

Assembly instructions for Taper (Taper/Taper) adhesive-bonded joints

1. Introduction

This document describes the method to assemble taper adhesive-bonded joints. To ensure that the performance of the installed joint complies with the requirements used for the design, it is essential that all personnel involved in the bonding procedure is familiar with and fully understands the techniques described in this document.

The instructions in this document are as complete as possible. However, it is not possible to describe all circumstances that might be encountered in the field. Therefore, our experienced supervisors may deviate from the described method in order to achieve an optimum solution using the latest bonding techniques and processing methods.

Besides, our supervisors may be consulted for clarification of statements made in this document and for advice about specific problems encountered in the field.

Annex A shows schemes of the complete assembly process; Annex A1 shows the spigot dimensioning process and Annex A2 shows the adhesive bonding process.

“The word shall indicates a requirement. The word should indicates a recommendation”.

2. References

These instructions are completed with the following referenced documents:

Documentation	Reference number
Operating instructions M86 XL Pipe Shaver	TLS2003
Operating instructions M87 Pipe Shaver	TLS2004
Operating instructions M87 XL Pipe Shaver	TLS2005
Operating instructions M88 Pipe Shaver	TLS2006
Operating instructions M95 Pipe Shaver	TLS2007
Operational safety instructions	---
Operating instructions for Bondstrand Heating Blankets	TLS2009
RP48 epoxy adhesive for bonding GRE pipe & fittings	ADH4740
RP60 B epoxy adhesive for bonding GRE pipe & fittings	ADH4730

3. Quality

It is advised that the bonder possesses a valid Joints/Bonder Qualification Certificate, issued by the pipe manufacturer or a Qualified Certifier.

After preparation of bell- and spigot end, the actual bonding and finishing of the adhesive joint shall be performed continuously and without any interruption or delay.

4. Inspection

All pipes, fittings or components used in the pipeline system shall be inspected for damages, prior to the actual bonding activity. Rejected items shall be separated and quarantined from undamaged materials to avoid unintentional use.

Adhesive kits shall be inspected prior to use. Do not use adhesive kits or containers showing evidence of damage or leakage. The adhesive shall be used before the expiry date, which is shown on the adhesive kit. Make sure that storage of adhesive kits complies with the storage requirements.

Ensure all necessary tools and materials are available. Take notice of the safety precautions stated in this document and those in the referenced instructions.

Table of contents

1.	General	1
2.	References	1
3.	Quality	1
4.	Inspection	1
5.	Requirements for bonding surface and ambient conditions	4
5.1	Cleaning of a plain pipe end or an unprepared bell end	4
5.2	Unprepared and prepared surface	4
5.3	Ambient conditions and conditioning of bonding surfaces	4
5.4	Cleaning of a machined spigot end or a sanded bell end	5
5.5	Sanding of spigot and bell end	5
6.	Dimensioning of taper spigot end	6
6.1	Cutting of pipe	6
6.2	Shaving of pipe end	7 - 9
7.	Preparing for bonding	10
7.1	Sanding and conditioning of both bonding surfaces	10
7.2	Dry fit and marking	10
7.3	Installation of pulling equipment	11
8.	Bonding	12
8.1	Preparation of adhesive	12
8.2	Application of adhesive	12
8.3	Assembly of the spigot in the bell	13
8.4	Curing of the adhesive	14
9.	Materials, tools and consumables	15
9.1	Materials	15
9.2	Tools	15
9.3	Consumables	15
10.	Health and safety	16
Annex A	Schemes assembly process Taper-Taper bonded joint	17
Annex A1	Scheme of spigot dimensioning process	17
Annex A2	Scheme of adhesive bonding process	18

Annex B	Minimum cut length	19
Annex C	Shaving dimensions Taper Spigot	20
Annex C1	Shaving dimensions Taper Spigot (10 bar)	20
Annex C2	Shaving dimensions Taper Spigot (12 bar)	21
Annex C3	Shaving dimensions Taper Spigot (14 bar)	22
Annex C4	Shaving dimensions Taper Spigot (16 bar)	23
Annex C5	Shaving dimensions Taper Spigot (20 bar)	24
Annex C6	Shaving dimensions Taper Spigot (25 bar)	25
Annex C7	Shaving dimensions Taper Spigot (32 bar)	26
Annex C8	Shaving dimensions Taper Spigot (40 bar)	27
Annex C9	Shaving dimensions Taper Spigot (50 bar)	28
Annex C10	Shaving dimensions Taper Spigot 2000M/7000M	29
Annex D	Instructions dimensional check shaving dimensions Taper Spigot	30
Annex D	Position insertion mark at distance Y (mm) - Pipe and flanges	31
Annex D	Position insertion mark at distance Y (mm) - Fittings	31
Annex E	Determine required curing time	33
Annex E1	Determine required curing time pipe to pipe joints	33
Annex E2	Determine required curing time pipe to fitting joints	33

5. Requirements for bonding surface and ambient conditions

This section gives descriptions of specific conditions of the pipe surfaces meant for adhesive bonding, as well as methods to obtain the required condition of the bonding surfaces.

the required humidity and temperature conditions during the complete bonding procedure.

5.1 Cleaning of a plain pipe end or unprepared bell end

Both, the outer surface of a plain cut (not machined) pipe end and the inner surface of an unprepared (see section 5.2) bell must be clean and dry before starting any operation. If these unprepared surfaces of product ends have been in contact with oil or grease, they must be cleaned using a clean cloth, which is soaked in clean acetone, M.E.K. (Methyl Ethyl Ketone) or M.I.B.K. (Methyl Iso Butyl Ketone). Dry the cleaned surface with a clean, dry and non-fluffy cloth. If there are no traces of oil or grease contamination on these pipe ends, clean the surfaces using a clean, dry and non-fluffy cloth (see fig. 5.1.a).



Fig. 5.1.a

5.2 Unprepared and prepared surface

An unprepared surface is a surface on the inside of a bell or on the outside of a pipe end, where the original resin rich coating is still intact as it were after completion of the manufacturing process. Any manual or mechanical abrasion process, such as sanding or sand blasting, has never reduced the original thickness of these resin rich layers.

A prepared surface is a surface on the inside of a bell or on the outside of a pipe end that has been abraded manually or mechanically. By the abrasion process, the reinforcement of the composite may come in direct contact with the environment and is therefore sensitive for contamination.

5.3 Ambient conditions and conditioning of bonding surfaces

If the bonding surfaces are visibly wet, these surfaces must be dried and heated. If the temperature of the bonding surfaces is less than dew point plus 3°C, these surfaces must be heated in order to avoid condensate on the bonding surface. If the relative humidity of the environment is > 95 %, if it is foggy, or if there is any form of precipitation (e.g. rain, snow, hail), precautionary measures must be taken to create an environment where the bonding process can be performed under conditioned circumstances (e.g. a shelter). Drying of wet surfaces is performed using a clean, dry and non-fluffy cloth and is followed by heating of the bonding areas. Heating of surfaces that are wet or below dew point plus 3°C is performed with a heating source such as a hot air blower or a heating blanket. The humidity of a (sheltered) bonding environment is reduced with e.g. a hot air blower. Raise the temperature of the bonding surfaces during the heating process up to maximum 80°C or set the temperature of the heating blanket at maximum 80°C.

If the environment heats the bonding surface above 40°C, protect it from direct radiation by sunlight. The temperature of the bonding surfaces of spigot and bell, during the bonding procedure, shall be kept between 15°C and 40°C, but also at least 3°C above dew point. Precautionary measures shall be taken to guarantee the compliance with

5.4 Cleaning of a machined spigot end or a sanded bell end

A machined, prepared or sanded bonding surface that has been in contact with oil or grease shall not be used and must be cut. Machined, prepared or sanded bonding surfaces that are contaminated by other means than oil or grease can be cleaned by sanding (see section 5.5).

In case of doubt about the nature of the contamination, cut the concerned spigot or bell. If there are no traces of contamination on these pipe ends, clean the surfaces using a clean, dry and non-fluffy cloth. Do not touch the cleaned surface nor allow it to be contaminated.

5.5 Sanding of spigot and bell end

The sanding operation of the bonding surfaces of both, spigot- and bell end, shall be performed within 2 hours from the actual bonding. Bonding surfaces must be clean and dry at the start of the sanding operation (see sections 5.1, 5.3 and 5.4). Sanding of unprepared bell ends is performed mechanically, using an emery cup with a grid of grade P40 to P60 (see fig. 5.5.a).

Sanding of factory prepared bell ends and machined spigot ends is performed mechanically using an emery cup, a flapper wheel or emery cloth with a grid of grade P40 to P60. A correctly sanded surface does not change in colour when continuing sanding (see fig. 5.5.b). Bonding surfaces must be sanded equally in circumferential direction. The bonding surface must stay smooth by applying an even pressure on the sanding equipment. Break sharp edges of the tip of the machined spigot end.

The bonding surface is cleaned using a dry and clean dust bristle (see fig. 5.5.c). Sanded surfaces must have a dull, fresh finish, not a polished look. Do not touch the cleaned surface, nor allow it to be contaminated.



Fig. 5.5.a



Fig. 5.5.b



Fig. 5.5.c

6. Dimensioning of taper spigot end

In case a pipe with the correct length and (factory) shaved spigot end is available, then continue with section 7 of these instructions. This section 6 is relevant in case the pipe length has to be adjusted or a tapered spigot end has to be shaved. Make sure to comply with the relevant requirements stated in section 5 before starting a next step in the activities to complete the bonding procedure.

6.1 Cutting of pipe

- Contaminated pipe surfaces must be cleaned prior to perform any operation on the pipe (see relevant requirements stated in section 5).
- Ensure that the pipe is adequately supported or clamped on a pipe vice.
Use rubber padding having a minimum thickness of 2 mm or similar to protect the pipe from damage.
- Determine the required length from the product drawing or by measurement (see fig. 6.1.c).
- Scribe the pipe at the required length, using a pipe fitters' wrap-around (see fig. 6.1.d); take notice of the minimum cut length (see Annex B).
- Cut the pipe square using a diamond or carbide coated hacksaw or an abrasive wheel.
- Ensure that the squareness of the cut end remains within required tolerance (A) (see fig. 6.1.f and table 6.1.f).

