Trusted above all.

Grooved Products

Installation Instructions

Introduction to grooved products installation

Viking is renowned for the development, manufacturing, sales and distribution of excellent fire protection technologies and has been a dependable partner in fire protection for many decades.

The broad product portfolio encompasses innovative and proven system components for water, foam and gas extinguishing systems as well as fire detection systems and is a reflection of Viking's unwavering focus on providing customers with the finest products and highest level of support.

Through Viking's dedicated and knowledgeable customer service, installers of fixed fire protection systems have access to those quality products and can place their trust in the professional and dedicated support services provided by Viking employees. From the smallest project to the largest endeavour, Viking is their single-point partner with the goal to provide the right material whenever and wherever needed.

Viking is passionate about fire protection and committed to the growth of the fixed fire protection industry. As Viking is completely focused and dedicated to this market, customers can have confidence that Viking has the expertise that they need to be successful. They can count on Viking's resources and technical expertise to help them whenever they have a challenge to overcome. And they can be sure to find the right product or solution for their project with the necessary approval or accreditation.

This installation instruction booklet provides detailed guidance on the use of Viking's comprehensive range of grooved products. Besides access to those products, customers benefit from a market leading technical support team across Europe and the Middle East, which also holds regular technical training courses on water, foam, gaseous and detection systems, products and maintenance. Learn more at www.viking-emea.com.

Contents

1. Explanation of symbols

1.1 Hazard Pictograms

In this documentation safety instructions and important explanations will be marked by the following pictographs.

DANGER	This combination of symbol and signal word points towards a directly hazardous situation, which can cause death or serious injuries if not avoided.
WARNING	This combination of symbol and signal word points towards a possible hazardous situation, which can cause death or serious injuries if not avoided.
CAUTION	This combination of symbol and signal word points towards a possible hazardous situation, which can cause slight or minor injuries if not avoided.
NOTICE	This combination of symbol and signal word points towards a possible hazardous situation, which can cause damage to property or the environment if not avoided.

1.2 Information Pictogram

INFORMATION	This symbol highlights any useful tips and recommendations as well as any information to ensure

2. Installation information

2.1 Installation of piping products

DANGER

- **Before installing, extending or adjusting piping products the piping system should always be depressurized first and emptied.**
- **Protection goggles, helmet and safety shoes should be worn.**
- **Do not attach supports directly to couplings.**

Only attach supports to adjacent pipes and components.

Failure to observe these guidelines can result in a sudden loosening of the connection under pressure, which can lead to serious personal injury, damage to property and damage to the product.

It is the responsibility of the installer of the piping system and the planning engineer to select and ensure that products are suited to the intended use, and to ensure that the operating pressure and maximum admissible pressure (e.g. in the case of pressure checks) and other performance data are not exceeded and that applicable national or international laws, standards, directives and technical regulations will be observed and fulfilled.

The following basic instructions must be observed to ensure correct assembly of the pipe connection.

- **Check the suitability of the associated gasket for the intended use.**
- **Check the compatibility of the materials used in couplings, gaskets and fittings with the environmental conditions and with the anticipated media / extinguishing solutions. Consult the latest version of the product datasheets or contact your local Viking office for further information.**
- **Only use approved lubricants for the corresponding sealing material for assembly of the gasket / coupling.**
- **Observe the operating and maintenance instructions for the tools to be used.**
- **Check that the outer diameter and groove dimensions of the pipes or fittings are within the applicable groove specifications.**
- **Check that the gasket is correctly placed on the gasket seat of pipe or fitting.**
- **Check that the coupling keys engage correctly in the pipe or fitting grooves.**
- **Tighten the coupling nuts evenly and by alternating sides, until the angle-design bolt pads meet metal to metal. Ensure equal offsets at bolt pads on both sides of the coupling.**
- **If a tightening torque is specified for assembly of the coupling, the nuts must be tightened using this torque, to ensure correct assembly.**

2.2 Supporting piping

Piping that is joined with grooved pipe couplings, like all other piping systems, also requires support to bear the weight of the pipes, accessories and materials.

With the support or hanging methods applied, the load on the connections, piping and other components must be kept as low as possible.

In addition, where required, the support must allow for movement of the piping and meet other requirements such as drainage or venting.

The specific national or international laws, standards, directives and technical regulations must be observed and fulfilled in relation to support spacing (e.g. VdS-CEA 4001, NFPA, FM, etc).

NOTICE

Risk of material damage

- **Do NOT attach supports directly to couplings.**
- **Only attach supports to adjacent pipes and components.**

Viking is not responsible for the design of piping systems and accepts no liability for systems that are not properly designed.

3. Installation preparation

3.1 Pipe preparation

Pipes must be prepared in accordance with the current groove specifications.

ⓘ *See chapter 10 "Roll Groove Specifications for Steel pipe" on page 42*

and

ⓘ *See chapter 11 "Cut Groove Specifications for Steel pipe" on page 45*

- The ends of the pipes should be cut square.
- Acceptable deviations from squareness can be obtained from the groove specifications.
- The pipe ends must be burr-free to avoid damage to the gasket during assembly.
- Use of pipes with beveled ends is not recommended.
- Beveled end pipe is acceptable only if pipe ends are in conformance with EN 10217-1
- The gasket seats must be free from any indentations, roll marks, scores, seams or other harmful surface defects, such as loose paint, scale, dirt, chips, grease and rust, that may interfere with proper sealing of the gasket.
- The grooves must be free from loose dirt, chips, rust and scale that may interfere with proper coupling assembly.

3.2 Gasket

- To ensure the best possible functioning of the gasket, the right gasket must always be selected for the corresponding medium.
- Selecting the wrong gasket can lead to leaks and to property damage.
- Do not expose gaskets to temperatures outside the recommended temperature range, as excessive temperatures can affect the life and performance of the gasket.

The following listed services are general recommendations only and apply only to our gaskets. This recommendation does not necessarily imply that the coupling housing, related fittings or other parts are suited to the same service.

Consult the latest version of the product datasheets or contact your local Viking office for further information.

Table 1: Gasket materials (Standard)

Grade	Compound	Temperature range	Color code	General service recommendations
E	EPDM	-40°C up to 110°C (ambient temperature)	Green stripe	For use within the stipulated temperature ranges in water extinguishing systems.

Other gasket materials are available for other applications on request, for further information contact your local Viking office

CAUTION

EPDM gaskets must never be brought into contact with lubricants or oils containing mineral oils, as well as other materials containing mineral oils (e.g. fuels or cleaning agents).

NOTICE

- Where gaskets or couplings with pre-mounted gaskets are stored for extended periods of time, the physical properties of the elastomers can change during the storage period. They can be rendered unusable due to hardening, softening, breaking, crack formations or other surface decomposition. These changes are the result of special individual or combined influence factors like e.g. deformations, oxygen, ozone, light, heat, moisture or oils and solvents.
- With some simple precautions the life and storage time can be extended considerably. Basic instructions on storage, cleaning and preservations of elastomer sealing elements are described in national and international standards such as e.g.: ISO 2230 or DIN 7716.
- The recommendations of these standards on storage conditions and storage time must be observed. Consult the latest version of the product datasheets or contact your local Viking office for further information.

3.3 Lubrication

CAUTION

- To avoid gasket pinching, the outside of the gasket and the inside of the coupling half-shells as well as the inside of the sealing lips and the outside of the pipe ends must be lightly lubricated.
- Lubricating also eases installation of the gasket onto the pipe end.
- DO NOT use too much lubricant!

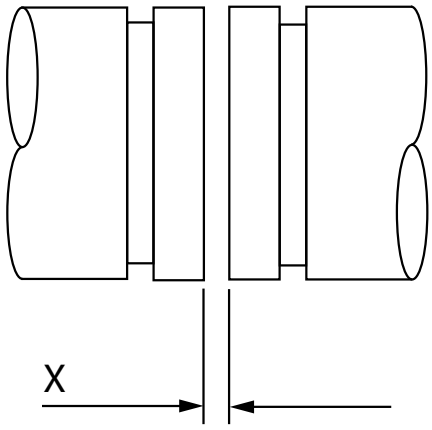
Generally use the lubricant for pipe couplings designated in our product sheets as lubricant for the EPDM gaskets (grade "E").

Under certain conditions other lubricants may also be necessary, such as e.g. mineral oil-free silicone lubricant or EPDM-compatible lubricant for use in drinking water areas. Consult the latest version of the product datasheets or contact your local Viking office for further information.

CAUTION

- Under no circumstances may mineral-oil containing lubricants, oils or other mineral-oil containing materials (e.g. fuels) be brought into contact with the EPDM gaskets.
- However, should this occur, the affected gasket must be changed immediately and may not be reused

3.4 Nominal pipe and separation



The nominal pipe end separation dimensions are suitable for system layout purposes only

Table 2: Nominal pipe end separation X

Nominal Pipe Size DN (mm)	Nominal Pipe Size (inch)	Pipe Outside Diameter OD (mm)	Pipe End Separation X (mm)	Pipe End Separation X (inch)
25	1″	33.7	2.6	0.102
32	1¼″	42.4		
40	1½″	48.3		
50	2″	60.3		
65	2½″	73.0		
65	3 OD	76.1		
80	3″	88.9		
100	4¼ OD	108.0		
100	4″	114.3	5.3	0.209
125	5¼ OD	133.0		
125	5½ OD	139.7		
150	6¼ OD	159.0		
150	6½ OD	165.1		
150	6″	168.3		
200	8″	219.1	5.9	0.232
250	10″	273.0		
300	12″	323.9		

NOTICE

- These nominal pipe end separation dimensions arise from the nominal values of the groove specifications and the design dimensions of the pipe couplings.
- They only represent the nominal values to be observed for design and installation purposes.
- They do not represent the maximum or minimum values which may arise from allowable tolerances of the groove and manufacturing tolerances of the pipe couplings.
- Please also observe the current groove specifications

3.5 Information on using impact wrenches

If an impact wrench is used to assemble the couplings, the torque tightness shown on the impact wrench must NEVER exceed the recommended torque indicated as maximum for the corresponding coupling.

