing Clamp
Size Range: 1/2" thru 2"

Fig. 69F
Adjustable Swivel
Ring Felt Lined
Size Range: 1/2" thru 6"

Fig. 67F
Copper Tube Felt
Lined Hanger
Size Range: 1/2" thru 6"

Fig. CT-255
Copper Tubing
Alignment Guide
Size Range: 1" thru 4"

Fig. CT-121
Copper Tubing Riser Clamp
Size Range: 1/2" thru 4"

Fig. CT-128R
Rod Threaded Ceiling Flange
Size Range: 3/8" thru 1/2"

CPVC PIPE HANGERS

Fig. 185
One Hole Pipe Strap
Size Range: 3/4" thru 2"

Fig. 186
Two Hole Pipe Strap
Size Range: 3/4" thru 2"

Fig. 187
Two Hole 90°
Side Mount Strap
Size Range: 3/4" thru 2"

Fig. 188
Two Hole Stand Off Strap
Size Range: 3/4" thru 2"

PIPE RINGS

Fig. 108
Split Pipe Ring
Size Range: 3/8" thru 8"

Fig. 138R
Extension Split Pipe Clamp
Size Range: 3/8" thru 3"

Fig. 104
Adjustable Swivel Ring,
Split Ring Type
Size Range: 3/4" thru 8"

Fig. 69
Adjustable Swivel Ring
Size Range: 1/2" thru 8"

SOCKET CLAMPS

Fig. 595 & 594
Socket Clamp for Ductile Iron or
Cast Iron Pipe & Socket Clamp Washer
Size Range: 4" thru 24" pipe

Fig. 600 & 599
Socket Clamp for Ductile Iron or
Cast Iron Pipe & Socket Clamp Washer
Size Range: 3" thru 24" pipe

PIPE HANGERS

Clevis • Steel Pipe Clamps • Brackets

CLEVIS

Fig. 67
Pipe or Conduit Hanger
Size Range:
1/2" thru 6"

Fig. 65
Light Duty Adjustable Clevis
Size Range:
3/8" thru 4"

Fig. 260
Adjustable Clevis Hanger
Size Range:
1/2" thru 30"

Fig. 260 ISS
Clevis Hanger with Insulation Saddle System
Size Range:
2" thru 16"

Fig. 300
Adjustable Clevis for Insulated Lines
Size Range:
3/4" thru 12"

Fig. 590
Adjustable Clevis for Ductile or Cast Iron
Size Range:
3" thru 24"

STEEL PIPE CLAMPS

Fig. 261
Extension Pipe or Riser Clamp
Size Range:
3/4" thru 24"

Fig. 40
Riser Clamp Standard
Size Range:
2" thru 24"

Fig. 103
Offset Pipe Clamp
Size Range:
3/4" thru 8"

Fig. 100
Extended Pipe Clamp
Size Range:
1/2" thru 8"

Fig. 212
Medium Pipe Clamp
Size Range:
1/2" thru 30"

Fig. 212FP
Earthquake Bracing Clamp
Size Range:
2 1/2" thru 12"

Fig. 216
Heavy Pipe Clamp
Size Range:
3" thru 42"

Fig. 295
Double Bolt Pipe Clamp
Size Range:
3/4" thru 36"

Fig. 295A
Alloy Double Bolt Pipe Clamp
Size Range:
1 1/2" thru 24"

Fig. 295H
Heavy Duty Double Bolt Pipe Clamp
Size Range:
6" thru 36"

Fig. 224
Alloy Steel Pipe Clamp
Size Range:
4" thru 16"

Fig. 246
Heavy Duty Alloy Steel Pipe Clamp
Size Range:
10" thru 24"

BRACKETS

Fig. 202
Iron Side Beam Bracket
Size Range: 3/8" thru 5/8"

Fig. 206
Steel Side Beam Bracket
Size Range: 3/8" thru 5/8"

Fig. 207
Threaded Steel Side Beam Bracket
Size Range: 3/8" and 1/2"

Fig. 189
Staight Eye Socket
Size: 3/8"

Fig. 190
Off-Set Eye Socket
Size: 3/8"

Fig. 194
Light Welded Steel Bracket

Fig. 195
Medium Welded Steel Bracket

Fig. 199
Heavy Welded Steel Bracket

BEAM CLAMPS

Fig. 86 & 88
C-Clamp with Set Screw and Lock Nut
Size Range:
3/8" thru 3/4"

Fig. 95
C-Clamp with Locknut
Size Range:
3/8" and 1/2"

Fig. 89
Retaining Clip
Size Range:
3/8" thru 1/2"

Fig. 89X
Retaining Clip
Size Range:
3/8" thru 3/4"

Fig. 92
Universal C-Type Clamp
Standard Throat
Size Range:
3/8" and 1/2"

Fig. 93
Universal C-Type Clamp Wide Throat
Size Range:
3/8" and 1/2"

Fig. 94
Wide Throat Top Beam C-Clamp
Size Range:
5/8" and 3/4"

Fig. 227
Top Beam Clamp

Fig. 14
Adjustable Side Beam Clamp
Size Range:
3/8" thru 5/8"

Fig. 217
Adjustable Side Beam Clamp
Size Range:
3" thru 7 5/8"

Fig. 133
Standard Duty Beam Clamp
Size Range: 4" thru 12"

Fig. 134
Heavy Duty Beam Clamp
Size Range: 4" thru 12"