Table 6.1.f Tolerance cut end

ID (mm)	A (MM)
25 - 600	± 3
700 - 900	± 4
1000 - 1200	± 6

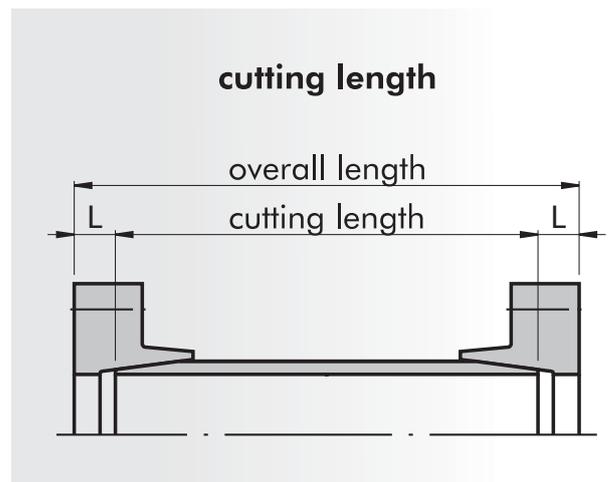


Fig. 6.1.c



Fig. 6.1.d

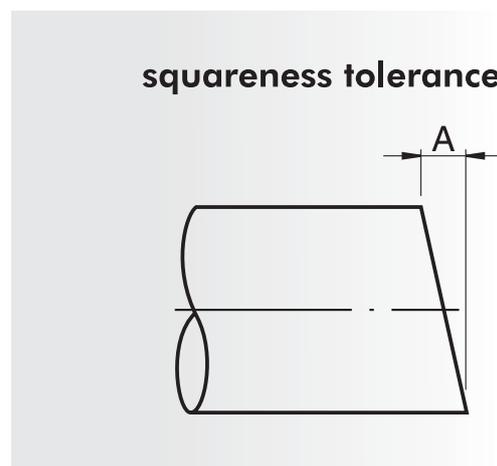


Fig. 6.1.f

6.2 Shaving of pipe end

- a Various types of shavers are available (see fig. 6.2.a).
To operate the shaver, carefully follow the applicable shaver instructions (see section 2).
- b The pipe end to be shaved shall be clean (see relevant requirements in section 5) and must be adequately supported (see section 6.1.b and fig. 6.2.b).
- c Start the shaving procedure (see fig. 6.2.c), using a maximum shaving feed of 2 mm.
Be careful shaving the first layer as the pipe wall might have an unequal thickness over the circumference.



Fig. 6.2.a.

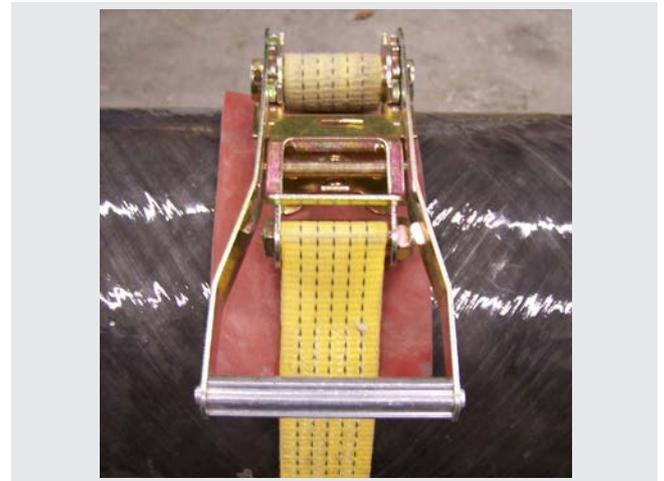


Fig. 6.2.b



Fig. 6.2.c

d Repeat the shaving action until the required spigot dimension (see Annex C) is achieved.
Measurement of the nose thickness (T) at a number spots (3 - 6) in the circumference of the head of the spigot (see fig. 6.2.d) can be used to obtain an indication of having achieved the required spigot diameter (S1).



Fig. 6.2.d

e Use an unprepared (dummy) bell to check the correctness of the shaved spigot end dimensions by determining the actual insert depth of the spigot in the bell.
Mark the actual insert depth of the spigot in the (dummy) bell on the section containing the spigot end (see fig. 6.2.e). The spigot diameter (S1) is checked by comparing the actual insert depth with the allowable values of the insert depth (see Annex C).

The actual insert depth shall comply with the following requirement:

The actual insert depth shall be:

- Equal to or smaller than the maximum insert depth
- Equal to or greater than the minimum insert depth.

(Minimum insert depth \leq Actual insert depth \leq Maximum insert depth).

If the actual insert depth of the spigot in the (dummy) bell is too long ($>$ maximum insert depth, Annex C, tables C1 - C10, this means that the spigot diameter (S1) is too small.

Choose for one of the following corrective actions:

- Cut the shaved length to comply with the required insert depth.
- Cut the shaved spigot at about 50 % of the shaved length and repeat dimensioning starting from section 6.1

If the actual insert depth of the spigot in the (dummy) bell is too short ($<$ minimum insert depth, see Annex C, tables C1 - C10), this means that the spigot diameter (S1) is too big. Choose for the following corrective action:

Cut the shaved spigot at about 50 % of the shaved length and repeat dimensioning starting from section 6.1.



Fig. 6.2.e

f The eccentricity of the shaved spigot diameter (S1) relative to the inner diameter (ID) is determined from a number (≥ 6) of measurements of the nose thickness (T) in the circumference of the spigot diameter (S1). The maximum allowable difference between the measured nose thicknesses (Tol_{max}) is indicated in tables C1 - C10 of Annex C. An explanation of a check of the eccentricity of the shaved spigot diameter is given in Annex D, Re. 2.

If the actual tolerance on the nose thickness (Tol_{act}) is too big ($> Tol_{max}$, see Annex C, tables C1 - C10), this means that the eccentricity of the shaved spigot diameter (S1) relative to the inner diameter (ID) is too big. Choose for the following corrective action:

Cut the shaved spigot at about 50% of the shaved length and repeat dimensioning starting from section 6.1.

Note:

Shaving the spigot diameter (S1) 1 mm smaller (nose thickness 0.5 mm less) results in an additional insert depth of the spigot in the bell depending on the taper angle (see fig. N1):

- For a taper angle $\alpha = 1.75^\circ$,
the additional insert depth = 16.4 mm.
- For a taper angle $\alpha = 2.50^\circ$,
the additional insert depth = 11.5 mm.

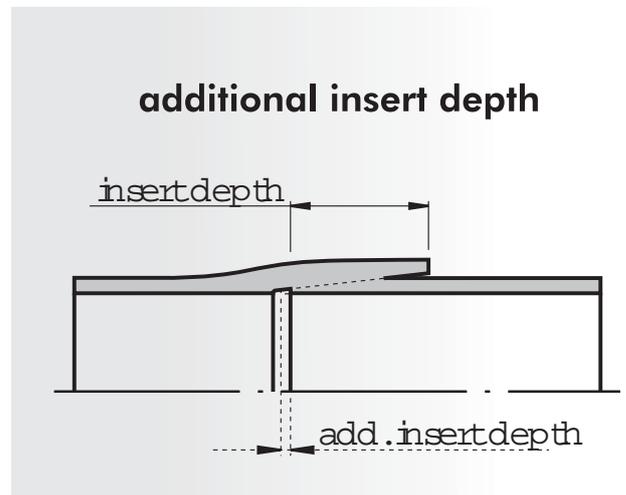


Fig. N1

7. Preparing for bonding

Before any actual bonding activity can start, the spigot and bell end to be jointed shall be prepared as described below. Especially in the small diameter range, more joints may have to be prepared, as more joints can be made with one adhesive kit; in some cases it may be advantageous to assemble more joints at the same time.

7.1 Sanding and conditioning of both bonding surfaces

- a Make sure to comply with the relevant requirements stated in section 5.

Note:

The maximum number of sanding operations for each of the bonding surfaces, either the bell or the spigot, is two. In case a bonding surface is subjected to more than two sanding operations the dimensions shall be checked by determination of the insert depth of the spigot in the bell to be bonded. In this situation, the check of the insert depth shall be performed with the actual bell of the joint to be made, instead of using a dummy bell end.

7.2 Dry fit and marking

- a A joint of two pipe sections is marked with an insertion mark. A joint of a pipe and a fitting is marked with an insertion mark as well as an alignment mark.
- b In order to be able to check the required final position of the spigot relative to the bell a marking shall be made on the outer surface:
 - An insertion mark is made on the pipe containing the spigot end in order to check the insert depth of the spigot in the bell.
 - An alignment mark is made on both, the bell and the pipe containing the spigot, in order to check the required orientation.
- c For an insertion mark:

Measure distance Y (see Annex D, Table D1) back from the head of the spigot and scribe a line in circumferential direction on the outer surface of the pipe (see fig. 7.2.c).

Note:

Y is derived from the following equation:

$$Y = \text{Minimum insert depth} + X \quad (\text{Eq.1})$$

Where:

- For Minimum insert depth see Annex C, Tables C1-C10.
 - X is taken as a default value of 50 mm in Annex D, Table D1.
- In case the value of X = 50 mm is not workable, choose another practical value of X and determine Y using equation (Eq.1).*

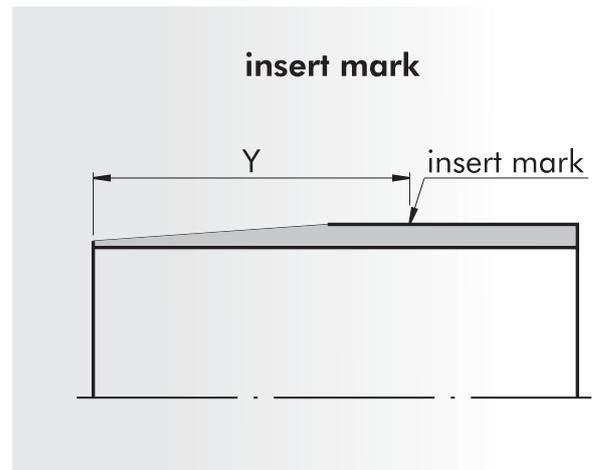


Fig. 7.2.c

- d For an alignment mark:
Scribe a longitudinal line on the outer surface of the bell, continuing on the outer surface of the pipe containing the shaved spigot end (see fig. 7.2.d).

7.3 Installation of pulling equipment

- a The mechanical equipment to pull the spigot centrally in the bell is installed on both sides of the joint (see fig. 7.3.a).

Normally two winches will suffice; if needed more winches can be used.

The position of the winches is equally spaced over the circumference of the parts to be jointed in order to realise centric entrance of the spigot in the bell.

Make sure that there will be sufficient space to apply adhesive on the bonding surfaces.

- b Respect the required alignment of the parts to be jointed as well as the support during the bonding operation.

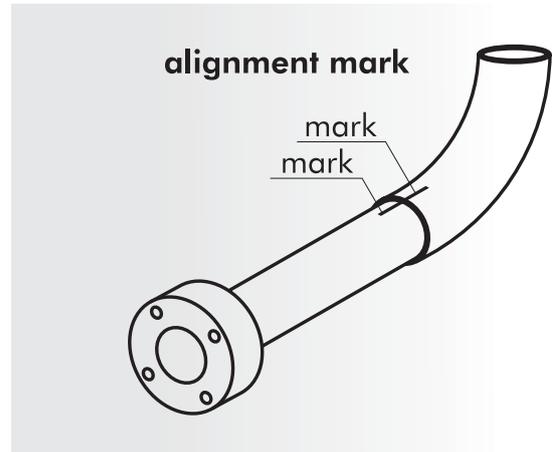


Fig. 7.2.d



Fig. 7.3.a

8. Bonding

The actual bonding starts with the preparation of the adhesive and finishes when the adhesive between the jointed parts is cooled down to ambient temperature, after completion of curing of the adhesive.