The nuts must also be tightened evenly and by alternating sides with an impact wrench, until the bolt pads meet metal to metal. In the case of couplings with angle-design bolt pads, equal off- sets must occur at the bolt pads to ensure the rigidity of the pipe connection.

UNDER NO CIRCUMSTANCES should you further tighten with the impact wrench if you can see that the coupling is assembled correctly.

WARNING

Failure to observe these regulations can result in the gasket becoming pinched and / or damaged or in the bolts being fractured and thus damage to the coupling. This can lead to the connection becoming loose and to injury and serious damage to property

When using an impact wrench it may be necessary that the assembly be carried out more slowly to ensure that the nuts are tightened evenly and by alternating sides, until the assembly is completed correctly.

When using impact wrenches the assembler generally does not have a direct "wrench feel" or "torque feel" to judge nut tightness.

WARNING

Since some impact wrenches are capable of high output, one should become familiar with the impact wrench first, to avoid damaging or fracturing the bolts or the coupling bolt pads during assembly.

NOTICE

- First complete some experimental assemblies with the impact wrench and a box spanner or better again with a torque wrench to determine the power of the impact wrench.
- During assembly of the system regularly check other couplings with the same methods, to ensure that assembly is as uniform as possible.
- Always observe the manufacturer operating instructions to guarantee safe and proper use of the impact wrench.
- Make sure that the correct box spanner inserts are always used for assembling the coupling.

3.5 Notes for sprinkler systems with dry pipework

CAUTION

- When using in cooling or freezing rooms or areas in which temperatures go below freezing, preparation of surfaces on the pipe ends is particularly important.
- At temperatures below zero to lower temperature limits for the gasket materials (EPDM: -40°C), the gasket always will be harder. Thus all indentations, projections, loose paint, scale, dirt, chips, grease and rust on the pipe ends must be removed to ensure a leak-free seal.

NOTICE

- We recommends generally that dry pipework under pressure has to be filled with an inert gas (e.g. nitrogen).
- Consult the latest version of the product datasheets or contact your local Viking office for further information.

4. Installation guidance

4.1 Rigid pipe couplings

4.1.1 Step-by step installation

Check the pipe ends:

- The pipe ends must be burr-free to avoid damage to the gasket during assembly.
- The outer surfaces of the pipes from the pipe end to the groove must be smooth and free from any indentations, roll marks, scores, seams or other harmful surface defects, such as loose paint, scale, dirt, chips, oil, grease and rust.
- Grooves must be free from loose dirt, chips, rust and scale.
- In addition, groove specifications must be observed and complied with, see

ⓘ *Chapter 10 "Roll Groove Specifications for Steel pipe" on page 42*

and

ⓘ *Chapter 11 "Cut Groove Specifications for Steel pipe" on page 45.*

Check the gasket:

- Check the color code of the gasket and ensure that the gasket is suited to the planned use.
- The standard gaskets provided ex-works with couplings are grade "E" (EPDM) and are marked with a green stripe. In addition, one side of these gaskets bears the mark "EPDM".
- Check that the gasket is clean and undamaged.
- EPDM gaskets must never be brought into contact with lubricants containing mineral oils, oils or other materials containing mineral oils (e.g. fuels or cleaning agents).

Lubricate the gasket and coupling:

- To avoid gasket pinching, the outside of the gasket;
  - the inside of the coupling half-shells;
  - the inside of the sealing lips; and
  - the outside of the pipe ends

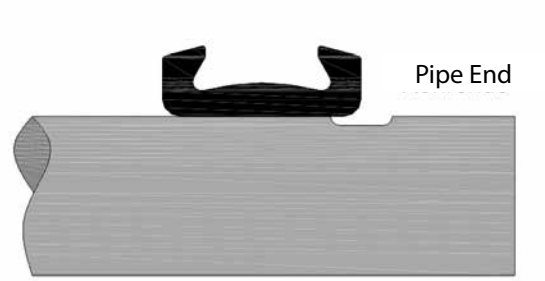
  must be lightly lubricated.
- Generally use the lubricant for pipe couplings designated in the product datasheet as lubricant for the EPDM gaskets (grade "E").
- Cover the sealing lips and the outside of the gasket with a thin layer of lubricant.
- Cover the inside of both half-shells of the coupling with a thin layer of lubricant.

CAUTION

Failure to observe these guidelines can lead to damage to the gasket and to leakage.

Lubricate the gasket and coupling:

- Push or pull the gasket carefully over the pipe end until the cut edge of the pipe end is visible again.
- Ensure that the gasket does not protrude (even in part) over the end of the pipe.



Shown enlarged for clarity

- In the case of large couplings e.g. from DN80 up, it may be easier to turn the gasket inside out and then slide it over the pipe end.
- Ensure that the gasket does not protrude over the end of the pipe.

Bring together the pipe ends:

- Bring the two pipe ends together edge to edge. Ensure alignment is straight and concentric.
- If the gasket was turned inside out for larger couplings, roll the gasket into the correct position.
- Slide the gasket over both pipe ends, so that it is centered between both grooves.

CAUTION

Under no circumstances may the gasket project into the groove area of either of the two pipe ends. The sealing lips of the gasket must not be pinched between the pipes at the cut edges.

Mount the pipe coupling half-shells – Model 900 (Angle Style, see below for T&G style):

- Bolts and nuts should now be removed from one side of the coupling, if not already done and the bolts and nuts on the other side should be loosened, until the thread of the bolt no longer protrudes over the nut.
- The coupling prepared as indicated can now be opened and swiveled to the side, so that it can be placed over the pipe and the gasket.

Mount the pipe coupling half-shells – Model 900 (Angle Style):

- Slide the opened coupling over the pipe and over the gasket.
- Place one of the casing halves (e.g. the lower one) onto the gasket, so that the keys engage in the grooves of the pipe ends.
- Swivel the other half of the casing over the gasket.

- Now place the second half of the casing onto the gasket, so that the keys engage in the grooves of the pipe ends.
- Make sure that the keys of the casing halves engage correctly in the grooves of both pipes.
- Ensure that on both sides of the coupling there is an equal gap between the angle-design bolt pads of the casing halves.

CAUTION

Make sure that the gasket does not become rolled or pinched.
Failure to observe these guidelines can lead to damage to the gasket and to leakage.

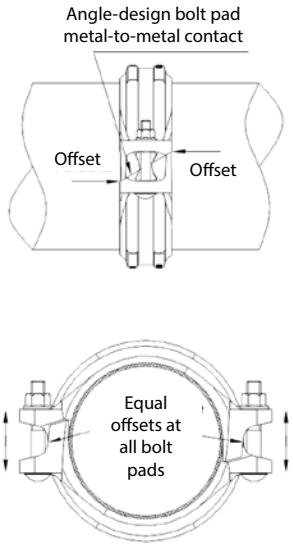
Assemble the bolts and nuts – Model 900 (Angle Style):

- Insert the remaining bolt into the bolt holes and tighten the nut by hand.
- Likewise tighten up the other nut by hand again, so that both bolt threads protrude equal lengths out of the nuts.
- Make sure the oval necks of the bolts seat properly in the oval bolt holes.

Tighten the bolts – Model 900 (Angle Style):

- Tighten the coupling nuts evenly and by alternating sides, until the angle-design bolt pads meet metal to metal.
- To achieve optimum sealing performance and stability,

  the nuts must be tightened with the specified torque corresponding to each of the thread sizes (ⓘ *see Table 3 on page 17*).
- Always use the correct box spanner inserts when assembling each coupling.
- Ensure that the keys of the casing halves are fully engaged in the grooves.



(shown enlarged for clarity)

- When tightening the bolts the angle-design bolt pads slide against each other over both sides of the coupling. This ensures that the pipes are optimally secured.
- Make sure that there are equal offsets at both angle- design bolt pads on both sides of the coupling and that the keys of the casing halves engage fully in the grooves.

WARNING

Failure to observe these guidelines can lead to a loose connection which can in turn result in injury and / or serious damage to property.

- The nuts must be tightened evenly and by alternating sides, otherwise the gasket can become pinched and damaged, which can lead to immediate or subsequent leaks.

Mount the pipe coupling half-shells – Model 1G (Tongue & Groove Style):

- Bolts and nuts should now be removed from one side of the coupling, if not already done, and the bolts and nuts on the other side should be loosened, until the thread of the bolt no longer protrudes over the nut.
- The coupling prepared as indicated can now be opened and swiveled to the side, so that it can be placed over the pipe and the gasket.

Mount the pipe coupling half-shells – Model 1G (Tongue & Groove Style):

- Slide the opened coupling over the pipe and over the gasket.
- Place one of the casing halves (e.g. the lower one) onto the gasket, so that the keys engage in the grooves of the pipe ends.
- Swivel the other half of the casing over the gasket

- Now place the second half of the casing onto the gasket, so that the keys engage in the grooves of the pipe ends.
- Make sure that the keys of the casing halves engage correctly in the grooves of both pipes.
- Ensure that on both sides of the coupling there is an equal gap between the bolt pads of the casing halves.

CAUTION

Make sure that the gasket does not become rolled or pinched.
Failure to observe these guidelines can lead to damage to the gasket and to leakage.

Assemble the bolts and nuts – Model 1G (Tongue & Groove Style):

- Insert the remaining bolt into the bolt holes and tighten the nut by hand.
- Likewise tighten up the other nut by hand again, so that both bolt threads protrude equal lengths out of the nuts.
- Make sure the oval necks of the bolts seat properly in the oval bolt holes.

Tighten the bolts – Model 1G (Tongue & Groove Style):

- Tighten the coupling nuts evenly and by alternating sides, until the bolt pads meet metal to metal.
- To achieve optimum sealing performance and stability,

  the nuts must be tightened with the specified torque corresponding to each of the thread sizes (ⓘ *see Table 3 on page 17*).
- Always use the correct box spanner inserts when assembling each coupling.
- Ensure that the keys of the casing halves are fully engaged in the grooves.