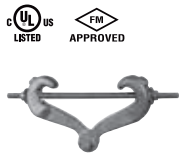


Fig. 218
Malleable Beam Clamp without Extension Piece

Fig. 228
Universal Forged Steel Beam Clamp

Fig. 292 & 292L
Universal Forged Steel Beam Clamp with Weldless Eye Nut

STRUCTURAL ATTACHMENTS

Fig. 55 & 55L
Structural Welding Lug
Size Range (55):
1/2" thru 3 3/4"
Size Range (55L):
1/2" thru 2"

Fig. 54
Two-Hole Welding Beam Lug
Size Range:
1/2" thru 2 1/4"

Fig. 66
Welding Beam Attachment
Size Range:
3/8" thru 3 1/2"

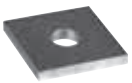


Fig. 60
Steel Washer Plate
Size Range:
3/8" thru 3 3/4"

Fig. 112 & 113
Brace Fitting Complete
Size Range: 1" and 1 1/4"

U-BOLTS

Fig. 137 & 137S
Standard U-Bolts
Size Range: 1/2" thru 36"

Fig. 137C
Plastic Coated U-Bolts
Size Range: 1/2" thru 8"

Fig. 120
Light Weight U-Bolt
Size Range: 1/2" thru 10"

HANGER RODS & ATTACHMENTS

Fig. 142
Coach Screw Rods Machine Threaded on Opposite End
Size Range: 3/8" thru 1/2"

Fig. 146
Continuous Thread
Size Range: 1/4" thru 1 1/2"

Fig. 140 & 253
Machine Threaded Rods Threaded on Both Ends
Size Range: 3/8" thru 5"

Fig. 248
Eye Rod Not Welded
Size Range: 3/8" thru 2 1/2"

Fig. 278
Eye Rod Welded
Size Range: 3/8" thru 2 1/2"

Fig. 248X
Linked Eye Rods
Size Range: 3/8" thru 2 1/2"

Fig. 278X
Linked Eye Rods Welded
Size Range: 3/8" thru 2 1/2"

Fig. 148
Rod with Eye End
Size Range: 2 3/4" thru 5"

Fig. 135 & 135E
Straight Rod Coupling
Size Range: 1/4" thru 1"

Fig. 136: c UL us LISTED FM APPROVED
Fig. 136R: c UL us LISTED

Fig. 136 & 136R
Straight Rod Coupling
Size Range: 1/4" thru 1"

Fig. 114
Turnbuckle Adjuster
Size Range: 1/4" thru 3/4"

UL us LISTED FM APPROVED

Fig. 110R
Socket, Rod Threaded
Size Range: 1/4" thru 7/8"

UL us LISTED FM APPROVED

Fig. 157
Extension Piece
Size Range: 3/8" thru 7/8"

Fig. 290
Weldless Eye Nut
Size Range: 3/8" thru 2 1/2"

Fig. 299
Forged Steel Clevis
Size Range: 3/8" thru 4"

Fig. 230
Turnbuckle
Size Range: 3/8" thru 2 1/2"

Fig. 233
Turnbuckle
Size Range: 1 1/4" thru 5"

Fig. 291
Clevis Pin with Cotters
Size Range: 1/2" thru 4"

Machine Bolts and Hex Nuts

STRAPS

Fig. 262
Strap Short
Size Range: 1/2" thru 4"

Fig. 126
One-Hole Clamp
Size Range: 3/8" thru 4"

Fig. 243
Pipe Strap
Size Range: 1/2" thru 6" pipe

Fig. 244
Pipe Strap
Size Range: 1/2" thru 6" pipe

PIPE HANGERS

Concrete Inserts & Attachments • Pipe Supports • Ceiling Plates

CONCRETE INSERTS & ATTACHMENTS

Fig. 152
Screw Concrete Insert
Size Range: 3/8" thru 7/8"

Fig. 282
Universal Concrete Insert
Size Range: 3/8" thru 7/8"

Fig. 281
Wedge Type Conrete Insert
Size Range: 1/4" thru 7/8"

Fig. 285
Light Weight Concrete Insert
Size Range: 1/4" thru 5/8"

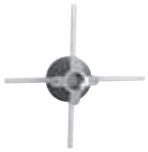


Fig. 286
Iron Cross
Size Range: 3/4" thru 1 1/2"

Fig. 284
Metal Deck Hanger
Size Range: 3/8" thru 3/4"

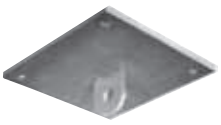


Fig. 47
Concrete Single Lug Plate
Size Range: 1/2" thru 2"

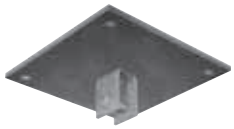


Fig. 49
Concrete Clevis Plate
Size Range: 3/8" thru 1 3/4"

Fig. 52
Concrete Rod Attachment Plate
Size Range: 3/8" thru 1 1/4"

PIPE SUPPORTS

Fig. 62
Type A, B, and C Pipe Stanchion
Size Range: 2" thru 18"

Fig. 63
Type A, B, and C Pipe Stanchion
Size Range: 2 1/2" thru 42"

Fig. 192
Adjustable Pipe Saddle
Size Range: 2" thru 12"

Fig. 191
Adjustable Pipe Saddle with U-Bolt
Size Range: 2" thru 12"

Fig. 258
Pipe Stanchion Saddle
Size Range: 4" thru 36"

Fig. 264
Adjustable Pipe Saddle Support
Size Range: 2 1/2" thru 36"

Fig. 265
Adjustable Pipe Saddle Support with U-Bolt
Size Range: 4" thru 36"