The adhesive shall be supplied by the pipe manufacturer. Be aware that the bonding procedure shall be performed continuously and without any interruption or delay, within the potlife/working life of the adhesive. This means that the period within mixing of the adhesive components until the spigot has been pulled into the bell shall fall within the potlife/working life.

8.1 Preparation of adhesive

- a Select the proper type and kit size of adhesive, if applicable.
Determine the number of adhesive kits required for one joint, or the number of joints which can be made with one kit. For detailed information about the adhesive, reference is made to the relevant document (see section 2).
- b The temperature of the adhesive shall comply with the requirements stated in the relevant document (see section 2).
- c Apply the adhesive immediately after finishing the mix procedure.
- d Never use adhesive that has started to cure; this is the case when the mixture gets clotted, toughens and the temperature rises significantly.

8.2 Application of adhesive

- a Use a fresh spatula or adhesive scraper for the application of adhesive on the freshly prepared bonding surfaces. In case the spatula used for mixing is also used for the application of the adhesive, the spatula must be cleaned first.
- b Wet the sanded surfaces of bell- and spigot end with some force with a thin, uniform coating of adhesive (hardly any thickness).
- c Apply a thin (≈ 0.5 mm) and uniform layer of adhesive on the adhesive coated bonding surface of the spigot end. Do not apply more adhesive than strictly necessary to avoid an excessive resin bead on the inside of the joint, resulting in flow restrictions.
Make sure to apply an adhesive layer on the cut end of the spigot (see fig. 8.2.c and fig. 8.2.d).
- d Make sure to apply sufficient adhesive on the cylindrical end of the spigot that will be covered by the bell (see fig. 8.2.c and fig. 8.2.d).
- e Protect the adhesive coatings on the bonding surfaces and prevent any contamination.

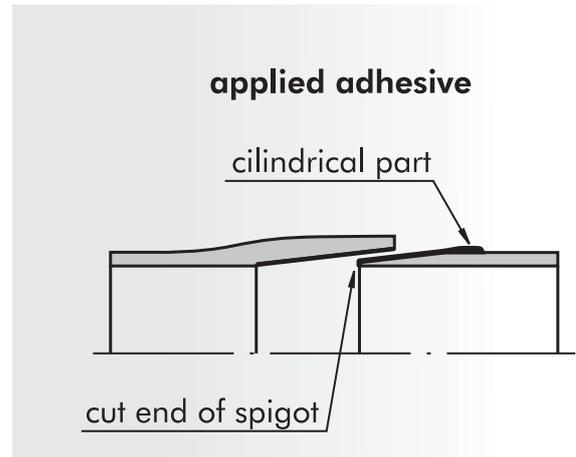


Fig. 8.2.c

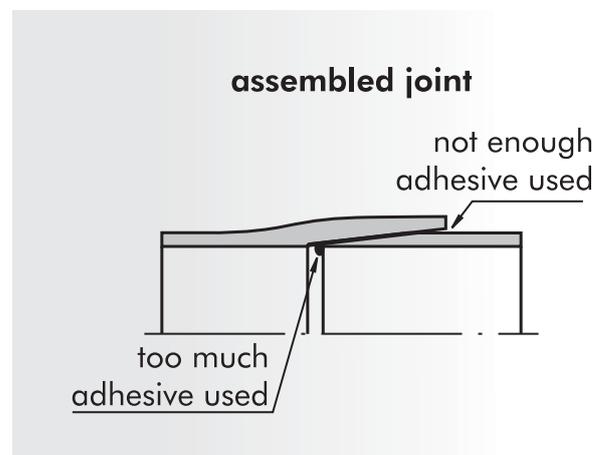


Fig. 8.2.d

8.3 Assembly of the spigot in the bell

- a Parts to be jointed shall be aligned as true as possible. Any visual misalignment is unacceptable.
- b Insert the spigot in the bell and pay attention to the alignment mark on the outer surface with regard to the orientation of the parts to be jointed.
- c Hook the winches, apply an equal load on each winch and pull the sections to be bonded in a smooth movement together until the spigot does not enter anymore into the bell (see fig. 8.3.c); respect the marking on the outer surface. Make sure that the spigot is inserted centrally into the bell until the joint is firmly fixed together.
- d Determine the distance (Dist) measured from the head of the bell to the insertion mark (see fig. 8.3.d); this distance (Dist) shall comply with the requirement stated in Annex D, Re. 1. The distance (Dist) may depend on the type of adhesive.
- e It may be necessary to create some space between the winch cables and the pipe outside to ease positioning of the heating blanket. The load on the pulling equipment may only be changed within the potlife/working life of the adhesive.

Note:

Continuation of activities on the pipeline system may never influence the load on the pulling equipment in either positive or negative sense.

- g Keep the tension load on the pulling equipment until the adhesive is fully cured. If the load on the jointed parts is released within the potlife/working life of the adhesive, the bonding procedure shall be repeated starting from section 8.2. If the load on the jointed parts is released after the potlife/working life of the adhesive, but before completion of the curing cycle, then the joint is rejected and the bonding procedure shall be repeated starting from section 7.
- h Remove the excessive adhesive from the outer surface (see fig. 8.3.h) and if possible from the inside of the joint. The fillet on the head of the bell should be smoothly rounded; the inside might be cleaned with a plug (see fig. 8.3.h.1).

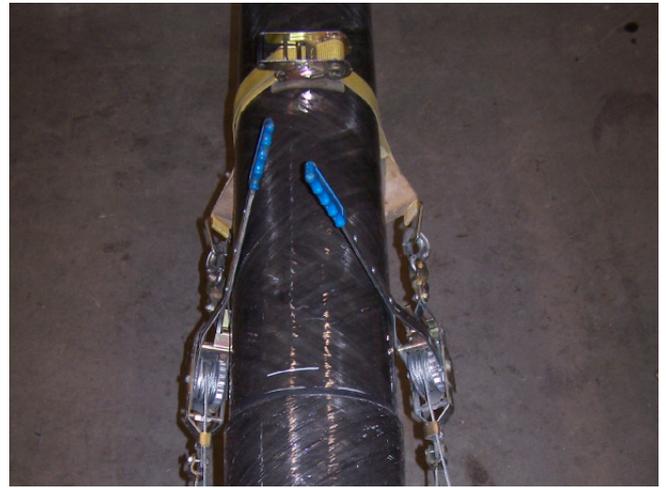


Fig. 8.3.c



Fig. 8.3.d



Fig. 8.3.h

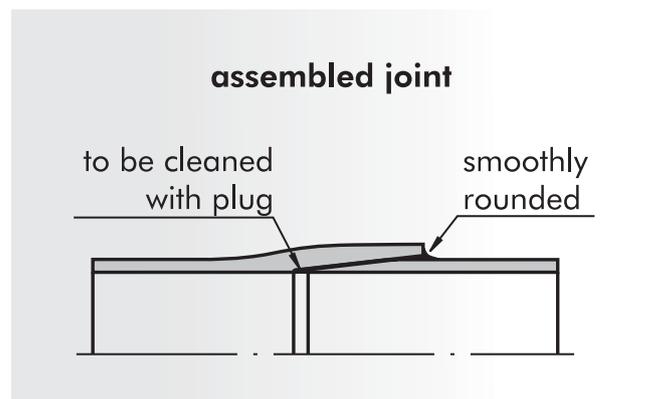


Fig. 8.3.h.1

8.4 Curing of the adhesive

- a The tension on the pulling equipment shall not be changed until completion of the cure of the adhesive. Until completion of the cure of the adhesive the joint shall not be moved, vibrated or otherwise disturbed.
- b Wrap the required size and voltage heating blanket around the joint, ensuring full coverage of the bond area and keeping the power supply cable free from the blanket. Tie the heating blanket down using e.g. a string or steel wire and assuring an optimal surface contact with the bell (see fig. 8.4.b). More details can be found in the heating blanket instruction (see section 2).
- c Overlapping ends of oversized blankets risk to be over-heated. Insulate overlapping ends and position the overlap outside the insulation.
- d Insulate the heating blanket with suitable insulating material (by preference a fire blanket or equivalent). Close at least one open end of the jointed pipe line sections in order to avoid cooling down by draught. Insulating material should overlap the sides of the blanket with at least 100 mm and should match the pipe (see fig. 8.4.d).
- e Apply electric power to the heating blanket. If applicable, adjust the temperature of the blanket such that the surface temperature of the jointed parts complies with the requirements stated in the relevant adhesive instructions (see section 2). Check the functioning of the heating blanket at least at the start and at the end of the curing process by measuring the surface temperature of the bell using a (digital) thermometer.
- f The curing time starts when the required surface temperature of the jointed components is reached. Write the starting time of the curing on the pipe, next to the heating blanket. For the required curing time see Annex E.
- g Adhesive bonded flanges shall be cured by placing the heating blanket against the inner surface of the flange. For an optimal heat transfer the blanket shall be pressed against the inner surface of the jointed parts, after the excess adhesive has been removed from the inside of the joint (see fig. 8.4.g).
- h If the curing time or the curing temperature does not comply with the requirements of the curing cycle, the complete curing cycle shall be repeated.
- i The electrical power to the heating blanket shall be switched off after completion of the curing time and after having checked the surface temperature for the last time. Indicate the end time of the curing cycle on the pipe. It is advised to mark the joint, indicating that the adhesive is cured. Allow the joint to cool down before loading mechanically or hydrostatically.



Fig. 8.4.b



Fig. 8.4.d



Fig. 8.4.g

9. Materials, tools and consumables

9.1 Materials

- Adhesive*

9.2 Tools

- Shaver*
- Heating blanket*
(plus temperature controller, if applicable)
- Dummy of bell end*

- Measuring tape and/or folding rule
- Vernier calliper
- Pipe fitters' wrap-around
- Level and marker
- Pipe vice or stable supports (brackets) with rubber coated clamping device
- Hacksaw, disc grinder or power jigsaw
- Small electrical or air driven grinding machine
- Pairs of winches or come-alongs
- Pairs of band clamps with puller rings
- Insulation material or blankets
- Digital temperature gauge for surface temperature measurement
- Dew point meter
- Temperature meter
- Relative humidity meter
- Digital thermometer for measurement of surface temperature during curing process
- Hot air blower
- Tenting (subject to weather conditions)

* To be supplied by the pipe manufacturer.