- With the T&G style coupling no metal-to-metal contact of the bolt pads is required. You will normally see a 1.6 mm up to 3.2 mm (1/16" up to 1/8") gap between the bold pads when installed

WARNING

Failure to observe these guidelines can lead to a loose connection which can in turn result in injury and / or serious damage to property.

4.1.2 Recommended bolt torque

Table 3: Thread sizes and tightening torques for rigid couplings

Nominal Pipe Size DN	Nominal Pipe Size	Pipe Outside Diameter OD	Thread Size metric	Recommended bolt torque	
				Model 900	Model 1G
(mm)	(inch)	(mm)	(mm)	(Nm)	(Nm)
25	1″	33.7	M10	40-60	40-60
32	1¼″	42.4			
40	1½″	48.3			
50	2″	60.3		60-80	
65	2½″	73.0			
65	3 OD	76.1			
80	3″	88.9			
100	4¼ OD	108.0			
100	4″	114.3			
125-150	5¼ OD - 6″	133.0-168.3	M12	120-160	110-135
			M16	220-300	135-175
200	8″	219.1	M20	320-380	175-245
250	10″	273.0	M22	450-600	245-325
300	12″	323.9			

To achieve optimum sealing performance and stability, always aim for the average-value of the recommended torque.

A proficient assembler can generally sense when a bolt reaches a certain torque, which helps to ensure these specified torques having a relatively large tolerance, even in the absence of a torque wrench.

NOTICE

- In case of doubt or if you are inexperienced or if you have no feeling for the torque tightness yet, first complete some experimental assemblies with a torque wrench, where appropriate in direct comparison with a box spanner.
- During assembly of the system regularly check other couplings with the same methods, to ensure that assembly is as uniform as possible.

WARNING

- Using a torque, which exceeds the specified value, does not improve the sealing performance.
- On the contrary, this can cause damage to the coupling which can result in failure or breaking of the pipe connection even long after assembly.
- A secure pipe connection and sealing cannot be guaranteed either if the tightening torque used is too low.

4.2 Flexible pipe couplings

4.2.1 Step-by step installation

Check the pipe ends:

- The pipe ends must be burr-free to avoid damage to the gasket during assembly.
- The outer surfaces of the pipes from the pipe end to the groove must be smooth and free from any indentations, roll marks, scores, seams or other harmful surface defects, such as loose paint, scale, dirt, chips, oil, grease and rust.
- Grooves must be free from loose dirt, chips, rust and scale.
- In addition, groove specifications must be observed and complied with, see

ⓘ *Chapter 10 "Roll Groove Specifications for Steel pipe" on page 42*

and

ⓘ *Chapter 11 "Cut Groove Specifications for Steel pipe" on page 45.*

Check the gasket:

- Check the color code of the gasket and ensure that the gasket is suited to the planned use.
- The standard gaskets provided ex-works with couplings are grade "E" (EPDM) and are marked with a green stripe. In addition, one side of these gaskets bears the mark "EPDM".
- Check that the gasket is clean and undamaged.
- EPDM gaskets must never be brought into contact with lubricants containing mineral oils, oils or other materials containing mineral oils (e.g. fuels or cleaning agents).

Lubricate the gasket and coupling:

- To avoid gasket pinching, the outside of the gasket;
  - the inside of the coupling half-shells;
  - the inside of the sealing lips; and
  - the outside of the pipe ends

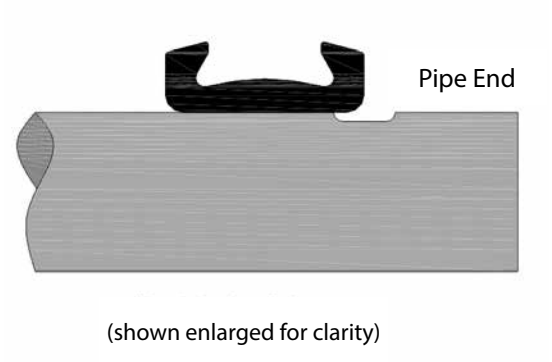
  must be lightly lubricated.
- Generally use the lubricant for pipe couplings designated in the product datasheet as lubricant for the EPDM gaskets (grade "E").
- Cover the sealing lips and the outside of the gasket with a thin layer of lubricant.
- Cover the inside of both half-shells of the coupling with a thin layer of lubricant.

CAUTION

Failure to observe these guidelines can lead to damage to the gasket and to leakage.

Lubricate the gasket and coupling:

- Push or pull the gasket carefully over the pipe end until the cut edge of the pipe end is visible again.
- Ensure that the gasket does not protrude (even in part) over the end of the pipe.



(shown enlarged for clarity)

- In the case of large couplings e.g. from DN80 up, it may be easier to turn the gasket inside out and then slide it over the pipe end.
- Ensure that the gasket does not protrude over the end of the pipe.

CAUTION

Under no circumstances may the gasket project into the groove area of either of the two pipe ends. The sealing lips of the gasket must not be pinched between the pipes at the cut edges.

Mount the pipe coupling half-shells – Model 1G (Tongue & Groove Style):

- Bolts and nuts should now be removed from one side of the coupling, if not already done, and the bolts and nuts on the other side should be loosened, until the thread of the bolt no longer protrudes over the nut.
- The coupling prepared as indicated can now be opened and swiveled to the side, so that it can be placed over the pipe and the gasket.

Mount the pipe coupling half-shells – Model 1G (Tongue & Groove Style):

- Slide the opened coupling over the pipe and over the gasket.
- Place one of the casing halves (e.g. the lower one) onto the gasket, so that the keys engage in the grooves of the pipe ends.
- Swivel the other half of the casing over the gasket

- Now place the second half of the casing onto the gasket, so that the keys engage in the grooves of the pipe ends.
- Make sure that the keys of the casing halves engage correctly in the grooves of both pipes.
- Ensure that on both sides of the coupling there is an equal gap between the bolt pads of the casing halves.

CAUTION

Make sure that the gasket does not become rolled or pinched.
Failure to observe these guidelines can lead to damage to the gasket and to leakage.

Assemble the bolts and nuts – Model 1G (Tongue & Groove Style):

- Insert the remaining bolt into the bolt holes and tighten the nut by hand.
- Likewise tighten up the other nut by hand again, so that both bolt threads protrude equal lengths out of the nuts.
- Make sure the oval necks of the bolts seat properly in the oval bolt holes.

Tighten the bolts – Model 1G (Tongue & Groove Style):

- Tighten the coupling nuts evenly and by alternating sides, until the bolt pads meet metal to metal.
- To achieve optimum sealing performance and stability,

  the nuts must be tightened with the specified torque corresponding to each of the thread sizes (ⓘ *see Table 3 on page 17*).
- Always use the correct box spanner inserts when assembling each coupling.
- Ensure that the keys of the casing halves are fully engaged in the grooves.

- With the T&G style coupling no metal-to-metal contact of the bolt pads is required. You will normally see a 1.6 mm up to 3.2 mm (1/16" up to 1/8") gap between the bold pads when installed

CAUTION

The nuts must be tightened evenly and by alternating sides, otherwise the gasket can become pinched and damaged, which can lead to immediate or subsequent leaks.

4.2.2 Recommended bolt torque

Table 4: Thread sizes and tightening torques for flex couplings

Nominal Pipe Size DN	Nominal Pipe Size	Pipe Outside Diameter OD	Thread Size metric	Recommended bolt torque	
				Model 900	Model 1G
(mm)	(inch)	(mm)	(mm)	(Nm)	(Nm)
25	1″	33.7	M10	40-60	40-60
32	1¼″	42.4			
40	1½″	48.3			
50	2″	60.3		60-80	
65	2½″	73.0			
65	3 OD	76.1			
80	3″	88.9			
100	4¼ OD	108.0			
100	4″	114.3			
125-150	5¼ OD - 6″	133.0-168.3	M12	120-160	110-135
			M16	220-300	135-175
200	8″	219.1	M20	320-380	175-245
250	10″	273.0	M22	450-600	245-325
300	12″	323.9			

To achieve optimum sealing performance and stability, always aim for the average-value of the recommended torque.

A proficient assembler can generally sense when a bolt reaches a certain torque, which helps to ensure these specified torques having a relatively large tolerance, even in the absence of a torque wrench.

NOTICE

- In case of doubt or if you are inexperienced or if you have no feeling for the torque tightness yet, first complete some experimental assemblies with a torque wrench, where appropriate in direct comparison with a box spanner.
- During assembly of the system regularly check other couplings with the same methods, to ensure that assembly is as uniform as possible.

WARNING

- Using a torque, which exceeds the specified value, does not improve the sealing performance.
- On the contrary, this can cause damage to the coupling which can result in failure or breaking of the pipe connection even long after assembly.
- A secure pipe connection and sealing cannot be guaranteed either if the tightening torque used is too low.

4.3 Reducing couplings

4.3.1 Step-by step installation

Follow the steps given in section 4.2.1 for flexible couplings.

4.3.2 Recommended bolt torque

Follow the steps given in section 4.2.2 for flexible couplings.

4.4 Mechanical tees and sprinkler tees

4.4.1 Bore hole sizes

Table 5: Bore hole sizes for mechanical and sprinkler tees

Nominal Outlet Size	Minimum hole diameter	
	Mechanical Tees	Sprinkler Tees
	Tolerance: +3.2 mm/+0.126 inch	Tolerance: +1.6 mm/+0.063 inch
All 21.3 mm / 1/2-inch Outlets	38 mm / 1.5 inch	30 mm / 1.18 inch
All 26.9 mm / 3/4-inch Outlets	38 mm / 1.5 inch	30 mm / 1.18 inch
All 33.7 mm / 1-inch Outlets	38 mm / 1.5 inch	30 mm / 1.18 inch
All 42.4 mm / 1.1/4-inch Outlets	51 mm / 2 inch (1)	-
All 48.3 mm / 1.1/2-inch Outlets	51 mm / 2 inch (1)	-
All 60.3 mm / 2-inch Outlets	64 mm / 2.5 inch	-
All 73.0 mm / 2.1/2-inch Outlets	70 mm / 2.75 inch	-
All 76.1 mm Outlets	70 mm / 2.75 inch	-
All 88.9 mm / 3-inch Outlets	89 mm / 3.5 inch	-
All 114.3 mm / 4-inch Outlets	114 mm / 4.5 inch	-

(1) Mechanical Tee 60.3 x 48.3 mm and 60.3 x 42.4 mm require a 45 mm / 1.75 inch hole.