Fig. 259
Pipe Saddle Support with U-Bolt
Size Range: 4" thru 36"

CEILING PLATES

Fig. 127
Plastic Ceiling Plate
Size Range: 3/8" and 1/2"

Fig. 395
Cast Iron Ceiling Plate
Size Range: 1/2" thru 8"

Fig. 128R
Rod Threaded, Ceiling Flange
Size Range: 3/8" and 1/2"

Fig. 153
Pipe Hanger Flange
Size Range: 3/8" thru 3/4"

PIPE HANGERS

Pipe Rolls • Pipe Guides & Slides • Pipe Shields & Saddles

PIPE ROLLS

Fig. 177
Adjustable Pipe Roll Support
Size Range: 1" thru 30"

Fig. 171
Single Pipe Roll
Size Range: 1" thru 30"

Fig. 178
Spring Cushion Hanger

Fig. 181
Adjustable Steel
Yoke Pipe Roll
Size Range: 2½" thru 24"

Fig. 175
Roller Chair
Size Range: 2" thru 30" pipe

Fig. 277
Pipe Roll and Base Plate
Size Range: 2" thru 24"

Fig. 271
Pipe Roll Stand
Size Range: 2" thru 42"

Fig. 274, 274P & 275
Adjustable Pipe Roll Stand
Size Range: 2" thru 42"

PIPE GUIDES & SLIDES

Fig. 255
Pipe Alignment Guide
Size Range: 1" thru 24" pipe and insulation thickness of 1" thru 4"

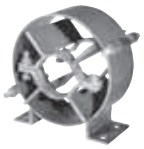


Fig. 256
Pipe Alignment Guide
Size Range: 1" thru 24" pipe and insulation thickness of 1" thru 4"

Fig. 257 & 257A
Structural Tee Slide Assembly
Size Range: All sizes within maximum load rating

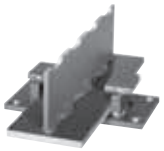


Fig. 436 & 436A
Fabricated Tee Slide Assembly
Size Range: All sizes within maximum load rating

Fig. 439 & 439A
Structural "H" Slide Assembly, Complete
Size Range: 6" thru 36"

Fig. 432
Special Clamp
Size Range: 2" thru 24"

Fig. 212
Medium Pipe Clamp
Size Range: 2" thru 30"

PIPE SHIELDS & SADDLES

Fig. 167
Insulation Protection Shield
Size Range: ½" thru 24" pipe with up to 2" thick insulation

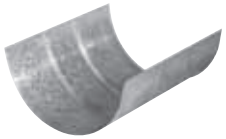


Fig. 168
Rib-Lok Shield
Size Range: ½" thru 8" pipe or copper tube with up to 2" thick insulation

Fig. 160 to 166A
Pipe Covering Protection Saddle
Size Range: ¾" thru 36"

PIPE HANGERS
Trapeze

TRAPEZE

Fig. 46
Universal Trapeze Assembly

Fig. 45
Channel Assembly

Fig. 50
Equal Leg Angle for Trapeze Assembly

SWAY BRACE – SIESMIC
Pipe Brace Clamps • Structural Attachments • Sway Brace Attachment • Restraints

PIPE BRACE CLAMPS

Fig. 770
Q Brace Clamp
Size Range: 1" thru 6" Service Pipe

Fig. 776
Brace Clamp
Size Range: 2½" thru 8" Service Pipe

Fig. 775
Lateral/Longitudinal Brace Clamp
Size Range: 2½" thru 8" Service Pipe

STRUCTURAL ATTACHMENTS

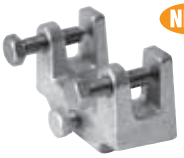


Fig. 778
Bar Joist and Beam Attachment (WF)
Size Range:
Flange Thickness ⅛" thru ¾"

Fig. 772
Adjustable Steel Beam Attachment
Size Range: Flange Widths 4" thru 15"

Fig. 779
Multi-Connector Adapter
Size Range: 1" thru 8" Service Pipe

RESTRAINTS

Fig. 773
Surge Restrainer
Size Range:
¾" thru 2" Swivel Ring Hanger

Fig. 777
Swivel Joint Connector - Rod Tap
Size Range: ⅜" Rod Diameter

SWAY BRACE ATTACHMENT

Fig. 771
Sway Brace Swivel Attachment
Size Range: 1" and 1¼" Brace Pipe

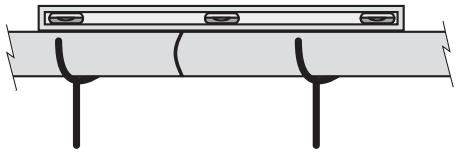
Alignment of Pipe

Proper alignment is important if a piping system is to be correctly fabricated. Poor alignment may result in welding difficulties and a system that does not function properly.

Welding rings may be employed to assure proper alignment as well as the correct welding gap. In addition to using welding rings, some simple procedures can be followed to assist the pipe fitter. Below and on the following page are alignment procedures commonly used by today's craftsmen.

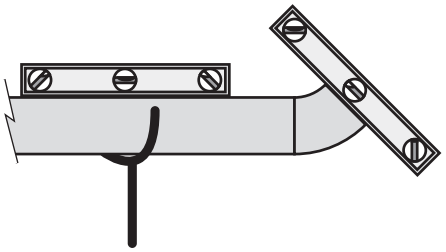
Pipe-to-Pipe

1. Level one length of pipe using spirit level.
2. Bring lengths together leaving only small welding gap.
3. Place spirit level over both pipes as shown and maneuver unpositioned length until both are level.
4. Tack weld top and bottom.
5. Rotate pipe 90°.
6. Repeat procedure.