9.3 Consumables

- Cutting disks
- Emery disks, emery cups, emery cloth, flapper wheels
(all grade P40 to P60)
- Spatula (rubber scraper plate, filling knife), marker pen,
dust (paint) brush
- Rubber gloves, working gloves, dust masks, safety
goggles
- Cleaning plug
- Overalls, safety shoes, safety helmet
- Cleaning rags, cleaning fluid such as acetone, Methyl
Ethyl Ketone (MEK) or Methyl Iso Butyl Ketone (MIBK)

10. Health and safety

When working with GRE products, following safety precautions shall be taken:

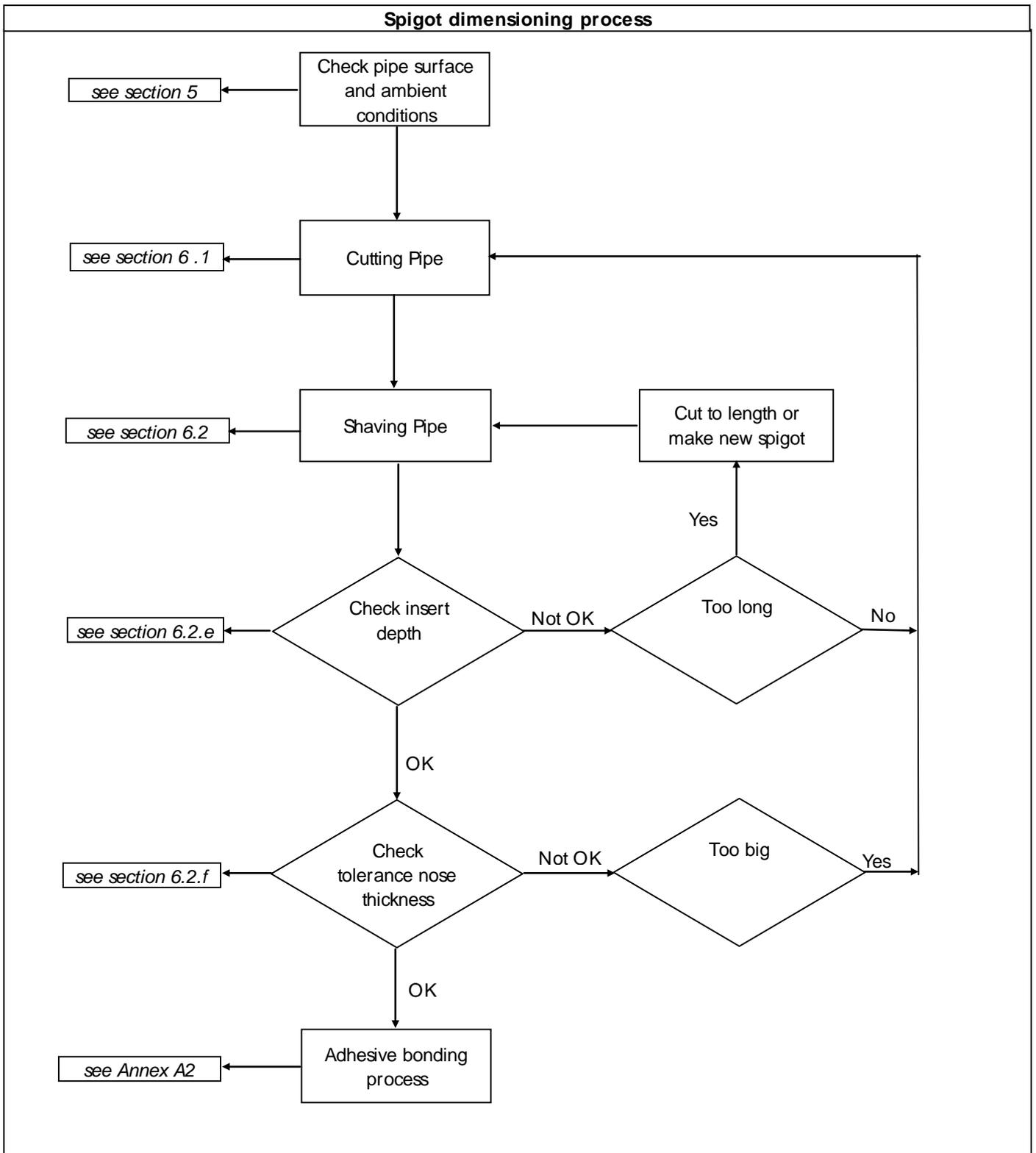
- Wear at all time suitable protective clothing.
- Use Personnel Protective Equipment (PPE), such as:
 - Long sleeves
 - Hard head (if required by site conditions)
 - Safety shoes
 - Glasses
 - Gloves (for mechanical and chemical protection)
 - Dust mask (during machining and sanding)
 - Ear protection (during mechanical operations)

For health and safety data reference is made to the applicable instructions (see section 2).

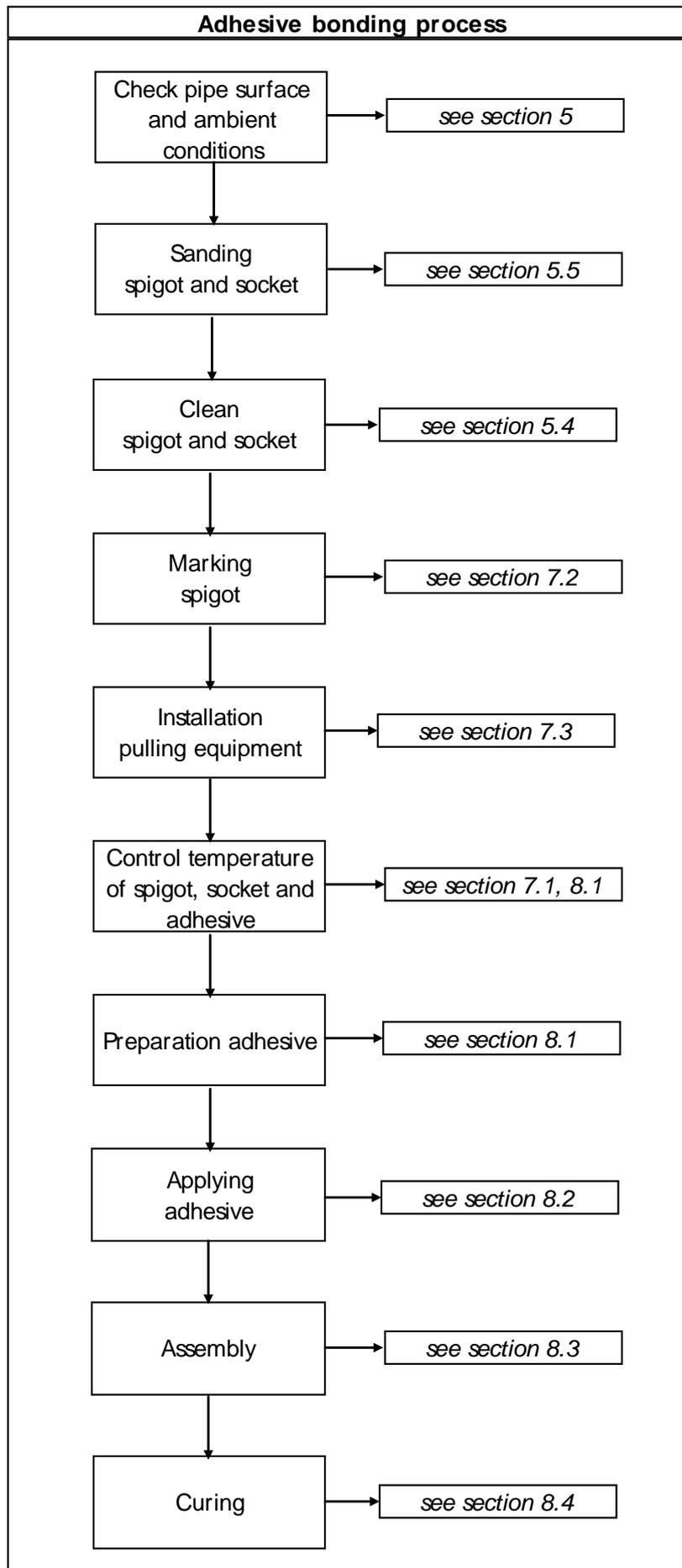


Annex A Schemes assembly process Taper bonded joint

Annex A1 Scheme of spigot dimensioning process



Annex A2 Scheme of adhesive bonding process



Annex B Minimum cut length

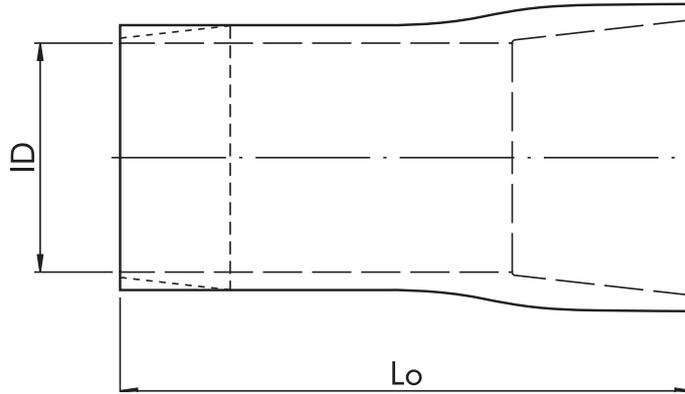


Fig. B1 Minimum cut length (L_o) for pipe Taper bell - Taper spigot

ID		PN (bar)								
Inch	mm	10	12	14	16	20	25	32	40	50
2	50	500	500	500	500	500	500	500	500	500
3	80	500	500	500	500	500	500	500	500	500
4	100	500	500	500	500	500	500	500	500	500
6	150	500	500	500	500	500	500	500	500	500
8	200	580	580	580	580	580	640	640	670	700
10	250	580	580	610	610	610	670	670	700	760
12	300	580	580	640	640	640	700	700	750	840
14	350	580	580	640	640	640	700	730	760	
16	400	610	610	670	670	670	730	800	860	
18	450	610	610	670	670	670	730			
20	500	610	640	640	700	720	860			
24	600	610	670	670	730	730	860			
28	700	870	900	950	1150					
30	750	870	900	950	1150					
32	800	870	900	950	1150					
36	900	900	950	1000	1060					
40	1000	1150								

Table B1 Minimum cut length (L_o) (mm)

Annex C Shaving dimensions Taper spigot (10 bar)

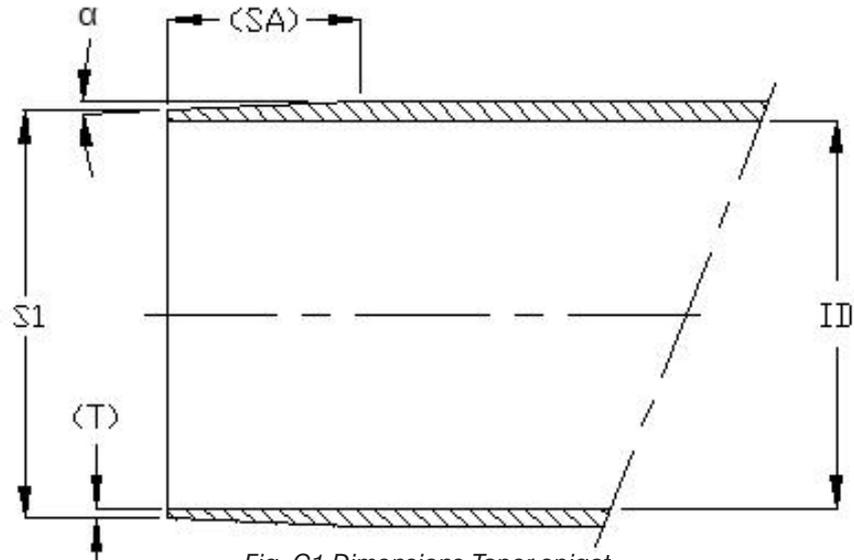


Fig. C1 Dimensions Taper spigot

General pipe info			10 bar					
Nominal Pipe size		Shave angle α (°)	Eccentric Tolerance	DRY FIT insert depth D_s		Nose thickness (reference) (T_{nom})	Spigot diameter (reference) (S1)	Spigot Length (reference) (SA)
mm	inch	+/- 10'		+/- 5mm Pipe/Flg	Fitting			
50	2	1.75	0.6	50	50	1.0	55.2	26.2
80	3	1.75	0.6	50	50	1.0	83.8	26.2
100	4	1.75	0.6	50	50	1.0	107.2	26.2
150	6	2.5	0.6	50	50	1.0	161.0	22.9
200	8	2.5	0.6	50	80	1.0	210.8	36.6
250	10	2.5	0.8	80	80	1.0	264.9	45.8
300	12	2.5	0.9	80	80	1.0	315.7	55.0
350	14	2.5	1.1	80	80	1.5	347.4	48.1
400	16	2.5	1.2	80	110	1.5	396.7	57.3
450	18	2.5	1.4	80	110	1.5	436.8	66.4
500	20	2.5	1.5	110	110	2.0	486.1	66.4
600	24	2.5	1.8	110	110	2.0	582.6	87.0
700	28	1.75	2.1	140	140	4.0	708.0	94.9
750	30	1.75	2.3	140	140	4.0	758.0	111.3
800	32	1.75	2.4	170	170	4.0	808.0	127.6
900	36	1.75	2.7	200	200	4.0	908.0	157.1
1000	40	1.75	3.0	200	200	4.5	1009.0	173.5