NOTICE

Don't drill the hole on weld line.

4.4.2 Step-by step installation

Remove burrs:

- Remove any burrs

Prepare the pipe:

- Clean the gasket sealing surface within 16mm of the hole and visually inspect the sealing surface for defects that may prevent proper sealing of the gasket.
- Check the color code of the gasket and ensure that the gasket is suited to the planned use.
- The standard gaskets provided ex-works with couplings are grade "E" (EPDM) and are marked with a green stripe. In addition, one side of these gaskets bears the mark "EPDM".
- Check that the gasket is clean and undamaged.
- EPDM gaskets must never be brought into contact with lubricants containing mineral oils, oils or other materials containing mineral oils (e.g. fuels or cleaning agents).
- Apply the lubricant to the gasket surfaces with a thin layer of lubricant.

- Insert the gasket into outlet housing making sure the tab in the gasket line up with the tab recesses in the housing.
- Align outlet housing over the pipe hole making sure that the locating collar is in the pipe hole.

Align the tee:

Mechanical tee

- Align the strap around the pipe, insert the bolts and tighten the nuts finger tight.

Sprinkler tee

- Attach the U-bolt from the other side and tighten the nuts finger tight.

Tighten nuts:

- Alternatively and evenly tighten the nuts to the specified bolt torque given below

4.4.3 Recommended bolt torque

There should be even gaps on two sides between upper and lower housings.

Metric Bolts		
Bolt Size	**Specified Bolt Torque**	**Wrench Size**
metric	**Nm**	**mm**
M10	40-60	16
M12	110-135	22
M16	135-175	24
M20	175-245	30

CAUTION

Proper torqueing of bolts / nuts is required to obtain specified performance.

- Over torqueing the bolts / nuts may result in damage to the bolts / nuts and / or casting which could result in pipe joint separation.
- Under torqueing the bolts / nuts 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.

4.5 Hinged flange adaptors

4.5.1 Step by step installation

Check the pipe ends:

- The pipe ends must be burr-free to avoid damage to the gasket during assembly.
- The outer surfaces of the pipes from the pipe end to the groove must be smooth and free from any indentations, roll marks, scores, seams or other harmful surface defects, such as loose paint, scale, dirt, chips, oil, grease and rust.
- Grooves must be free from loose dirt, chips, rust and scale.
- In addition, groove specifications must be observed and complied with, see

ⓘ *Chapter 10 "Roll Groove Specifications for Steel pipe" on page 42*

and

ⓘ *Chapter 11 "Cut Groove Specifications for Steel pipe" on page 45.*

Check the gasket:

- Check the color code of the gasket and ensure that the gasket is suited to the planned use.
- The standard gaskets provided ex-works with couplings are grade "E" (EPDM) and are marked with a green stripe. In addition, one side of these gaskets bears the mark "EPDM" .
- Check that the gasket is clean and undamaged.
- EPDM gaskets must never be brought into contact with lubricants containing mineral oils, oils or other materials containing mineral oils (e.g. fuels or cleaning agents).

Lubricate the gasket and coupling:

- Cover the sealing lips and the outside of the gasket with a thin layer of lubricant.

Install the gasket:

Mechanical tee

- Slip the gasket over the pipe end, with the gasket opening side towards "A". Make sure the gasket sealing lip is flush with the pipe end.

Install the housing:

Sprinkler tee

- Remove bolts and nuts, place two housings over the gasket, making sure the housing keys fit into the pipe grooves. Reinsert the bolts and hand tighten the nuts.

Tighten nuts:

- Securely tighten nuts alternatively and equally to the specified bolt torque by using spanner.
  Specified torque rates (ⓘ *see "Specified Bolt Torque on page 29*)

Connect mating flange:

- Align flange bolt holes with mating flange (or valve) bolt holes. Insert a standard flange bolt through bolt hole and hand tighten a nut. Insert another bolt opposite the first and hand tighten a nut. Continue this until all bolt holes are fitted. Tighten nuts evenly to specified bolt torque, so flange faces remain parallel. Assembly completed.

4.4.3 Recommended bolt torque

Table 7: Recommended bolt toque for hinged flange adaptors

ANSI Bolts			
Bolt Size		Specified Bolt Torque	
inch	metric	Lbs-Ft.	N.m
3/8	M10	30-45	40-60
1/2	M12	80-100	110-135

NOTICE

Torque rates for standard flange bolts / nuts are not specified here

CAUTION

Proper torqueing of bolts / nuts is required to obtain specified performance.

- Over torqueing the bolts / nuts may result in damage to the bolts / nuts and / or casting which could result in pipe joint separation.
- Under torqueing the bolts / nuts 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.

5. Movement

Each flexible 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 coupling due to two factors:

- designed-in clearance between the key of the coupling and the groove diameter and groove width; and
- the gap between pipe ends joined by the coupling.

5.1 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 couplings is shown below:

Table 8: Available linear movement

Size	Movement
DN25 up to DN32 (1″ up to 1 1/4″)	0 up to 4.0 mm
DN40 up to DN300 (1 1/2″ up to 12″)	0 up to 6.4 mm

Table 9: Linear movement

Size		Linear movement	
Inch	mm	Cut Groove (mm)	Roll Groove (mm)
1	33.7	2	1
1 1/4	42.4	2	1
1 1/2	48.3	3.2	1.6
2	60.3	3.2	1.6
2 1/2	73	3.2	1.6
2 1/2	76.1	3.2	1.6
3	88.9	3.2	1.6
4	108	3.2	1.6
4	114.3	3.2	1.6
5	133	3.2	1.6
5	139.7	3.2	1.6
5	141.3	3.2	1.6
6	159	3.2	1.6
6	165.1	3.2	1.6
6	168.3	3.2	1.6
8	219.1	3.2	1.6
10	273	3.2	1.6
12	323.9	3.2	1.6

5.2 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 coupling joints is shown in the performance data for each coupling type:

Table 10: Linear and angular movement

Size		Angular Movement		
		Model 1N		Model 901
		Roll Groove	Cut groove	Roll/Cut groove
Inch	mm	Degrees		
1	33.7	2.75	1.37	-
1 1/4	42.4	2.17	1.08	1.50
1 1/2	48.3	1.90	0.95	1.30
2	60.3	1.52	0.75	2.00
2 1/2	73	1.45	0.72	-
2 1/2	76.1	1.20	0.60	2.50
3	88.9	1.03	0.52	1.10
4	108	1.85	0.92	-
4	114.3	1.6	0.80	1.00
5	133	1.68	0.83	-
5	139.7	1.32	0.62	0.50
5	141.3	1.05	0.50	-
6	159.0	1.03	0.65	-
6	165.1	1.08	0.58	0.50
6	168.3	1.08	0.53	0.50
8	219.1	0.83	0.42	0.50
10	273.0	0.67	0.33	-
12	323.9	0.57	0.30	-

NOTICE

- These values for deflection from centerline are the maximum nominal range of movement available at one joint of standard grooved pipes.
- These values are maximums. For design and installation purposes, these values should be reduced if possible.
- Basically a reduction
  - of 50% for sizes DN32 (1¼") up to DN80 (3")
  - and a reduction of 25% for sizes DN100 (4") up to DN200 (8") is recommended.
- Joints which are fully deflected to the maximum can no longer provide linear movement. Partially deflected joints, however, will provide some portion of linear movement.

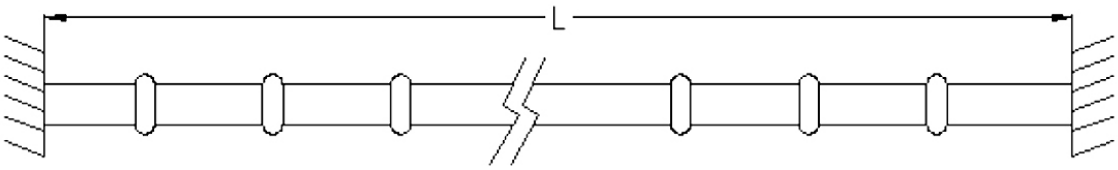
WARNING

- Pressure thrusts will tend to straighten deflected pipe.
- Ensure proper supporting and fixture of the deflected pipeline.
- Failure to do so can lead to damage to the coupling which can result in failure or breaking of the pipe connection and / or lead to breaking of the support

5.3 Movement application

5.3.1 Thermal stress

Thermal stress is caused by changes in temperature, resulting in either expansion or contraction. When designing a system you must allow for this thermal movement. To determine the appropriate number of flexible couplings to allow for this thermal movement please refer to the following:



Example

- 4" straight steel pipe, 30 m long.
- Anchored on both ends.
- Minimum temperature (during installation) = 5 °C
- Maximum working temperature = 55 °C

We want to know the number of couplings that are required to address this thermal movement problem.

From the thermal expansion values given in *table 11 below*, we know the overall pipeline length will increase by 18 mm (0.71").

Thermal Expansion Formula 1

$\alpha = \lambda \times L \times T$

λ : Thermal Expansion

α : Linear Expansion coefficient for steel

L : Pipe Length

T : Temperature Difference

You can also use *Formula 1* or *Table 11* below to find the amount of thermal expansion.

The allowed movement of a 4" flexible coupling is:

Movement range x Adjustment = Allowed movement

4.3mm x 75% = 3.2mm

The appropriate number of couplings is:

Thermal expansion / Allowed movement = Number of couplings
18 mm / 3.2 mm = 5.6

Conclusion:

The appropriate number of couplings is 6.