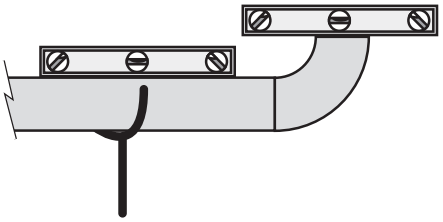
45° Elbow-to-Pipe

1. Level pipe using spirit level.
2. Place fitting to pipe leaving small welding gap.
3. Place 45° spirit level on face of elbow and maneuver elbow until bubble is centered.
4. Tack weld in place.



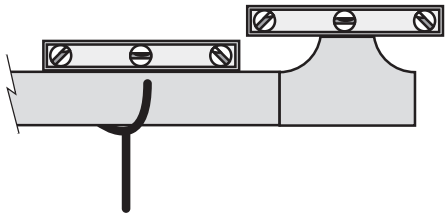
90° Elbow-to-Pipe

1. Level pipe using spirit level.
2. Place fitting to pipe leaving small welding gap.
3. Place spirit level on face of elbow and maneuver elbow until level.
4. Tack weld in place.

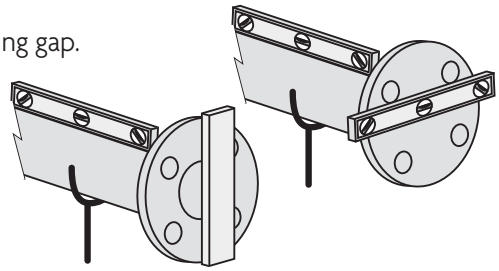


Tee-to-Pipe

1. Level pipe using spirit level.
2. Place tee to pipe leaving small welding gap.
3. Place spirit level on face of tee and maneuver tee until level.
4. Tack weld in place.



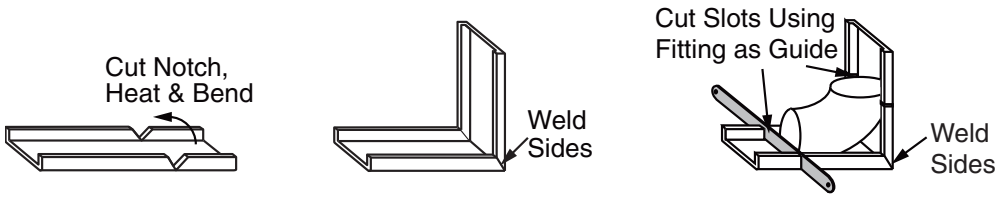
Flange-to-Pipe



1. Bring flange to pipe end leaving small welding gap.
2. Align top two holes of flange with spirit level.
3. Tack weld in place.
4. Center square on face of flange as shown.
5. Tack weld in place.
6. Check sides in same way.

Jig for Small Diameter Piping

The jig is made from channel iron 3' 9" long. Use 1/8" x 1 1/2" for pipe sizes 1 1/4" thru 3"; 1/8" x 3/4" for sizes 1" or smaller.



1. Cut out 90° notches about 9" from end.
2. Heat bottom of notch with torch.
3. Bend channel iron to 90° angle and weld sides.
4. Place elbow in jig and saw half thru sides of channel iron as shown. Repeat this step with several elbows so jig may be used for different operations.
5. A used hack saw blade placed in notch as shown will provide proper welding gap.

TAP AND DRILL SIZES*

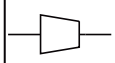
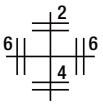
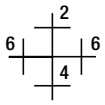
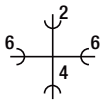
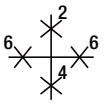
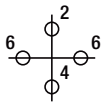
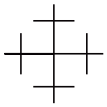
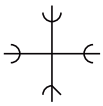
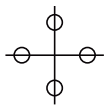
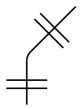
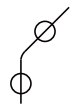
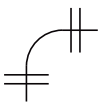
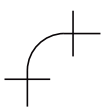
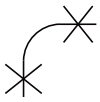
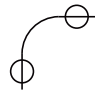
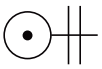
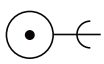
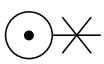
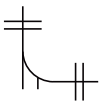
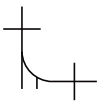
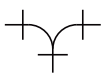
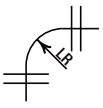
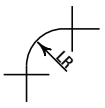
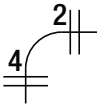
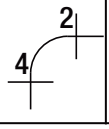
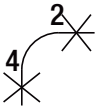
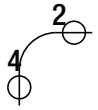
Tap Size	Threads/In.	Drill Size
1/4	20	7
5/16	18	F
3/8	16	5/16
7/16	14	U
1/2	13	27/64
9/16	12	31/64
5/8	11	17/32
3/4	10	21/32
7/8	9	49/64
1	8	7/8
1 1/8	7	63/64
1 1/4	7	1 7/64
1 3/8	6	1 7/32
1 1/2	6	1 11/32
1 3/4	5	1 9/16
2	4 1/2	1 25/32