Table C1 Shaving dimensions 10 bar

Note:

For pipeline installation: a dummy or the actual bell can be used for dry fit

For spoolbuilding: the actual bell shall be used for dry fit

Dry fit insertion depth = according table

Using unfilled adhesive type (RP44, RP48, RP55): bonded insertion = dry fit insertion -0 / +10mm

Using filled adhesive type (RP60B, RP34C): bonded insertion = dry fit insertion -10 / +10mm

Eccentric tolerance (= max nose thickness - min nose thickness) = 0,6 OR $0,003 * ID$ which is highest

Annex C Shaving dimensions Taper spigot (12 bar)

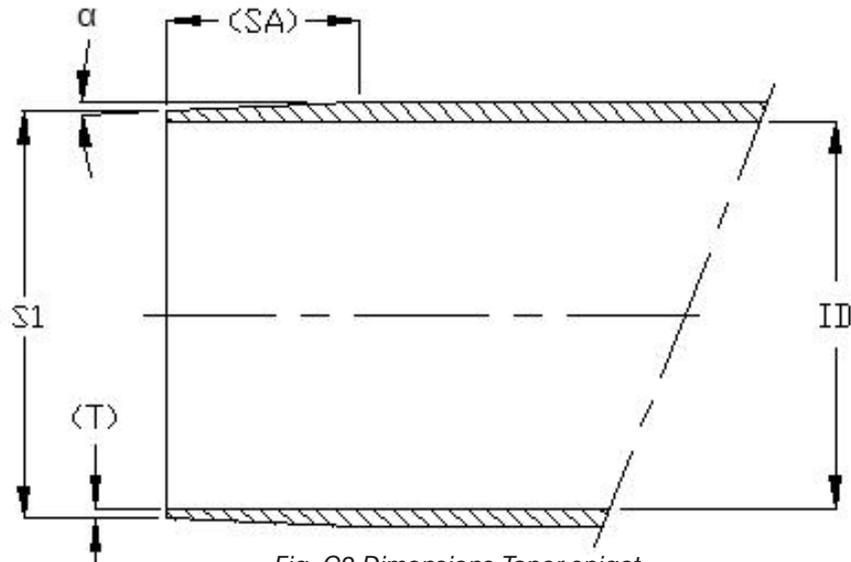


Fig. C2 Dimensions Taper spigot

General pipe info				12 bar				
Nominal Pipe size		Shave angle α (°)	Eccentric Tolerance	DRY FIT insert depth Ds		Nose thickness (reference) (Tnom)	Spigot diameter (reference) (S1)	Spigot Length (reference) (SA)
mm	inch	+/- 10'	mm	+/- 5mm Pipe/Flg	Fitting	mm	mm	mm
50	2	1.75	0.6	50	50	1.0	55.2	26.2
80	3	1.75	0.6	50	50	1.0	83.8	26.2
100	4	1.75	0.6	50	50	1.0	107.2	26.2
150	6	2.5	0.6	50	50	1.0	161.0	27.5
200	8	2.5	0.6	50	50	1.0	210.8	38.9
250	10	2.5	0.8	80	80	1.0	264.9	55.0
300	12	2.5	0.9	80	80	1.0	315.7	68.7
350	14	2.5	1.1	80	80	1.5	347.4	64.1
400	16	2.5	1.2	110	110	1.5	396.7	80.2
450	18	2.5	1.4	110	110	1.5	436.8	91.6
500	20	2.5	1.5	110	140	2.0	486.1	93.9
600	24	2.5	1.8	140	170	2.0	582.6	119.1
700	28	1.75	2.1	170	170	4.0	708.0	150.6
750	30	1.75	2.3	200	200	4.0	758.0	170.2
800	32	1.75	2.4	230	230	4.0	808.0	189.8
900	36	1.75	2.7	260	260	4.0	908.0	229.1
1000	40	1.75	3.0	290	290	4.5	1009.0	255.3

Table C2 Shaving dimensions 12 bar

Note:

For pipeline installation: a dummy or the actual bell can be used for dry fit

For spoolbuilding: the actual bell shall be used for dry fit

Dry fit insertion depth = according table

Using unfilled adhesive type (RP44, RP48, RP55): bonded insertion = dry fit insertion -0 / +10mm

Using filled adhesive type (RP60B, RP34C): bonded insertion = dry fit insertion -10 / +10mm

Eccentric tolerance (= max nose thickness - min nose thickness) = 0,6 OR 0,003 * ID which is highest

Annex C Shaving dimensions Taper spigot (14 bar)

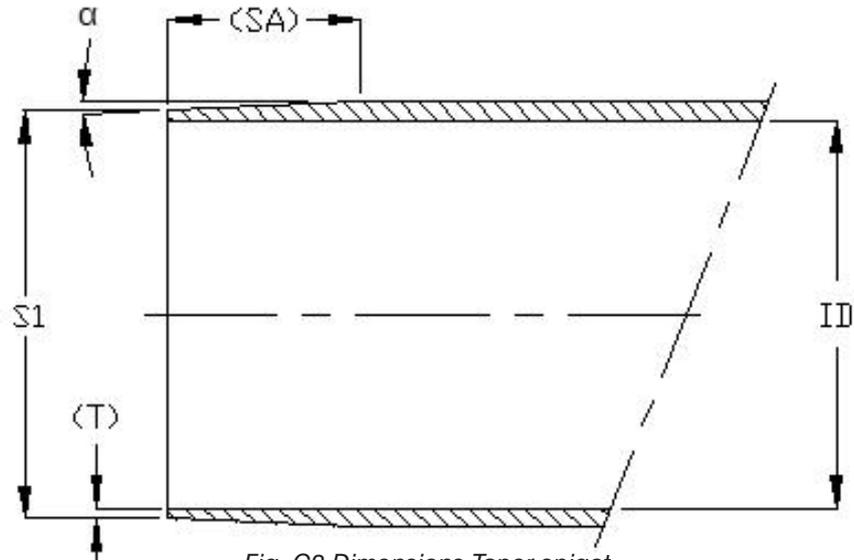


Fig. C3 Dimensions Taper spigot

General pipe info			14 bar					
Nominal Pipe size		Shave angle α (°)	Eccentric Tolerance mm	DRY FIT insert depth Ds		Nose thickness (reference) (Tnom) mm	Spigot diameter (reference) (S1) mm	Spigot Length (reference) (SA) mm
mm	inch	+/- 10'		+/- 5mm Pipe/Flg	Fitting			
50	2	1.75	0.6	50	50	1.0	55.2	26.2
80	3	1.75	0.6	50	50	1.0	83.8	26.2
100	4	1.75	0.6	50	50	1.0	107.2	26.2
150	6	2.5	0.6	50	50	1.0	161.0	34.4
200	8	2.5	0.6	80	80	1.0	210.8	50.4
250	10	2.5	0.8	80	80	1.0	264.9	68.7
300	12	2.5	0.9	110	110	1.0	315.7	87.0
350	14	2.5	1.1	110	110	1.5	347.4	84.7
400	16	2.5	1.2	110	110	1.5	396.7	100.8
450	18	2.5	1.4	140	140	1.5	436.8	114.5
500	20	2.5	1.5	140	140	2.0	486.1	119.1
600	24	2.5	1.8	170	170	2.0	582.6	155.7
700	28	1.75	2.1	230	230	4.0	708.0	206.2
750	30	1.75	2.3	260	260	4.0	758.0	232.4
800	32	1.75	2.4	230	230	5.5	811.0	206.2
900	36	1.75	2.7	260	260	6.0	912.0	235.7
1000	40	1.75	3.0	290	290	6.5	1013.0	271.7

Table C3 Shaving dimensions 14 bar

Note:

For pipeline installation: a dummy or the actual bell can be used for dry fit

For spoolbuilding: the actual bell shall be used for dry fit

Dry fit insertion depth = according table

Using unfilled adhesive type (RP44, RP48, RP55): bonded insertion = dry fit insertion -0 / +10mm

Using filled adhesive type (RP60B, RP34C): bonded insertion = dry fit insertion -10 / +10mm

Eccentric tolerance (= max nose thickness - min nose thickness) = 0,6 OR 0,003 * ID which is highest

Annex C Shaving dimensions Taper spigot (16 bar)