Thermal expansion

Table 11:Thermal expansion

Temp. difference (°C)	Pipe length (m)					
	1	5	10	20	30	40
	Thermal expansion (mm)					
1	0.012	0.06	0.12	0.24	0.36	0.48
5	0.06	0.3	0.6	1.2	1.8	2.4
10	0.12	0.6	1.2	2.4	3.6	4.8
20	0.24	1.2	2.4	4.8	7.2	9.6
30	0.36	1.8	3.6	7.2	11	15
40	0.48	2.4	4.8	9.6	14	20
50	0.6	3	6	12	18	24
60	0.72	3.6	7.2	14	22	29
70	0.84	4.2	8.4	17	25	34
80	0.96	4.8	9.6	19	29	39

6. Riser design

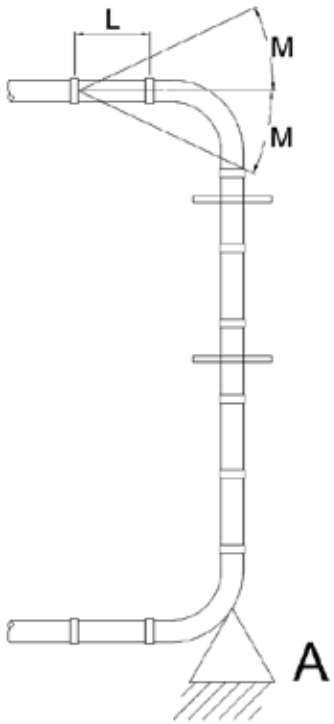
Risers assembled with Flexible couplings are generally installed in either of two ways. In the most common method, the pipe ends are butted together within the coupling joint. Note that when installing risers, the gasket is first placed onto the lower pipe and rolled back away from the pipe end prior to positioning the upper pipe. Anchoring of the riser may be done prior to pressurization with the pipe ends butted or while pressurized, when, due to pressure thrust, the pipe ends will be fully separated.

An alternative method or riser installation is to place a metal spacer of a predetermined thickness between the pipe ends when an additional length of pipe is added to the riser stack. The upper pipe length is anchored, the spacer removed and the coupling is then installed. This method creates a predetermined gap at each pipe joint which can be utilized in pipe systems where thermal movement is anticipated and in systems with rigid (threaded, welded, flanged) branch connections where shear forces due to pressure thrust could damage the rigid connections.

The following examples illustrate methods of installing commonly encountered riser designs.

6.1 Risers without branch connections

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 couplings is shown below:

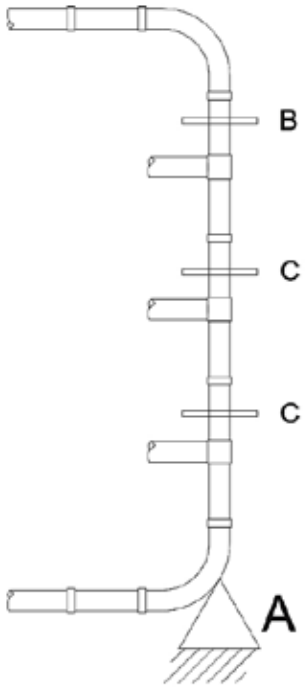


Install the riser with the pipe ends butted.

Locate an anchor at the base of the riser (A) to support the total weight of the pipe, couplings and fluid. Provide pipe guides on every other pipe length, as a minimum, to prevent possible deflection of the pipe line at the coupling joints as the riser expands due to pressure thrust or thermal growth. Note that no intermediate anchors are required.

When the system is pressurized the pipe stack will "grow" due to pressure thrust which causes maximum separation of pipe ends within the couplings. The maximum amount of stack growth can be predetermined (ⓘ *see Chapter 5.1 "Linear movement" on page 30*). In this example the pipe length "L" at the top of the riser must be long enough to permit sufficient deflection (ⓘ *see Chapter 5.2 "Angular movement" on page 31*) to accommodate the total movement "M" from both pressure thrust and thermal gradients.

6.2 Risers with branch connections



Install the riser with the predetermined gap method. Anchor the pipe at or near the base with a pressure thrust anchor "A" capable of sup- porting the full pressure thrust, weight of pipe and the fluid column. Anchor at "B" with an anchor capable of withstanding full pressure thrust at the top of the riser plus weight of pipe column. Place inter- mediate anchors "C" as shown, between anchors "A" and "B". Also place intermediate clamps at every other pipe length as a minimum.

When this system is pressurized, the pipe movement due to pressure thrust will be strained and there will be no shear forces acting at the branch connections.

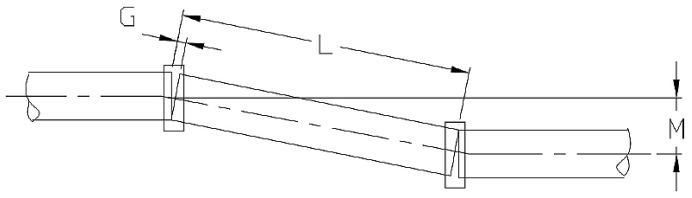
6.2 Misalignment & deflections

The angular movement capability of the flexible coupling permits the assembly of pipe joints where the piping is not properly aligned. At least two couplings are required to provide for lateral pipe misalignment. Deflection (longitudinal misalignment) may be accommodated within a single coupling as long as the angle of deflection does not exceed the value shown in the coupling performance data for the particular size and coupling type.

A pipe joint that utilizes the angular deflection capability of the coupling will react to pressure and thermal forces dependent upon the manner in which it is restrained. An unrestrained joint will react to these forces by straightening, thus reducing, if not eliminating, the deflection at the joint. If joint deflection has been designed into the pipe layout and must be maintained, then sufficient anchors must be provided to resist the lateral forces and hold the joint in the deflected condition.

The amount of deflection from pipe run centerline can be calculated utilizing the following equations:

$M = L \sin\theta$
$\theta = \sin^{-1}(G \div D)$
$M = (G \div D) \times L$



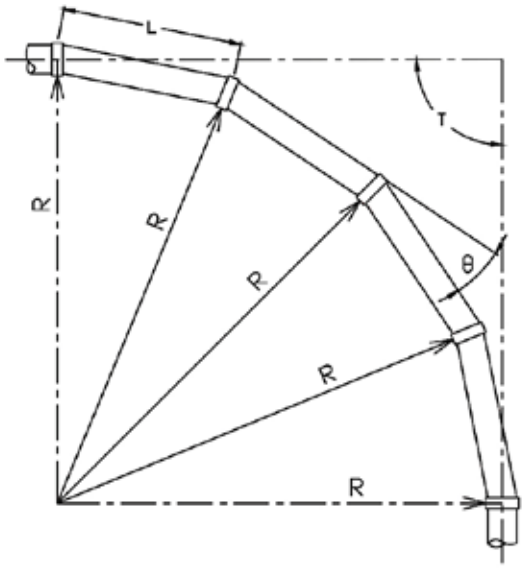
Legend:

M = Misalignment (inches)

G = Maximum Allowable Pipe End Movement (Inches) as shown under "Performance Data" (Value to be reduced by Design Factor)

θ = Maximum Deflection (Degrees) from centerline as shown under "Performance Data" (Value to be reduced by Design Factor)
D = Pipe Outside Diameter (Inches) L = Pipe Length (Inches)

6.1 Curved layout



Utilizing the angular deflection at each coupling joint curves may be laid out using straight pipe lengths and Couplings.

This example shows how to calculate the curve radius, required pipe lengths, and number of required couplings.

$R = L / (2 \times \sin(\theta/2))$
$L = 2 \times R \times \sin(\theta/2)$
$N = T / \theta$

Legend:

N = Number of Couplings R = Radius of Curve (feet) L = Pipe Length (feet)
θ= Deflection from centerline (Degrees) of each Coupling (See coupling performance data, value to be reduced by Design Factor)

T = Total Angular Deflection of all Couplings.

7. Movement capability of couplings expansion & contraction joints

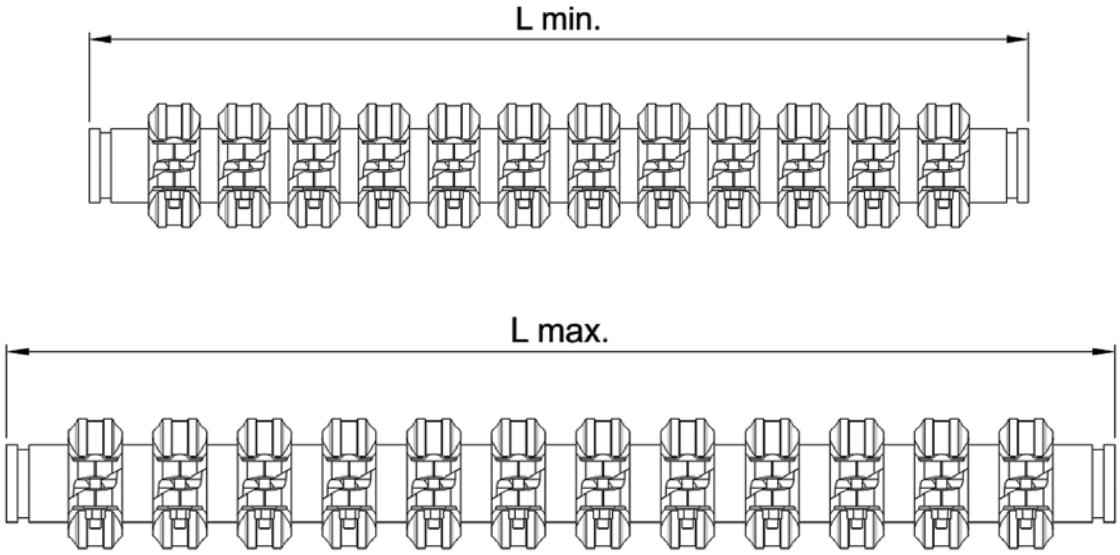


Table 12: Movement capability of couplings-expansion and contraction joints

Nominal size	Pipe O.D. (mm)	Maximum allowable movement (mm)	L min. (mm)	L max. (mm)	Number of couplings	Operating pressure (bar)
1″	33.7	45	617	662	10	21
1 1/4″	42.4					
1 1/2″	48.3					
2″	60.3					
2 1/2″	73.0					
76.1	76.1					
3″	88.9					
4″	114.3	47	503	550	7	
139.7	139.7					
5″	141.3					
165.1	165.1	52				
6″	168.3		591	643		
8″	219.1					
10″	273.0					
12″	323.9					

8. Anchoring & supports

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 additional to many universal pipe hanger and support design factors. As with any pipe system, the hanger or support system must provide for

- the weight of the pipe, couplings, fluid and pipe system components;
- reduce stresses at pipe joints; and
- permit required pipe system movement to relieve stress.