*Unified National Coarse

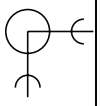
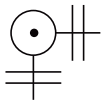
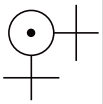
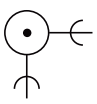
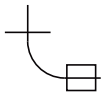
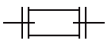
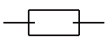
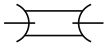
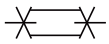
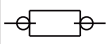
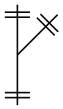
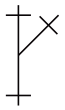
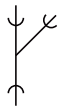
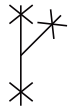
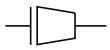
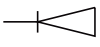
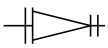
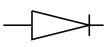
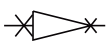
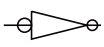
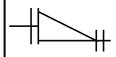
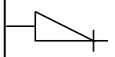
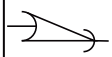
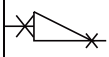
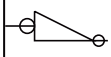
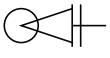
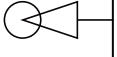
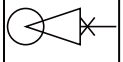
DRILL SIZES FOR NPT PIPE TAPS

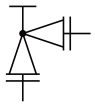
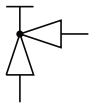
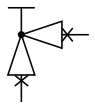
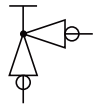
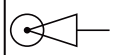
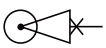
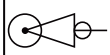
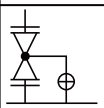
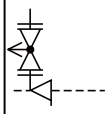
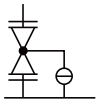
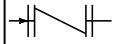
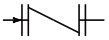
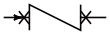
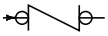
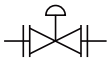
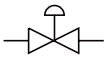
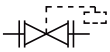
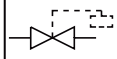
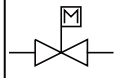
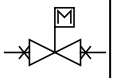
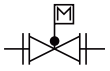
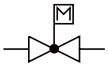
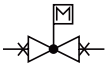
Tap Size	Threads/In.	Drill Dia.
1/8	27	R
1/4	18	7/16
3/8	18	37/64
1/2	14	23/32
3/4	14	59/64
1	11 1/2	1 5/32
1 1/4	11 1/2	1 1/2
1 1/2	11 1/2	1 47/64
2	11 1/2	2 7/32
2 1/2	8	2 5/8
3	8	3 1/4
3 1/2	8	3 3/4
4	8	4 1/4

Symbols for Pipe Fittings

	Flanged	Screwed	Bell & Spigot	Welded	Soldered
Bushing (Reducing)					
Cap					
Cross (Reducing)					
Cross (Straight)					
Crossover					
Elbow - 45°					
Elbow - 90°					
Elbow - Turned Down					
Elbow - Turned Up					
Elbow - Base					
Elbow - Double Branch					
Elbow - Long Radius					
Elbow - Reducing					

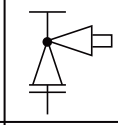
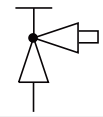
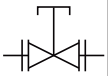
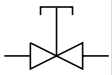
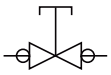
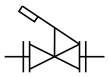
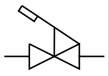
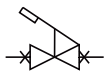
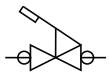
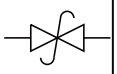
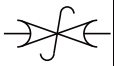
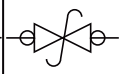
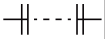
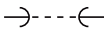
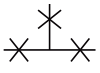
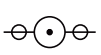
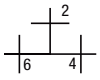
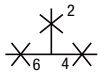
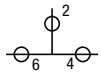
Symbols for Pipe Fittings *Continued*

	Flanged	Screwed	Bell & Spigot	Welded	Soldered
Elbow - Side Outlet (Outlet Down)					
Elbow - Side Outlet (OutletUp)					
Elbow - Street					
Joint - Connecting Pipe					
Joint - Expansion					
Lateral					
Orifice Plate					
Reducing Flange					
Plug - Bull					
Plug - Pipe					
Reducer - Concentric					
Reducer - Eccentric					
Valve - Gate Angle Gate (Plan)					

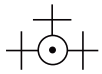
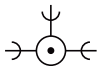
	Flanged	Screwed	Bell & Spigot	Welded	Soldered
Valve - Globe Angle Globe (Elevation)					
Valve - Globe (Plan)					
Valve (Auto) - By-Pass					
Valve (Auto) - Governor Operated					
Valve - Reducing					
Valve - Check (Straight Way)					
Valve - Cock					
Valve - Diaphragm					
Valve - Float					
Valve - Gate*					
Valve - Gate Motor Operated					
Valve - Globe					
Valve - Globe Motor Operated					

*Also used for General Stop Valve when amplified by specification.

Symbols for Pipe Fittings *Continued*

	Flanged	Screwed	Bell & Spigot	Welded	Soldered
Valve - Angle Hose Angle					
Valve - Hose Gate					
Valve - Hose Globe					
Valve - Lockshield					
Valve - Quick Opening					
Valve - Saftey					
Sleeve					
Tee - Straight					
Tee - Outlet Up					
Tee - Outlet Down					
Tee - Double Sweep					
Tee - Reducing					
Tee - Single Sweep					

Symbols for Pipe Fittings *Continued*

	Flanged	Screwed	Bell & Spigot	Welded	Soldered
Tee - Side Outlet (Outlet Down)					
Tee - Side Outlet (Outlet Up)					
Union					
Angle Valve Check					
Angle Valve Gate					