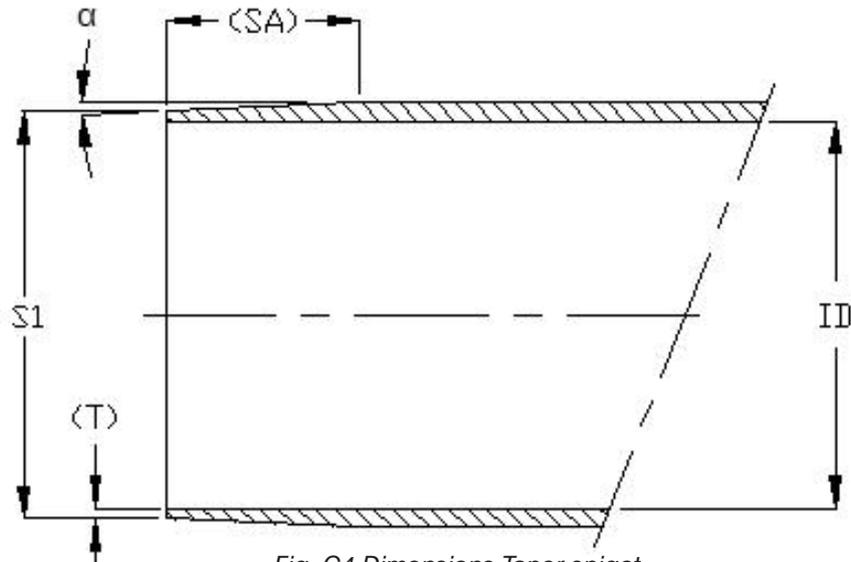


Fig. C4 Dimensions Taper spigot

General pipe info			16 bar					
Nominal Pipe size		Shave angle α (°)	Eccentric Tolerance	DRY FIT insert depth D_s		Nose thickness (reference) (T_{nom})	Spigot diameter (reference) ($S1$)	Spigot Length (reference) (SA)
mm	inch	+/- 10'	mm	+/- 5mm Pipe/Flg	Fitting	mm	mm	mm
50	2	1.75	0.6	50	50	1.0	55.2	26.2
80	3	1.75	0.6	50	50	1.0	83.8	26.2
100	4	1.75	0.6	50	50	1.0	107.2	32.7
150	6	2.5	0.6	50	50	1.0	161.0	43.5
200	8	2.5	0.6	80	80	1.0	210.8	61.8
250	10	2.5	0.8	110	110	1.0	264.9	82.5
300	12	2.5	0.9	110	140	1.0	315.7	103.1
350	14	2.5	1.1	110	140	1.5	347.4	105.4
400	16	2.5	1.2	140	170	1.5	396.7	123.7
450	18	2.5	1.4	140	170	1.5	436.8	139.7
500	20	2.5	1.5	170	200	2.0	486.1	146.6
600	24	2.5	1.8	200	230	2.5	583.6	174.1
700	28	1.75	2.1	230	230	5.5	711.0	216.0
750	30	1.75	2.3	260	260	6.0	762.0	229.1
800	32	1.75	2.4	290	290	5.5	811.0	271.7
900	36	1.75	2.7	350	350	6.0	912.0	310.9
1000	40	1.75	3.0	320	320	8.0	1016.0	304.4

Table C4 Shaving dimensions 16 bar

Note:

For pipeline installation: a dummy or the actual bell can be used for dry fit

For spoolbuilding: the actual bell shall be used for dry fit

Dry fit insertion depth = according table

Using unfilled adhesive type (RP44, RP48, RP55): bonded insertion = dry fit insertion -0 / +10mm

Using filled adhesive type (RP60B, RP34C): bonded insertion = dry fit insertion -10 / +10mm

Eccentric tolerance (= max nose thickness - min nose thickness) = 0,6 OR 0,003 * ID which is highest

Annex C Shaving dimensions Taper spigot (20 bar)

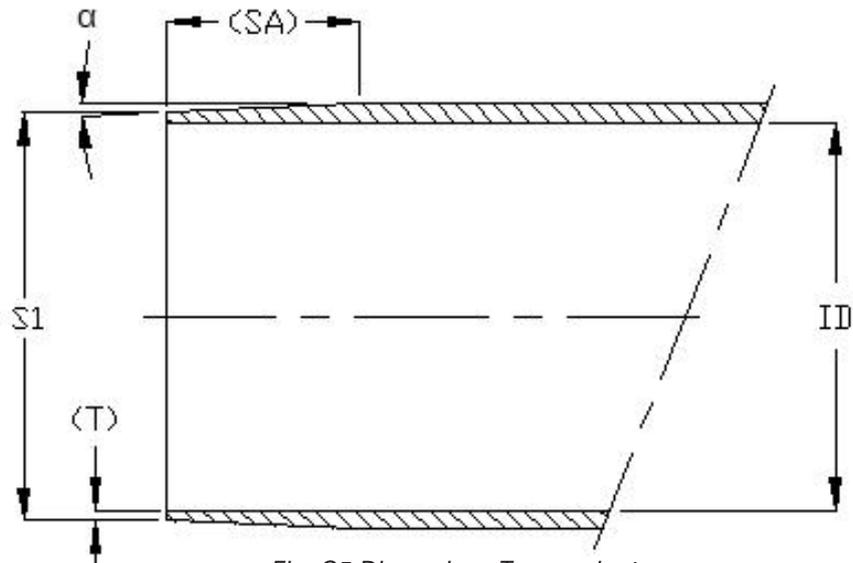


Fig. C5 Dimensions Taper spigot

General pipe info				20 bar				
Nominal Pipe size		Shave angle α (°)	Eccentric Tolerance	DRY FIT insert depth Ds		Nose thickness (reference) (Tnom)	Spigot diameter (reference) (S1)	Spigot Length (reference) (SA)
mm	inch	+/- 10'	mm	+/- 5mm Pipe/Flg	Fitting	mm	mm	mm
50	2	1.75	0.6	50	50	1.0	55.2	26.2
80	3	1.75	0.6	50	50	1.0	83.8	26.2
100	4	1.75	0.6	50	50	1.0	107.2	39.3
150	6	2.5	0.6	80	80	1.0	161.0	52.7
200	8	2.5	0.6	80	80	1.0	210.8	75.6
250	10	2.5	0.8	110	110	1.0	264.9	98.5
300	12	2.5	0.9	140	140	1.0	315.7	121.4
350	14	2.5	1.1	140	140	1.5	347.4	123.7
400	16	2.5	1.2	170	170	1.5	396.7	146.6
450	18	2.5	1.4	170	170	1.5	436.8	164.9
500	20	2.5	1.5	200	200	2.0	486.1	174.1
600	24	2.5	1.8	230	230	2.5	583.6	208.4
700	28	1.75	2.1	290	290	5.5	711.0	271.7
750	30	1.75	2.3	320	320	6.0	762.0	288.0
800	32	1.75	2.4	320	320	5.5	811.0	337.1
900	36	1.75	2.7	350	350	6.0	912.0	382.9

Table C5 Shaving dimensions 20 bar

Note:

For pipeline installation: a dummy or the actual bell can be used for dry fit

For spoolbuilding: the actual bell shall be used for dry fit

Dry fit insertion depth = according table

Using unfilled adhesive type (RP44, RP48, RP55): bonded insertion = dry fit insertion -0 / +10mm

Using filled adhesive type (RP60B, RP34C): bonded insertion = dry fit insertion -10 / +10mm

Eccentric tolerance (= max nose thickness - min nose thickness) = 0,6 OR 0,003 * ID which is highest

Annex C Shaving dimensions Taper spigot (25 bar)

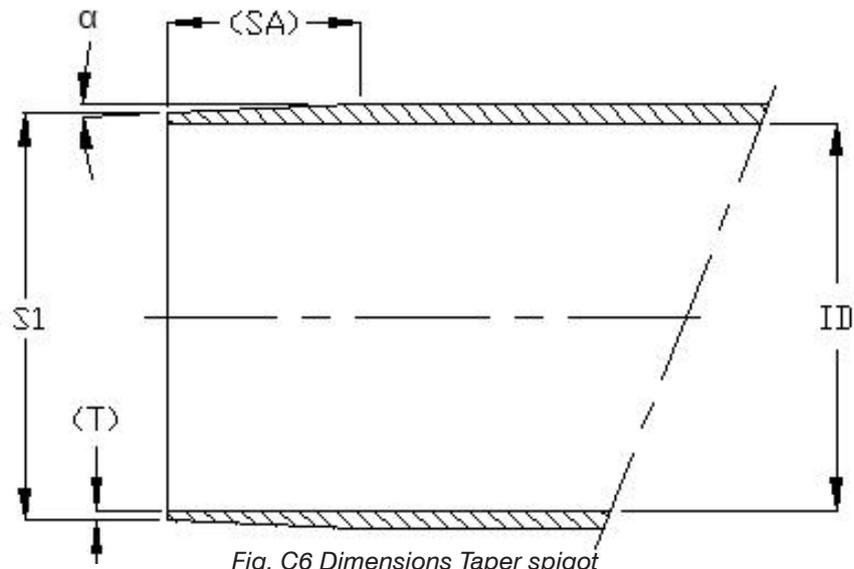


Fig. C6 Dimensions Taper spigot

General pipe info				25 bar				
Nominal Pipe size		Shave angle α (°)	Eccentric Tolerance	DRY FIT insert depth D_s		Nose thickness (reference) (Tnom)	Spigot diameter (reference) (S1)	Spigot Length (reference) (SA)
mm	inch	+/- 10'	mm	+/- 5mm Pipe/Flg	Fitting	mm	mm	mm
50	2	1.75	0.6	50	50	1.0	55.2	26.2
80	3	1.75	0.6	50	80	1.0	83.8	39.3
100	4	1.75	0.6	80	80	1.0	107.2	58.9
150	6	2.5	0.6	80	110	1.0	161.0	71.0
200	8	2.5	0.6	110	140	1.0	210.8	98.5
250	10	2.5	0.8	140	170	1.5	265.9	119.1
300	12	2.5	0.9	170	200	1.5	316.7	146.6
350	14	2.5	1.1	170	170	2.0	348.4	153.5
400	16	2.5	1.2	200	230	2.5	398.7	171.8
450	18	2.5	1.4	200	200	2.5	438.8	194.7
500	20	2.5	1.5	230	230	3.0	488.1	210.7
600	24	2.5	1.8	260	260	3.5	585.6	254.2
700	28	1.75	2.1	350	350	7.0	714.0	340.4
750	30	1.75	2.3	380	380	8.0	766.0	346.9
800	32	1.75	2.4	410	410	8.5	817.0	373.1

Table C6 Shaving dimensions 25 bar

Note:

For pipeline installation: a dummy or the actual bell can be used for dry fit

For spoolbuilding: the actual bell shall be used for dry fit

Dry fit insertion depth = according table

Using unfilled adhesive type (RP44, RP48, RP55): bonded insertion = dry fit insertion -0 / +10mm

Using filled adhesive type (RP60B, RP34C): bonded insertion = dry fit insertion -10 / +10mm

Eccentric tolerance (= max nose thickness - min nose thickness) = 0,6 OR 0,003 * ID which is highest

Annex C Shaving dimensions Taper spigot (32 bar)