The following chart shows the maximum span between pipe hangers, supports and anchors.

Table 13: Anchoring span distances

Nominal size (mm)		15	20	25	32	40	50	70	80	100	125	150	200	250	300
Max. span between supports (mm)	Insulating pipe	2	2.5	2.5	2.5	3	3	4	4	4.5	6	7	7	8	8.5
	Non-insulating pipe	2.5	3	3.5	4	4.5	5	6	6	6.5	7	8	9.5	11	12

9. Checking the installation

It is imperative that the pipes are prepared correctly and the couplings assembled correctly to ensure optimum performance of the connection.

Use of pipes / fittings that are undersized or oversized is not admissible, as well as shallow grooves or eccentric grooves or gaps between bolt pads.

To ensure correct installation all connections must be checked.

Any defects must be removed before starting-up the system and applying pressure.

WARNING

Failure to observe these guidelines can lead to the connection becoming loose and to injury and serious damage to property.

Generally the piping system is subjected to a pressure test after assembly, to check the leak-tightness of the connections and the pipe system. The national and international laws, guide- lines, standards and relevant technical regulations applicable in each country of use must be observed and fulfilled

NOTICE

- Check connections before and after the pressure test to determine any possible weak points.
- Check if there are gaps between the bolt pads and / or check if the keys slide up to the shoulders.
- Should any problems arise here, the system must be depressurized immediately and all connections that are not sound must be renewed.

A SUCCESSFUL PRESSURE TEST BEFORE STARTING-UP THE SYSTEM DOES NOT AUTOMATICALLY VALIDATE THAT ALL CONNECTIONS HAVE BEEN ASSEMBLED CORRECTLY AND DOES NOT GUARANTEE LONG-TERM, SECURE STABILITY AND LEAK- TIGHTNESS.

Viking does not accept any liability for leakages or for loose pipe connections that are attributable to non-observance of these installation instructions.

As in the case of all pipe connection methods a successful assembly depends on all details being fully observed. For optimum operating safety of the system all the guidelines in these installation instructions must be carefully observed.

9.1 Incorrect installation

9.1.1 Installations with pipes / fittings that are undersized

- Where the outer diameter of the pipe or fitting is below the admissible tolerance, the casing keys engage considerably less. This leads to reduced pressure resistance and bending strength of the connection.
- In addition, the gasket is pressed together / pre-stressed only slightly or not at all. The greater distance between the pipe and the casing can also lead to the gasket to be pushed out of the coupling.

WARNING

These factors can lead to reduced life of the gasket, to leakages and to a loose connection, which can in turn lead to injury and serious property damage.

9.1.2 Installations with pipes / fittings that are oversized

- Where the outer diameter of the pipe or the fitting exceeds the admissible tolerance, the casing keys can be so strongly engaged that the casing shoulders rest on the pipe.
- This can result in the angle-design bolt pads not meeting metal to metal, so that the gasket can be pushed through, whereby pressure resistance and bending strength of the connection and the life of the gasket can be reduced. This can result in leakages and damage.

9.1.3 Installation on pipes with shallow grooves

- In a groove that is not deep enough, the casing keys engage considerably less. This leads to reduced pressure resistance and bending strength of the connection.
- In addition, the gasket is pressed together / pre-stressed only slightly or not at all. The greater distance between the pipe and the casing can also lead to the gasket to be pushed out of the coupling.
- This can result in the angle-design bolt pads not meeting metal to metal, so that the gasket can also be pushed through here.

WARNING

These factors can lead to reduced life of the gasket, to leakages and to a loose connection, which can in turn lead to injury and serious property damage.

9.1.4 Installations on pipes with grooves that are too deep

- In a groove that is not deep enough, the casing keys engage considerably less. This leads to reduced pressure resistance and bending strength of the connection.
- In addition, the gasket is pressed together / pre-stressed only slightly or not at all. The greater distance between the pipe and the casing can also lead to the gasket to be pushed out of the coupling.
- This can result in the angle-design bolt pads not meeting metal to metal, so that the gasket can also be pushed through here.

WARNING

- These factors can lead to reduced life of the gasket, to leakages and to a loose connection, which can in turn lead to injury and serious property damage.
- Additionally, roll grooving pipe to an undersized dimension may overstress and weaken the pipe wall. Cut grooving pipe to an undersized dimension will result in insufficient wall thick- ness under the groove.

9.1.5 Installations on pipes with eccentric grooves

- Eccentric grooves generally occur where an out-of-round pipe is grooved with a stationary tool (like a lathe for example). It can also occur when roll grooving pipes with large wall thick- ness variations. An eccentric groove means that the groove is too shallow on one side and too deep on the other

WARNING

An eccentric groove can lead to a combination of problems, which are described in the sections on “Installations with pipes / fittings that are undersized” and “Installations on pipes with shallow grooves

If bolt pads do not meet metal to metal

- Ensure that the keys of the casing are fully engaged in the grooves. The coupling keys must not rest on the outside surface of the pipe.
- Make sure that the nuts are tightened correctly and to the specified torque rate.
- Make sure that the gasket is not pinched. If the gasket is pinched, change immediately.
- Make sure that the pipe and / or fitting are not oversized.
- Make sure that the groove meets the groove specifications (ⓘ *see Chapter 10 "Roll Groove Specifications for Steel pipe" on page 42 and Chapter 11 "Cut Groove Specifications for Steel pipe" on page 45*).
- If the groove is too shallow, under certain circumstances, the pipe may be grooved again in accordance with groove specifications.
- If the groove is too deep, do not reuse this pipe section but roll groove a new pipe section in accordance with groove specifications.