Glossary of Terms and Abbreviations

AGA..... American Gas Association
ANSI..... American National Standards Institute
API..... American Petroleum Institute
ASME..... American Society of Mechanical Engineers
ASPE..... American Society of Plumbing Engineers
ASHRAE..... American Society of Heating, Refrigeration, Air Conditioning Engineers
ASTM..... American Society for Testing Material
AWWA..... American Water Works Association
Adaptor..... A fitting that joins two different type of pipe together such as PVC to cast iron, or threaded to non-threaded.
Alloy..... A substance composed of two or more metals or a metal and a compound.
American Standard Pipe Thread..... A type of screw thread commonly used on pipe and fittings.
Annealing..... A softening treatment consisting of heating carbon or alloy steel or cast iron to an appropriate temperature, holding the temperature for a proper period of time and slowly cooling to ambient temperature.
BOCA..... Building Officials Conference of America
Bell Reducer..... Another term for a concentric reducer.
Bar Plug..... Iron plugs in the 4" thru 8" size that have slotted rather than square heads. Made on to a fitting by use of a steel bar as opposed to a wrench.
Backflow Preventer..... A device of means to prevent backflow (siphonage) into a potable water system.
Black Pipe..... Non-galvanized steel pipe with a lacquer finish.
Blind Flange..... A flange used to seal off the end of a pipe.
Branch..... Any part of the piping system other than a main, riser or stack.
Bubble Tight..... The condition of a valve seat that prohibits the leakage of visible bubbles when closed.
Bull Head Tee..... The outlet of the tee is larger than the run.
Bushing..... A pipe fitting for connecting a pipe with a female or larger size fitting: it has a hollow plug with male and female threads.
Butt Nipple..... A nipple with NPT threads and a shorter overall length than a close nipple used when there is a space consideration. A special order item.
Butt Weld..... A circumferential weld in pipe fusing the abutting pipe walls completely from inside wall to outside wall.
CI..... Cast Iron
Carbon Steel Pipe..... Steel pipe that owes its properties mostly to the carbon it contains.
Cavitation..... A localized gaseous condition that is found within a liquid stream.
Chamfer..... A bevel cut on the O.D. of a pipe nipple at 35 degrees (plus/minus 10 degrees) to axis. In a standard nipple both ends are chamfered.
Chase..... A recess in a wall in which pipes can be run.
Close Nipple..... A nipple with a length twice the length of a standard pipe thread.
Companion Flange..... A flange with a sealing surface on one side for connecting to a flanged fitting or flanged valve and a pipe thread entrance on the other side.

Continuous Weld Pipe (CW)..... A process for making smaller diameter pipe through 4 1/2" where the entire continuous ribbon of steel is heated in a furnace to the required temperature for forming and fusing. The edges of steel are firmly pressed together by rolls to obtain a forged weld. Heat and pressure form the weld

Countersunk Plug..... A low pattern plug lacking a protruding head rather with a recess or socket, usually in square or hexagon pattern.

Coupling..... A pipe fitting with female threads used to connect two pipes in a straight line.

Cross..... A pipe fitting with four branches in pairs, each pair on one axis, and the axis at right angles.

Cross-Connection..... Any connection or situation that may allow wastewater to enter the water supply system.

Cut Lengths..... Pipe cut to a specific length as ordered.

DWV..... Drainage, waste and vent system.

Dielectric Fitting..... A fitting having insulating parts or material that prohibits flow of electric current.

Die..... Cutting device used to thread pipe. A set of these attach to dieheads and is mounted on a threader.

Dope..... Pasty lubricant used to seal pipe threads prior to making a threaded pipe connection.

Drop Ear Elbow..... A small elbow having wings cast on each side; the wings have countersunk holes to secure to a ceiling or wall.

Dry-Pipe Valve..... A valve used with a dry-pipe sprinkler system where water is on one side of the valve and air is on the other side. When the link in the sprinkler head melts releasing air from the system the valve opens allowing water to flow.

Durham System..... A term used to describe soil or waste systems where all piping is threaded.

Eccentric Fittings..... Fittings whose openings are offset allowing liquid to flow freely.

Elbow..... A fitting that makes a 90 degree angle between adjacent pipes unless another angle is specified.

Electrogalvanizing..... A process on bonding a layer of zinc to steel or iron involving electroplating by running a current through a saline/zinc solution with a zinc anode and a steel or iron conductor.

Electric Resistance Weld Pipe (ERW)..... Cold finished pipe made by flat steel is cold shaped into tubular form and then welded at the seam from heat generated by resistance to the flow of electric current applied through electrical contacts.

End Connection..... The method of connecting the parts of a piping system.

Extra Heavy..... Description of piping material indicating thicker than standard.

FIP..... Female iron pipe connection. Standard internal threads on pipe fittings.

Face to Face Dimension..... The dimensions from the face of the inlet port to the face of the outlet port of a fitting or valve.

Face Bushing..... A bushing without the hex head. A low pattern bushing used when a smooth transition is required between fitting and nipple when insulating. Also used for reducing with 300# fittings as recommended by ASME B16.14.