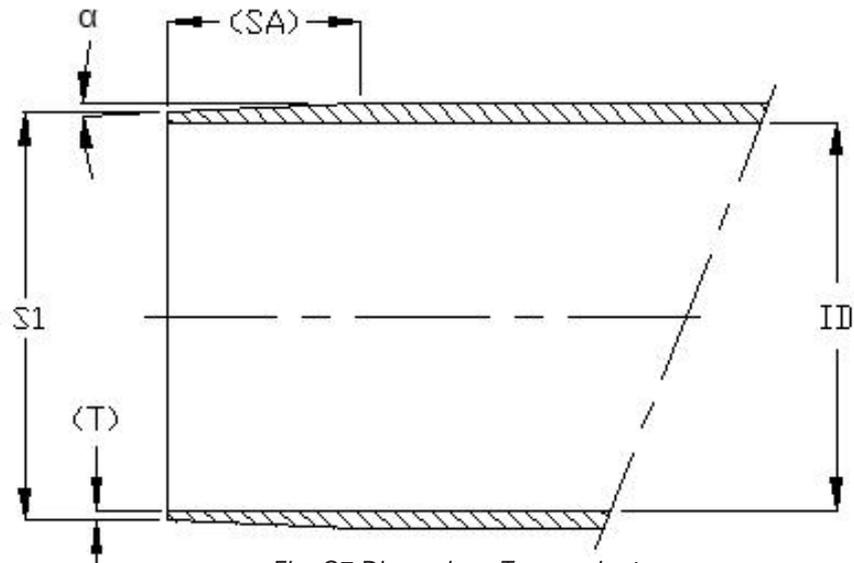


Fig. C7 Dimensions Taper spigot

General pipe info			32 bar					
Nominal Pipe size		Shave angle α (°)	Eccentric Tolerance	DRY FIT insert depth D_s		Nose thickness (reference) (T_{nom})	Spigot diameter (reference) ($S1$)	Spigot Length (reference) (SA)
mm	inch	+/- 10'	mm	+/- 5mm Pipe/Flg	Fitting	mm	mm	mm
50	2	1.75	0.6	50	50	1.0	55.2	26.2
80	3	1.75	0.6	80	80	1.0	83.8	52.4
100	4	1.75	0.6	80	80	1.0	107.2	78.6
150	6	2.5	0.6	110	110	1.0	161.0	93.9
200	8	2.5	0.6	140	140	1.0	210.8	130.6
250	10	2.5	0.8	170	170	1.5	265.9	155.7
300	12	2.5	0.9	200	200	1.5	316.7	192.4
350	14	2.5	1.1	230	230	2.0	348.4	203.8
400	16	2.5	1.2	230	230	2.5	398.7	226.7
450	18	2.5	1.4	260	260	2.5	438.8	256.5
500	20	2.5	1.5	290	290	3.0	488.1	279.4
600	24	2.5	1.8	350	350	3.5	585.6	339.0

Table C7 Shaving dimensions 32 bar

Note:

For pipeline installation: a dummy or the actual bell can be used for dry fit

For spoolbuilding: the actual bell shall be used for dry fit

Dry fit insertion depth = according table

Using unfilled adhesive type (RP44, RP48, RP55): bonded insertion = dry fit insertion -0 / +10mm

Using filled adhesive type (RP60B, RP34C): bonded insertion = dry fit insertion -10 / +10mm

Eccentric tolerance (= max nose thickness - min nose thickness) = 0,6 OR 0,003 * ID which is highest

Annex C Shaving dimensions Taper spigot (40 bar)

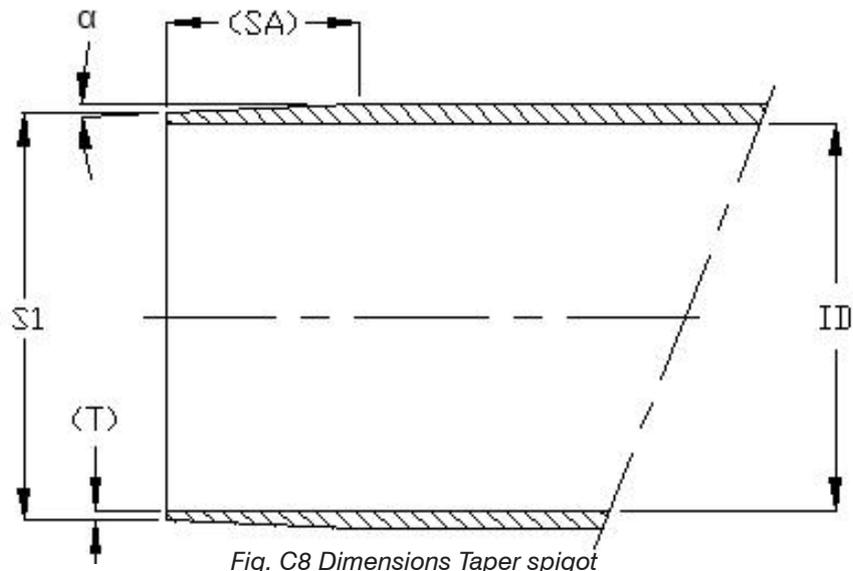


Fig. C8 Dimensions Taper spigot

General pipe info				40 bar				
Nominal Pipe size		Shave angle α (°)	Eccentric Tolerance	DRY FIT insert depth D_s		Nose thickness (reference) (Tnom)	Spigot diameter (reference) (S1)	Spigot Length (reference) (SA)
mm	inch	+/- 10'	mm	+/- 5mm Pipe/Flg	Fitting	mm	mm	mm
50	2	1.75	0.6	50	80	1.0	55.2	42.5
80	3	1.75	0.6	80	80	1.0	83.8	78.6
100	4	1.75	0.6	110	110	1.5	108.2	94.9
150	6	2.5	0.6	140	140	1.5	162.0	114.5
200	8	2.5	0.6	170	170	1.5	211.8	162.6
250	10	2.5	0.8	200	200	2.5	267.9	187.8
300	12	2.5	0.9	260	260	2.5	318.7	238.2
350	14	2.5	1.1	260	260	3.0	350.4	254.2
400	16	2.5	1.2	290	290	3.5	400.7	265.7
450	18	2.5	1.4	320	320	4.0	441.8	313.8
500	20	2.5	1.5	380	380	4.0	490.1	357.3
600	24	2.5	1.8	470	470	4.0	586.6	446.6

Table C8 Shaving dimensions 40 bar

Note:

For pipeline installation: a dummy or the actual bell can be used for dry fit

For spoolbuilding: the actual bell shall be used for dry fit

Dry fit insertion depth = according table

Using unfilled adhesive type (RP44, RP48, RP55): bonded insertion = dry fit insertion -0 / +10mm

Using filled adhesive type (RP60B, RP34C): bonded insertion = dry fit insertion -10 / +10mm

Eccentric tolerance (= max nose thickness - min nose thickness) = 0,6 OR 0,003 * ID which is highest

Annex C Shaving dimensions Taper spigot (50 bar)

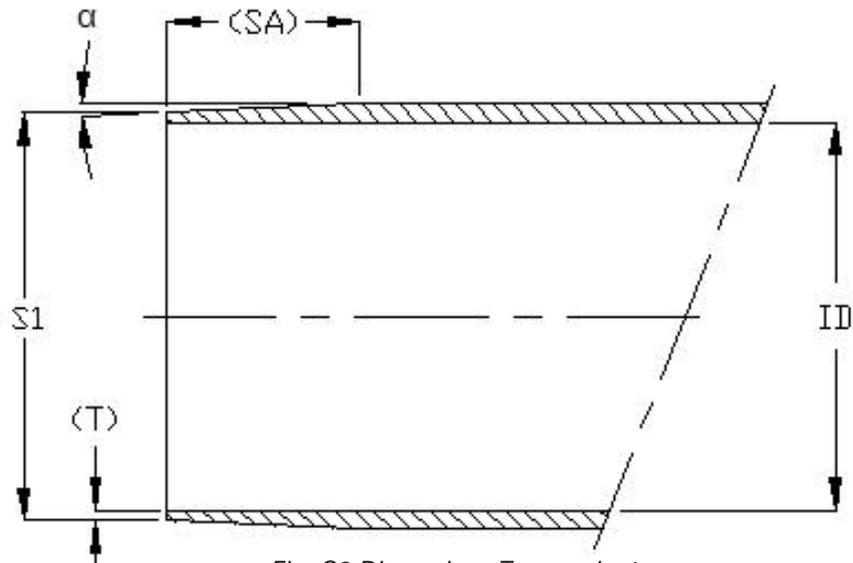


Fig. C9 Dimensions Taper spigot

General pipe info			50 bar					
Nominal Pipe size		Shave angle α (°)	Eccentric Tolerance mm	DRY FIT insert depth D_s		Nose thickness (reference) (T_{nom})	Spigot diameter (reference) (S1)	Spigot Length (reference) (SA)
mm	inch	+/- 10'		Pipe/Flg	Fitting	mm	mm	mm
50	2	1.75	0.6	80	80	1.0	55.2	58.9
80	3	1.75	0.6	110	110	1.5	84.8	88.4
100	4	1.75	0.6	140	140	2.0	109.2	111.3
150	6	2.5	0.6	170	170	2.0	163.0	142.0
200	8	2.5	0.6	200	200	2.5	213.8	187.8
250	10	2.5	0.8	260	260	3.0	268.9	240.5
300	12	2.5	0.9	290	290	3.5	320.7	288.6
350	14	2.5	1.1	320	320	4.0	352.4	313.8
400	16	2.5	1.2	380	380	4.0	401.7	371.0
450	18	2.5	1.4	440	440	4.0	441.8	416.8
500	20	2.5	1.5	500	500	4.0	490.1	471.8
600	24	2.5	1.8	590	590	4.0	586.6	586.3

Table C9 Shaving dimensions 50 bar

Note:

For pipeline installation: a dummy or the actual bell can be used for dry fit

For spoolbuilding: the actual bell shall be used for dry fit

Dry fit insertion depth = according table

Using unfilled adhesive type (RP44, RP48, RP55): bonded insertion = dry fit insertion -0 / +10mm

Using filled adhesive type (RP60B, RP34C): bonded insertion = dry fit insertion -10 / +10mm

Eccentric tolerance (= max nose thickness - min nose thickness) = 0,6 OR 0,003 * ID which is highest

Annex C Shaving dimensions Taper spigot 2000M/7000M

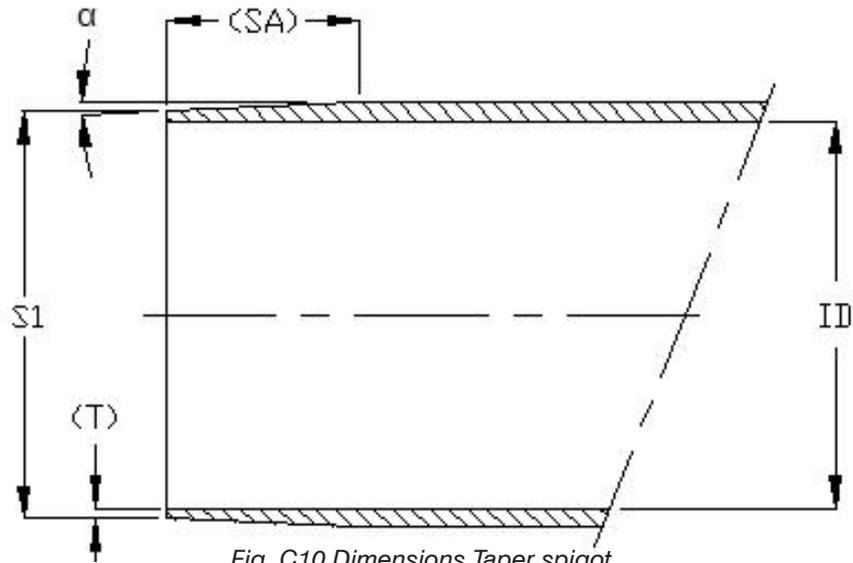


Fig. C10 Dimensions Taper spigot

General pipe info				2000M/7000M				
Nominal Pipe size		Shave angle α (°)	Eccentric Tolerance	DRY FIT insert depth Ds		Nose thickness (reference) (Tnom)	Spigot diameter (reference) (S1)	Spigot Length (reference) (SA)
mm	inch	+/- 10'	mm	+/- 5mm Pipe/Flg	Fitting	mm	mm	mm
200	8	2.5	0.6	65	65	3.1	215.2	55.0
250	10	2.5	0.8	80	80	4.1	271.2	66.4
300	12	2.5	0.9	95	95	4.7	323.2	82.5
350	14	2.5	1.1	100	100	5.2	348.2	87.0
400	16	2.5	1.2	110	110	6.1	398.2	96.2
450	18	2.5	1.4	114	114	4.6	443.0	134.0
500	20	2.5	1.5	127	127	5.0	492.2	147.0
600	24	3.5	1.8	178	178	3.8	586.3	189.7
700	28	1.75	2.1	178	178	6.4	712.9	198.0
750	30	1.75	2.3	178	178	4.2	758.4	198.0
800	32	1.75	2.4	178	178	8.9	817.8	198.0
900	36	1.75	2.7	203	203	5.6	911.3	223.0
1000	40	1.75	3.0	320	320	10.5	1021.5	340.0