10. Roll groove specifications for steel pipe

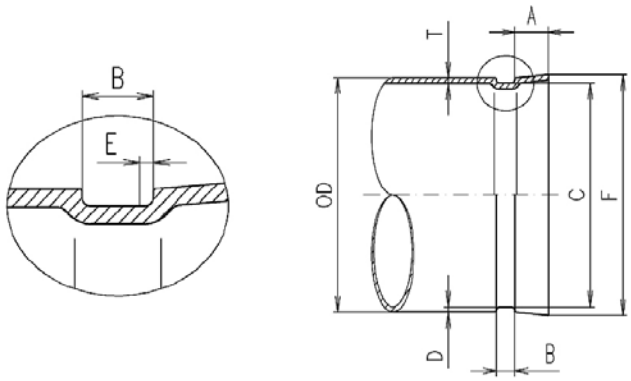


Table 14: Roll Groove Specifications for Steel pipe

Nominal Pipe Size	Pipe OD			Gasket Seat - A	Groove Width - B	Groove Dia. - C		Groove Depth - D		Max Flare - F		Min. Wall Thickness -T	
	Size	Tolerance		±0.76mm/ ±0.03inch	±0.76mm/ ±0.03inch	Size	Tolerance	Note 1	Note 2	Note 1	Note 2	Note 1	Note 2
		Max	Min										
mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
inch	inch	inch	inch	inch	inch	inch	inch	inch	inch	inch	inch	inch	inch
20	26.9	+0.25	-0.250	15.88	7.14	23.83	-0.38	-	1.53	-	29.2	-	1.65
3/4	1.05	+0.01	-0.010	0.625	0.281	0.94	-0.02	-	0.06	-	1.15	-	0.07
25	33.7	+0.41	-0.680	15.88	7.14	30.23	-0.38	1.60	1.73	34.5	36.3	1.8	1.65
1	1.327	+0.02	-0.026	0.625	0.281	1.19	-0.02	0.06	0.07	1.36	1.43	0.07	0.07
32	42.4	+0.50	-0.600	15.88	7.14	38.99	-0.38	1.60	1.70	43.3	45.0	1.8	1.65
1¼	1.669	+0.02	-0.023	0.625	0.281	1.54	-0.02	0.06	0.07	1.71	1.77	0.07	0.07
40	48.3	+0.44	-0.520	15.88	7.14	45.09	-0.38	1.60	1.60	49.4	51.1	1.8	1.65
1½	1.9	+0.02	-0.020	0.625	0.281	1.78	-0.02	0.06	0.06	1.95	2.01	0.07	0.07
50	60.3	+0.61	-0.610	15.88	8.74	57.15	-0.38	1.60	1.57	62.2	63.0	1.8	1.65
2	2.375	+0.02	-0.024	0.625	0.344	2.25	-0.02	0.06	0.06	2.45	2.48	0.07	0.07
65	73.0	+0.74	-0.740	15.88	8.74	69.09	-0.46	1.98	1.95	75.2	75.7	2.3	2.11
2½	2.875	+0.03	-0.029	0.625	0.344	2.72	-0.02	0.08	0.08	2.96	2.98	0.09	0.08
65	76.1	+0.76	-0.760	15.88	8.74	72.26	-0.46	1.99	1.92	77.7	78.7	2.3	2.11
2½	3	+0.03	-0.030	0.625	0.344	2.85	-0.02	0.08	0.08	3.06	3.10	0.09	0.08
80	88.9	+0.89	-0.790	15.88	8.74	84.94	-0.46	1.98	1.98	90.6	91.4	2.3	2.11
3	3.5	+0.04	-0.031	0.625	0.344	3.34	-0.02	0.08	0.08	3.57	3.60	0.09	0.08
100	108	+1.07	-0.790	15.88	8.74	103.73	-0.51	2.11	2.13	109.7	110.5	2.3	2.11
4	4.25	+0.04	-0.031	0.625	0.344	4.08	-0.02	0.08	0.08	4.32	4.35	0.09	0.08
100	114.3	+1.14	-0.790	15.88	8.74	110.08	-0.51	2.11	2.11	116.2	116.8	2.3	2.11
4	4.5	+0.05	-0.031	0.625	0.344	4.33	-0.02	0.08	0.08	4.58	4.60	0.09	0.08
125	133	+1.32	-0.790	15.88	8.74	129.13	-0.51	2.11	1.93	134.9	135.9	2.9	2.77
5	5.25	+0.05	-0.031	0.625	0.344	5.08	-0.02	0.08	0.08	5.31	5.35	0.11	0.11
125	139.7	+1.40	-0.790	15.88	8.74	135.48	-0.51	2.11	2.11	141.7	142.2	2.9	2.77
5	5.5	+0.06	-0.031	0.625	0.344	5.33	-0.02	0.08	0.08	5.58	5.60	0.11	0.11
125	141.3	+1.42	-0.790	15.88	8.74	137.03	-0.56	2.13	2.13	143.5	143.8	2.9	2.77
5	5.563	+0.06	-0.031	0.625	0.344	5.40	-0.02	0.08	0.08	5.65	5.66	0.11	0.11
150	159	+1.60	-0.790	15.88	8.74	154.5	-0.56	2.16	2.25	161.0	161.3	2.9	2.77
6	6.25	+0.06	-0.031	0.625	0.344	6.08	-0.02	0.09	0.09	6.34	6.35	0.11	0.11
150	165.1	+1.60	-0.790	15.88	8.74	160.8	-0.56	2.16	2.16	167.1	167.6	2.9	2.77
6	6.5	+0.06	-0.031	0.625	0.344	6.33	-0.02	0.09	0.09	6.58	6.60	0.11	0.11
150	168.3	+1.60	-0.790	15.88	8.74	163.96	-0.56	2.16	2.17	170.7	170.9	2.9	2.77
6	6.625	+0.06	-0.031	0.625	0.344	6.46	-0.02	0.09	0.09	6.72	6.73	0.11	0.11
200	219.1	+1.60	-0.790	19.05	11.91	214.4	-0.64	2.34	2.35	221.5	223.5	2.9	2.77
8	8.625	+0.06	-0.031	0.75	0.469	8.44	-0.03	0.09	0.09	8.72	8.80	0.11	0.11
250	273	+1.60	-0.790	19.05	11.91	268.28	-0.69	2.39	2.36	275.4	277.4	3.6	3.4
10	10.75	+0.06	-0.031	0.75	0.469	10.56	-0.03	0.09	0.09	10.84	10.92	0.14	0.13
300	323.9	+1.60	-0.790	19.05	11.91	318.29	-0.76	2.77	2.80	326.2	328.2	4	3.96
12	12.75	+0.06	-0.031	0.75	0.469	12.53	-0.03	0.11	0.11	12.84	12.92	0.16	0.16

Note 1: For models 1G, 1N, Reducing Couplings and Hinged Flange Adaptors

Note 2: For models 900 and 901

Notes for table 14

Column 1 – Nominal Pipe Size:

- Nominal pipe size.

Column 2 – Pipe Outside Diameter OD and Tolerance and Pipe Outside Circumference respectively:

- Weld seams must be ground flush with the pipe outside diameter OD and inner diameter ID prior to roll grooving. Failure to do so may result in unacceptable roll grooves and may cause damage to the roll grooving machine.
- Difference between maximum OD and minimum OD measured at 0° and at 90° on the circumference (roundness) must not exceed total OD tolerance listed.
- Maximum allowable tolerance from square cut ends is:
  - 0.76 mm (0.03") for sizes up to DN90 / 101.6 mm (3½"),
  - 1.14 mm (0.045") for DN100 / 108.0 mm (4¼ OD) through DN150 / 488.3 mm (6")
  - and 1.52 mm (0.06") for DN200 / 219.1 mm (8") and above, measured from a true square line.

  Roll grooving of beveled end pipe is not recommended as it may cause unacceptable reduction of the gasket seat A and unacceptable pipe end flare. Beveled end pipe is acceptable only if pipe ends are in conformance with EN 10217-2. Pipe outside circumference is for alternative measurement with a measuring tape (observe general notes below).

Column 3 – Gasket Seat A:

- The gasket seat must be free from any indentations, roll marks, scores, seams or other harmful surface defects such as loose paint, scale, dirt, chips, grease and rust, that may interfere with proper sealing of the gasket.
- The gasket seat A is to be measured from the pipe end to the endmost vertical flank of the groove side wall.

Column 4 – Groove Width B:

- The groove width B is to be measured between vertical flanks of the groove side walls. The bottom of groove must be free of loose dirt, chips, rust and scale that may interfere with proper coupling assembly.

Column 5 – Groove Bottom Diameter C and Groove Bottom Circumference respectively:

- The basic value of groove bottom diameter is the maximum allowable value. The groove must be maintained within the tolerance listed and must be uniform depth around the entire pipe circumference. The Groove bottom circumference is for alternative measurement with a measuring tape (ⓘ *observe general notes below*).

Column 6 – Groove Depth D:

- The groove depth is for reference only. The groove bottom diameter C, alternatively the groove bottom circumference must be maintained (ⓘ *see column 5*).

Column 7 – Groove Corner E:

- The dimension E starts at the reduction of pipe outside diameter and ends at the bottom of the groove (ⓘ *see illustration on page 42*).

Column 8 – Minimum Wall Thickness T:

- This is the minimum wall thickness which may be roll grooved.

Column 9 – Maximum Allowable Flare Diameter F and Flare Circumference respectively:

- The pipe end that may flare when the groove is rolled must be within this limit when measured at the extreme end of the pipe. The Flare circumference is for alternative measurement with a measuring tape (ⓘ *observe general notes below*).

General:

- If any mentioned circumference is measured with a pipe tape with linear scale, the deviation between measured circumference and actual circumference caused by the thickness of the measuring tape must be considered: Actual Circumference = Reading – 2 x p x Thickness of Tape.
- The coating thickness applied to the gasket seating surface and within the groove on the pipe exterior must not exceed 0.25 mm (0.010"). Coatings applied to the interior surfaces, including bolt pad mating surfaces, of our grooved couplings and grooved fittings must not exceed 0.25 mm (0.010").

10.1 Instructions to verify a proper roll groove

Step 1: (Before roll grooving):

- Check the pipe outside diameter OD using a diameter tape, a circumference tape or a Vernier caliper measuring at 0° and at 90° on the circumference. Check the wall thickness T using a Vernier caliper measuring at 0° and at 90° on the circumference. Pipe outside diameter and wall thickness must be within the tolerances specified in column 2 and column 8 of table 5.

Step 2:

- Roll groove the pipe end with suitable tool. Follow machine instructions and ensure safety precautions

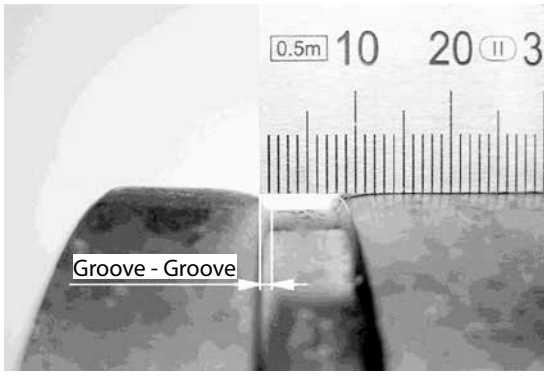
Step 3:

- Measure the groove bottom using a diameter tape, a circumference tape or a Vernier caliper measuring at
- 0° and at 90° on the circumference to ensure that the groove bottom diameter C or the groove bottom circumference is within the tolerances specified in column 5 of table 5.

Step 4:

- Measure the gasket seat length A and the groove width B using a ruler, a scale or a tape with linear scale to ensure the dimensions are within the tolerances specified in column 3 and column 4 of table 5.

Step 5:



- Check the groove corner E using a ruler, a scale or a tape with linear scale placed against the leading edge of the groove closest to the gasket seat A dimension.
- The groove corner E must not exceed the dimension given in column 7 of table 5.