Female Thread ..... The internal thread in pipe fittings, valves, etc.
Fitting, Compression ..... A fitting designed to join pipe or tubing by means of pressure or friction.
Flange Fitting ..... A fitting which utilizes a radically extended collar for sealing and connection.
Flange ..... A ring-shaped plate at the end of a pipe, at right angles to the pipe, provided with holes for bolts to allow fastening the pipe to similarly equipped adjoining pipe.
Floor Flange ..... A construction flange with no pressure rating. Used to secure structural components, e.g. hand rails, to floors or walls.
FM ..... Factory Mutual Engineering Corp.
Forged Steel Fittings ..... Solid pieces of steel are forced into fitting shapes under very high temperature and pressure and then machined into final form.
Friction Loss ..... The loss of pressure caused by the turbulence created in water while traveling through pipe, fittings and valves.
GAL ..... Gallons
GALV ..... Galvanized
GPM ..... Gallons per minute
Galvanic Action ..... When two dissimilar metals are immersed in the same electrolytic solution and connected electrically there is an interchange of atoms carrying an electric charge between them. The anode metal with the higher electrode potential corrodes with the cathode protected.
Galvanized Pipe ..... Steel pipe coated with zinc to resist corrosion.
Galvanizing ..... A process where the surface of iron or steel piping or fittings is covered with a layer of zinc.
Gasket ..... A flat device usually made of fiber or rubber used to provide a watertight seal between metal joints.
Groove - Cut ..... A circumferential groove that has been cut into a segment of pipe. Metal is removed in this process. For use in a grooved-end piping system.
Groove - Roll ..... A circumferential groove that has been forced or swagged into a pipe segment. The metal is displaced inside the pipe. No metal is removed in the process. For use in a grooved-end piping system.
Ground Joint ..... Where the parts to be joined are precisely finished and then ground so that the seal is tight.
Ground Joint Union ..... A pipe union that has a brass or copper grounding section between the two.
HVAC ..... Heating, ventilation and air conditioning
Half Coupling ..... A full steel coupling sawed in half. Uses as drain or valve access ports in steel tanks. Not recognized by industry specification.
Header ..... A large pipe from which a number of smaller ones are connected in line from the side of the large pipe.
Hot Dip Galvanizing ..... The process of coating iron or steel with a layer of zinc by passing the metal through a molten batch of zinc at a temperature of 450 deg F.
IAPMO ..... International Association of Plumbing & Mechanical Officials
ISO 9000 ..... A series of five standards for developing a total quality management system. Developed by the International Organization for Standardization.

ID ..... Inside diameter
IPS ..... Iron pipe size. Same as NPS.
Lateral Fitting ..... A wye (Y) fitting with an outlet at a 45 degree angle from the run.
LEED ..... Leadership in Energy and Environmental Design
Listed ..... Equipment or materials included in a list published by an organization that maintains periodic inspection on current production. The listing states that the equipment or material complies with approved standards or has been tested and found suitable for use in a specified manner.
Listing Agency ..... An agency accepted by the administrative authority which lists and maintains a periodic inspection program on current production.
Locknut ..... A malleable nut having a packing recess for seals for use in tank applications.
MI ..... Malleable iron
MIP ..... Male iron pipe connection. Standard external threads on pipes and fittings. Same as MPT.
MPT ..... Male pipe thread where the threads are on the outside of pipes and fittings.
Malleable Iron ..... Cast iron that is heat-treated to reduce brittleness allowing the material to stretch slightly.
Manifold ..... A fitting with a number of branches in line connecting to smaller pipes. Term is interchangeable with "Header."
Mill Length ..... Also known as random length; run of mill pipe 16 to 20 feet in length. Some pipe is made in double lengths of 30 to 35 feet
NPS ..... Nominal pipe size. Same as IPS.
NPT ..... Nominal Pipe Taper (American Standard Pipe Taper Thread)
NPSC ..... Nominal Pipe Straight Coupling (American Standard Straight Coupling Thread)
NSF ..... NSF International (formerly National Sanitation Foundation)
Natural Gas ..... A colorless, odorless fuel derived from the earth consisting primarily of Methane (CH4). Mercaptans (odors) are added to aid in leak detection.
Nipple ..... Nipples are used to connect fittings, extend lines and provide proper threading distances at the right locations. Normally, a nipple is 12" and under in length with a male thread at both ends.
Normalizing ..... A heat treatment applied to steel involving heating above the critical range followed by cooling in still air. Performed to refine the crystal structure and eliminate internal stress.
OD ..... Outside Diameter. The diameter of a pipe measured from the outside edges.
O.D. Pipe ..... Pipe that measures over 14" N.P.S. where the nominal size is the outside diameter and not the inside diameter.
OEM ..... Original Equipment Manufacturer
Offset ..... A combination of pipe and/or fittings that joins two nearly parallel sections of a pipe line.
PSI ..... Pounds per square inch
PSIG ..... Pounds per square inch guage
Pickling ..... Pipe immersed into an acid bath for removal of scale, oil, dirt, etc.

Plug..... Has a male thread and is used to close an opening. Can be made from iron or steel. Cored plugs are for standard applications while solid are for extra heavy applications. The head is typically square pattern. Recessed or countersunk plugs are in square or hexagonal pattern.

Ready Cut Pipe..... Pipe normally threaded both ends in lengths longer than 12" but shorter than 21'. Also referred to as cut pipe.

Reducer..... A pipe fitting with inside threads that is larger at one end than the other.

Right Hand/Left Hand Nipples (couplings)..... A nipple with a right hand thread on one side and a left hand thread on the other side. To be used with RH/LH couplings Takes the place of a union in tight areas to permit line connections and disconnections.

Riser..... A water supply pipe that extends vertically one full story or more to carry water to branches.

SMLS..... Seamless pipe

SPEC..... Specification

STD..... Standard

Saturated Steam..... Steam at the same temperature as water boils under the same pressure.

Schedule..... Numbers assigned to different wall thicknesses of pipe (e.g. 40, 80, 160)

Screwed Joint..... A pipe joint consisting of threaded male and female parts threaded together.

Seamless Pipe..... Pipe or tube formed by piercing a billet of steel and then rolling.

Service Tee..... Tee fitting with male threads on one run opening and female threads on the other run opening and outlet.

Service Pipe..... A pipe connecting water or gas mains with a building.

Short Nipple..... A nipple whose length is a little greater than that of two threaded lengths or somewhat longer than a close nipple so that it has some unthreaded portion between the two threads.