11. Cut groove specifications for steel pipe

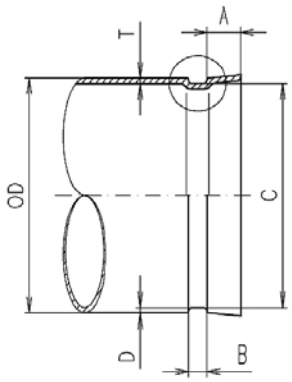


Table 15: Cut Groove Specifications for Steel pipe

Nominal Pipe Size	Pipe OD			Gasket Seat - A	Groove Width - B	Groove Dia. - C		Groove Depth - D	Cut Groove
	Size	Tolerance		±0.76mm/ ±0.03inch	±0.76mm/ ±0.03inch	Size	Tolerance		
		Max	Min						
mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
inch	inch	inch	inch	inch	inch	inch	inch	inch	inch
20	26.9	+0.25	-0.250	15.88	7.95	23.83	-0.38	1.53	2.87
3/4	1.05	+0.33	-0.01	0.625	0.31	0.94	-0.02	1.73	0.11
25	33.7	+0.41	-0.33	15.88	7.95	30.23	-0.38	1.73	3.38
1	1.327	+0.02	-0.01	0.625	0.31	1.19	-0.02	0.07	0.13
32	42.4	+0.48	-0.41	15.88	7.95	38.99	-0.38	1.70	3.56
1¼	1.669	+0.02	-0.02	0.625	0.31	1.54	-0.02	0.07	0.14
40	48.3	+0.61	-0.48	15.88	7.95	45.09	-0.38	1.60	3.68
1½	1.9	+0.02	-0.02	0.625	0.31	1.78	-0.02	0.06	0.14
50	60.3	+0.61	-0.61	15.88	7.95	57.15	-0.38	1.57	3.91
2	2.375	+0.02	-0.02	0.625	0.31	2.25	-0.02	0.06	0.15
65	73.0	+0.74	-0.74	15.88	7.95	69.09	-0.46	1.95	4.78
2½	2.875	+0.03	-0.03	0.625	0.31	2.72	-0.02	0.08	0.19
65	76.1	+0.76	-0.76	15.88	7.95	72.26	-0.46	1.92	4.78
2½	3	+0.03	-0.03	0.625	0.31	2.85	-0.02	0.08	0.19
80	88.9	+0.89	-0.79	15.88	7.95	84.94	-0.46	1.98	4.78
3	3.5	+0.04	-0.03	0.625	0.31	3.34	-0.02	0.08	0.19
100	108	+1.09	-0.79	15.88	9.53	103.73	-0.51	2.13	5.16
4	4.25	+0.04	-0.03	0.625	0.38	4.08	-0.02	0.08	0.20
100	114.3	+1.14	-0.79	15.88	9.53	110.08	-0.51	2.11	5.16
4	4.5	+0.04	-0.03	0.625	0.38	4.33	-0.02	0.08	0.20
125	133	+1.35	-0.79	15.88	9.53	129.13	-0.51	1.93	5.16
5	5.25	+0.05	-0.03	0.625	0.38	5.08	-0.02	0.08	0.20
125	139.7	+1.42	-0.79	15.88	9.53	135.48	-0.51	2.11	5.16
5	5.5	+0.06	-0.03	0.625	0.38	5.33	-0.02	0.08	0.20
125	141.3	+1.42	-0.79	15.88	9.53	137.03	-0.56	2.13	5.16
5	5.563	+0.06	-0.03	0.625	0.38	5.40	-0.02	0.08	0.20
150	159	+1.6	-0.79	15.88	9.53	154.5	-0.56	2.25	5.56
6	6.25	+0.06	-0.03	0.625	0.38	6.08	-0.02	0.09	0.22
150	165.1	+1.6	-0.79	15.88	9.53	160.8	-0.56	2.16	5.56
6	6.5	+0.06	-0.03	0.625	0.38	6.33	-0.02	0.09	0.22
150	168.3	+1.6	-0.79	15.88	9.53	163.96	-0.56	2.17	5.56
6	6.625	+0.06	-0.03	0.625	0.38	6.46	-0.02	0.09	0.22
200	219.1	+1.6	-0.79	19.05	11.13	214.4	-0.64	2.35	6.05
8	8.625	+0.06	-0.03	0.75	0.44	8.44	-0.03	0.09	0.24
250	273	+1.6	-0.79	19.05	12.70	268.28	-0.69	2.36	6.35
10	10.75	+0.06	-0.03	0.75	0.50	10.56	-0.03	0.09	0.25
300	323.9	+1.6	-0.79	19.05	12.70	318.29	-0.76	2.80	7.09
12	12.75	+0.06	-0.03	0.75	0.50	12.53	-0.03	0.11	0.28

Notes for table 15

Column 1 – Nominal Pipe Size:

- Nominal pipe size

Column 2 – Pipe Outside Diameter OD and Tolerance and Pipe Outside Circumference respectively:

- Difference between maximum OD and minimum OD measured at 0° and at 90° on the circumference (roundness) must not exceed total OD tolerance listed.
- Maximum allowable tolerance from square cut ends is:
  - 0.76 mm (0.03″) for sizes up to DN90 / 101.6 mm (3½″),
  - 1.14 mm (0.045″) for DN100 / 108.0 mm (4¼ OD) through DN150 / 488.3 mm (6″),
  - and 1.52 mm (0.06″) for DN200 / 219.1 mm (8″) and above, measured from a true square line.

  Cut grooving of beveled end pipe is not recommended as it may cause unacceptable reduction of the gasket seat A. Beveled end pipe is acceptable only if pipe ends are in conformance with EN 10217-2. Pipe outside circumference is for alternative measurement with a measuring tape (ⓘ *observe general notes below*).

Column 3 – Gasket Seat A:

- The gasket seat must be free from any indentations, roll marks, scores, seams or other harmful surface defects such as loose paint, scale, dirt, chips, grease and rust, that may interfere with proper sealing of the gasket.
- The gasket seat A is to be measured from the pipe end to the endmost vertical flank of the groove side wall.

Column 4 – Groove Width B:

- The groove width B is to be measured between vertical flanks of the groove side walls. The bottom of groove must be free of loose dirt, chips, rust and scale that may interfere with proper coupling assembly.

Column 5 – Groove Bottom Diameter C and Groove Bottom Circumference respectively:

- The basic value is the maximum allowable value. The groove must be maintained within the tolerance listed and must be uniform depth around the entire pipe circumference.
- The radii of the corners at bottom of groove shall be maximum 0.8 mm (0.032″) each. The Groove bottom circumference is for alternative measurement with a measuring tape (ⓘ *observe general notes below*).

Column 6 – Groove Depth D:

- The groove depth is for reference only. The groove bottom diameter C, alternatively the groove bottom circumference must be maintained (ⓘ *see column 5 of table 6*).

Column 7 – Minimum Wall Thickness T:

- This is the minimum wall thickness which may be cut grooved.

General:

- If any mentioned circumference is measured with a pipe tape with linear scale, the deviation between measured circumference and actual circumference caused by the thickness of the measuring tape must be considered: Actual Circumference = Reading – 2 x p x Thickness of Tape.
- The coating thickness applied to the gasket seating surface and within the groove on the pipe exterior must not exceed 0.25 mm (0.010″).
- Coatings applied to the interior surfaces, including bolt pad mating surfaces, of our grooved couplings and grooved fittings must not exceed 0.25 mm (0.010″).

11.1 Instructions to verify a proper cut groove

Step 1: (Before cut grooving):

- Check the pipe outside diameter OD using a diameter tape, a circumference tape or a Vernier caliper measuring at 0° and at 90° on the circumference. Check the wall thickness T using a Vernier caliper measuring at 0° and at 90° on the circumference. Pipe outside diameter and wall thickness must be within the tolerances specified in column 2 and column 7 of table 6.

Step 2:

- Cut groove the pipe end with suitable tool. Follow machine instructions and ensure safety precautions

Step 3:

- Measure the groove bottom using a diameter tape, a circumference tape or a Vernier caliper measuring at
- 0° and at 90° on the circumference to ensure that the groove bottom diameter C or the groove bottom circumference is within the tolerances specified in column 5 of table 6.

Step 4:

- Measure the gasket seat length A and the groove width B using a ruler, a scale or a tape with linear scale to ensure the dimensions are within the tolerances specified in column 3 and column 4 of table 6.

Europe, Middle East & Africa

BENELUX
Hinmanweg 11d
NL-7575 BE Oldenzaal
The Netherlands
Tel.: +31 (0)541 573233
Fax: +31 (0)541 573234
vikingnetherlands@vikingcorp.com

CENTRAL & EASTERN EUROPE
Industriestr. 10/12
D-23843 Bad Oldesloe
Germany
Tel.: +49 (0)4531 803 8087
Fax: +49 (0)4531 803 137
contact@viking-emea.com

FRANCE
Centre d'Affaires CESCOM
4, rue Marconi
BP 25180
F-57075 Metz Cedex 03
France
Tel.: +33 (0)800 10 29 23
Fax: +33 (0)800 88 70 46
vikingfrance@vikingcorp.com

IBÉRICA
Calle Picos de Europa 4A
San Fernando de Henares
E-28830 Madrid
Spain
Tel.: +34 91 677 8352
Fax: +34 91 677 8498
vikingspain@vikingcorp.com

ITALY
Via Pogliano, 26/a
I-20020 Lainate (MI)
Italy
Tel.: +39 02 932 851 1
Fax: +39 02 932 851 30
vikingitaly@vikingcorp.com

MIDDLE EAST
LOB 19 Office #2506
Post Box No. 17531
Jebel Ali Free Zone, Dubai
United Arab Emirates
Tel.: +971 (0)4 8895 561
Fax: +971 (0)4 8895 562
vikingdubai@vikingcorp.com

NORDIC
Staffans Väg 5
S-192 78 Sollentuna
Sweden
Tel.: +46 (0)8 594 415 90
Fax: +46 (0)8 591 280 18
vikingsweden@vikingcorp.com

POLAND
ul. Płaskowickiej Filipiny 46/33
PL-02 778 Warsaw
Poland
Tel.: +48 22 403 57 90
Fax: +48 22 403 57 69
vikingpoland@vikingcorp.com

ROMANIA & BULGARIA
17-19 Horia, Closca si Crisan St.
RO-075100 Otopeni - Ilfov
Romania
Tel.: +40 21 311 51 48
Fax: +40 21 311 51 41
maucha@viking-emea.com

TURKEY
İnönü Cad. Sümer Sok.
Zitaş İş Merkezi D2 Blok K:5, D:12
34742 Kozyatağı, Kadıköy, İstanbul
Turkey
T: +90 (0)216 403 18 00
F: +90 (0)216 403 18 03
vikingturkey@vikingcorp.com

UK & IRELAND
Unit 2 - Byram House, Newborn Court
Chapel Street
Epworth DN9 1HQ
United Kingdom
Tel.: +44 (0)1427 871 000
Fax: +44 (0)1427 873 917
vikinguk@vikingcorp.com

II1.2.1/1012-0515/en

For further information, please visit
www.viking-emea.com

For further information, please contact your local Viking sales office or refer to the technical documentation.
The contents of this publication are subject to modifications without notice.

Photo
Cover: MX-T

Trusted above all.

Viking S.A. | Z.I. Haneboesch, L-4562 Differdange / Niederkorn, Luxembourg | Tel.: +352 58 37 37 - 1, Fax: +352 58 37 36, vikinglux@vikingcorp.com