Shoulder Nipple..... A nipple halfway between the length of a close nipple and a short nipple.

Socket Weld..... A joint made by use of a socket weld fitting which has a prepared female end or socket for insertion of the pipe to which it is welded.

Sprinkler System..... An integrated system of underground and overhead piping designed in accordance with fire protection engineering standards.

Stainless Steel Pipe..... An alloy steel pipe with corrosion-resisting properties, usually imparted by nickle and chromium.

Straight Thread..... A parallel thread that lacks taper.

Street Elbow..... An elbow with male thread on one end and female thread on the other.

Superheated Steam..... Steam at a higher temperature than that at which water would boil under the same pressure.

Tank Nipple..... Nipples are in 6" lengths only. One side has a standard NPT thread while the other has a straight running NPSL thread. Can be used as tank legs or as a threaded port in the side of a steel tank secured with a lock nut.

Tapered Threads..... Male and female threads designed with a 60 degree angle, deeper at the end of the pipe or fitting and increasingly shallower the further they are from the end of the pipe or fitting.

Tee..... A fitting that has one side outlet at right angles to the run.

Thermal Movement of Pipe..... The calculated movement, expansion or contraction, in a pipe run or segment there of caused by heating or cooling of the pipe.

UL..... Underwriter's Laboratories, Inc.

Union..... Basically, two couplings held together with a nut that permit connections and disconnections with little disturbance to pipe sections. Unions commonly have a brass or copper seat ring between the couplings.

Union - All Iron..... A union without a copper, copper alloy or brass seat ring. Used in piping applications where alkalis or acids are present.

Union Ell..... An ell with a male or female union at one end.

Union Tee..... A tee with a male or female union at one end of the run.

Wall Thickness..... The thickness of the tubing or pipe wall.

Waste Nut..... A malleable nut with two screw holes on either side of the pipe opening. Used for mounting to equipment panels.

Water Hammer..... The noise and vibration which develops in a piping system when a column of non-compressable liquid flowing through a pipe line at a given pressure and velocity is abruptly stopped.

W.O.G...... Water, oil, gas: refers to the pressure rating of a fitting in ambient temperature.

WSP..... Working steam pressure: Refers to the pressure rating of a fitting at saturated steam temperature.

Wye (Y)..... A fitting that has one side outlet at an angle other than 90 degrees.

XH..... Extra Heavy

NOTES

NOTES

BRANDS OF ANVIL INTERNATIONAL

Anvil® product lines include malleable and cast iron fittings, unions and flanges; seamless steel pipe nipples; steel pipe couplings; universal anvilets; forged steel fittings and unions; pipe hangers and supports; threaded rod; and engineered hangers.

The Gruvlok® product line consists of couplings for grooved and plain-end fittings, butterfly valves and check valves; flanges; pump protection components; pipe grooving tools; as well as copper and stainless steel system components.

Anvil-Strut™ products include a complete line of channel in stock lengths of 10 and 20 feet, with custom lengths available upon request. A variety of fittings and accessories are also offered. All products can be ordered in an assortment of finishes and material choices including SupR-Green™, Zinc Trivalent Chromium, pre-galvanized, hot-dipped galvanized, electro-galvanized, aluminum, plain, and stainless steel.

JB Smith™ is the leading manufacturer of oil country tubular fittings, swages and bull plugs – all meeting API specifications. Offering tubing nipples, casing nipples as well as a full line of traditional line pipe and oil country threads in every schedule, JB Smith is the resource for all your oilfield needs.

Catawissa™ NACE and API approved wing unions for Standard Service are offered in non-pressure seal ends as well as threaded and butt weld, and are interchangeable with most leading union manufacturers. Fully traceable and available with complete mill certifications, Catawissa's oilfield wing union product line includes the standard ball-and-cone design plus our unique Figure 300 Flat Face design, where space and pipe line separation are a consideration.

The SPF/Anvil™ product line includes a variety of internationally sourced products such as grooved couplings, fittings and flanges, cast iron, malleable iron and ductile iron threaded fittings, steel pipe nipples, as well as o'lets.

The Merit® product line includes a variety of tee-lets, drop nipples, and steel welding flanges for fire protection applications. Most Merit products are UL/ULC Listed, FM Approved, and rated from 175 to 300 psi.

Steel pipe nipples and steel pipe couplings are manufactured in accordance with the ASTM A733 Standard Specification for Welded and Seamless Carbon Steel and Stainless Steel Pipe Nipples. Steel pipe couplings are manufactured in accordance with the ASTM A865 Standard Specification for Threaded Couplings, Steel, Black or Zinc-Coated (Galvanized) Welded or Seamless, for Use in Steel Pipe Joints. API couplings are manufactured in accordance with the API Specification for line pipe.

Canvil® manufactures low pressure hexagon reducer bushings, as well as plugs and hex caps up to 1" in diameter in various finishes including Oil Treat, Phosphate and Electro Galvanized. In addition, Canvil manufactures A105 hex or round material in class 3000 and 6000 pound, forged steel couplings and bar stock products offered as either as normalized (A105N) or non-normalized (A105) that are fully traceable for mechanicals and chemistry through our MTR program.

Anvil EPS-Engineered Pipe Supports are products used to support piping systems under thermal, seismic, and other dynamic loading conditions. The product line encompasses variable spring hangers, constant supports, sway struts and snubbers as well as standard and special design clamps. Anvil EPS brings the highest quality products and innovative engineering solutions to common and uncommon piping system problems.

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Building Connections That Last

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