Table C10 Shaving dimensions 2000M/7000M

Note:

For pipeline installation: a dummy or the actual bell can be used for dry fit

For spoolbuilding: the actual bell shall be used for dry fit

Dry fit insertion depth = according table

Using unfilled adhesive type (RP44, RP48, RP55): bonded insertion = dry fit insertion -0 / +10mm

Using filled adhesive type (RP60B, RP34C): bonded insertion = dry fit insertion -10 / +10mm

Eccentric tolerance (= max nose thickness - min nose thickness) = 0,6 OR 0,003 * ID which is highest

Annex D Instructions dimensional check shaving dimensions Taper spigot

The correctness of the shaving dimensions of the taper spigot end is checked by measurement of:

1. The insert depth of the spigot in the bell
2. The actual tolerance on the nose thickness

Note:

The nominal Spigot Length (SA) is given in Annex C, Table C1, for reference only. The Spigot Length (SA) shall not be used as quality criterion.

Re. 1 The insert depth of the spigot in the bell

A check of the required minimum insert depth of the spigot in the bell, after assembly of the spigot in the bell, is performed by measurement of the distance (Dist) from the head of the bell to the insertion mark (see section 8.3.d).

A correct insertion depth shall comply with the following requirement:

Filled adhesive (e.g. RP 60 B / RP 34)

$$(X-10) \leq \text{Dist} \leq X \quad (\text{Eq. D1})$$

Unfilled adhesive (e.g. RP 48 / RP 44, RP 55)

$$(X-10) \leq \text{Dist} \leq (X+10) \quad (\text{Eq. D2})$$

Example for position of insertion mark
(see section 7.2.c, fig. D1 and fig. D2):

In case for $X = 50$ mm is chosen, the insertion mark shall be scribed at a distance Y (mm), measured from the head of the spigot; for Y see following table D1.



Fig. D1



Fig. D2

Annex D Position insertion mark at distance Y (mm) from head of the spigot, for X = 50 mm

Pipe and flanges

Nominal pipe size		PN (bar)									
Inch	mm	10	12	14	16	20	25	32	40	50	2000M 7000M
50	2	95	95	95	95	95	95	95	95	125	
80	3	95	95	95	95	95	95	125	125	155	
100	4	95	95	95	95	95	125	125	155	185	
150	6	95	95	95	95	125	125	155	185	215	
200	8	95	95	125	125	125	155	185	215	245	110
250	10	125	125	125	155	155	185	215	245	305	125
300	12	125	125	155	155	185	215	245	305	335	140
350	14	125	125	155	155	185	215	275	305	365	145
400	16	125	155	155	185	215	245	275	335	425	155
450	18	125	155	185	185	215	245	305	365	485	159
500	20	155	155	185	215	245	275	335	425	545	172
600	24	155	185	215	245	275	305	395	515	635	223
700	28	185	215	275	275	335	395				223
750	30	185	245	305	305	365	425				223
800	32	215	275	275	335	365	455				223
900	36	245	305	305	395	395					248
1000	40	245	335	335	365						365

Table D1 Position of insertion mark

Fittings

Nominal pipe size		PN (bar)									
Inch	mm	10	12	14	16	20	25	32	40	50	2000M 7000M
50	2	95	95	95	95	95	95	95	125	125	
80	3	95	95	95	95	95	125	125	125	155	
100	4	95	95	95	95	95	125	125	155	185	
150	6	95	95	95	95	125	155	155	185	215	
200	8	125	95	125	125	125	185	185	215	245	110
250	10	125	125	125	155	155	215	215	245	305	125
300	12	125	125	155	185	185	245	245	305	335	140
350	14	125	125	155	185	185	215	275	305	365	145
400	16	155	155	155	215	215	275	275	335	425	155
450	18	155	155	185	215	215	245	305	365	485	159
500	20	155	185	185	245	245	275	335	425	545	172
600	24	155	215	215	275	275	305	395	515	635	223
700	28	185	215	275	275	335	395				223
750	30	185	245	305	305	365	425				223
800	32	215	275	275	335	365	455				223
900	36	245	305	305	395	395					248
1000	40	245	335	335	365						365

Table D2 Position of insertion mark

Re. 2 Eccentricity of spigot end

A check of the deviation on the nose thickness (T_{dev}) is an indirect method to check the eccentricity of the spigot diameter (S1) relative to the inner diameter (ID).

The deviation of the nose thickness (T_{dev}) is obtained from measurements of the nose thickness (T) in the circumference of the spigot diameter (S1), (see fig. D3).

The minimum value of the deviation on the nose thickness ($T_{dev\ min}$) = 0; in this case the spigot diameter (S1) is centric relative to the inner diameter (ID).

The maximum allowable deviation on the nose thickness ($T_{dev\ max}$) indicates the maximum allowable eccentricity of the spigot diameter (S1) relative to the inner diameter (ID).

The deviation on the nose thickness (T_{dev}) is determined from measurements of the actual nose thickness (T) and is compared with the maximum allowable tolerance (Tol_{max}), which is listed in Annex C, table C1.

The deviation on the nose thickness (T_{dev}) is derived from following equation:

$$T_{dev} = T_{max} - T_{min} \quad (\text{Eq. D2})$$

T_{max} and T_{min} are respectively the maximum and minimum value of the measured nose thickness (T).

The nose thickness (T) is measured at least 6 times, equally spaced over the circumference of the spigot diameter (S1), (see fig. D3).

The eccentricity of the spigot diameter (S1) relative to the inner diameter (ID) is correct if the deviation (T_{dev}) complies with the following requirement:

$$T_{dev} \leq Tol_{max} \quad (\text{Eq. D3})$$

measurement nose thickness

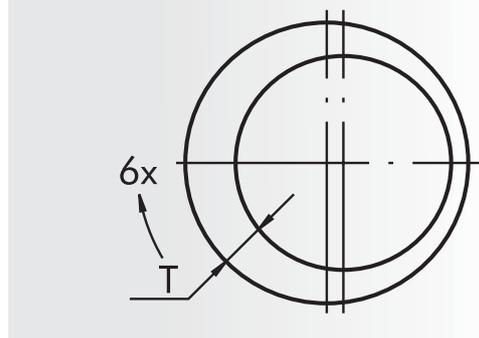


Fig. D3

Annex E1 Determine required curing time pipe to pipe joints

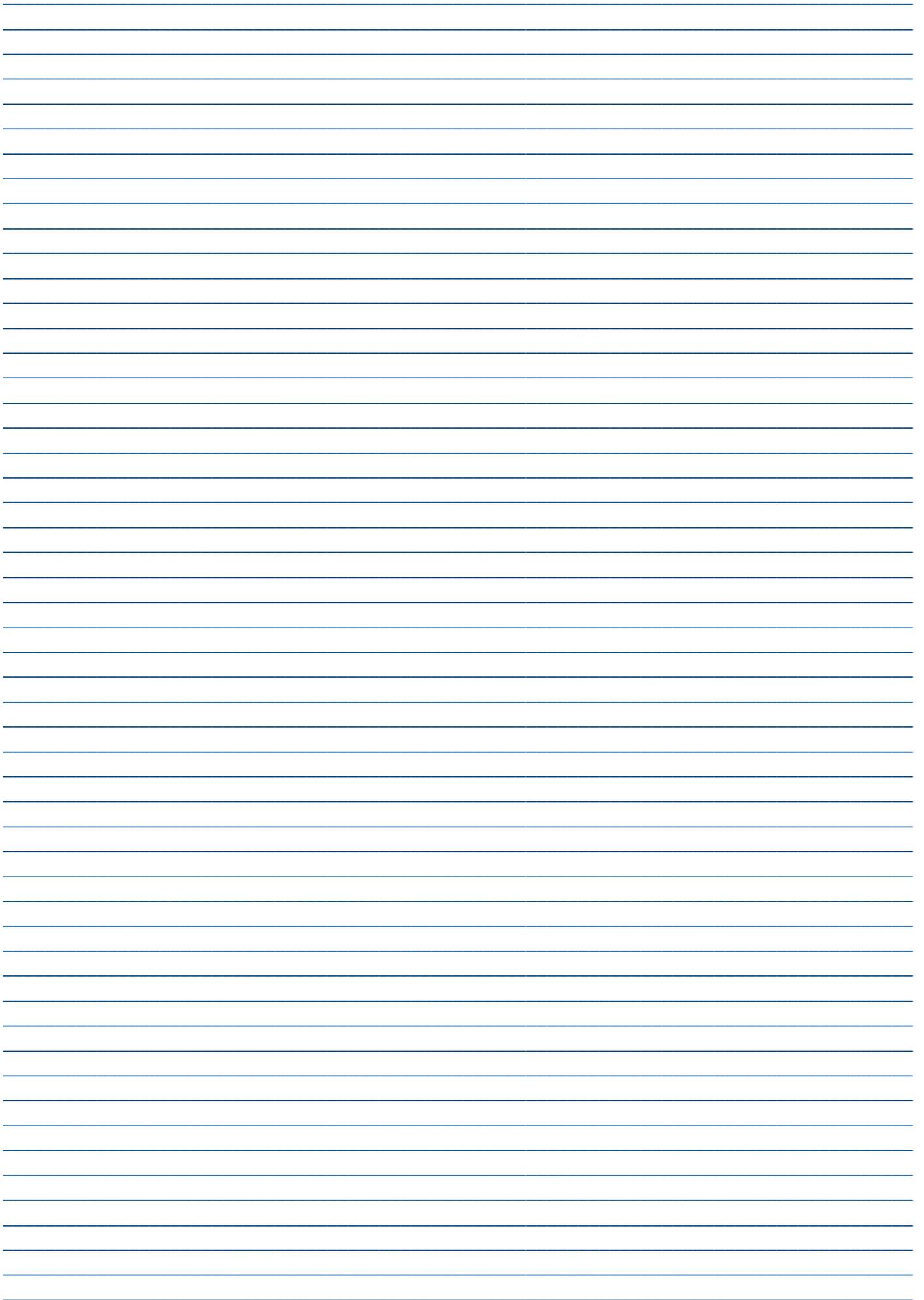
Curing time (hours) pipe to **pipe** joints

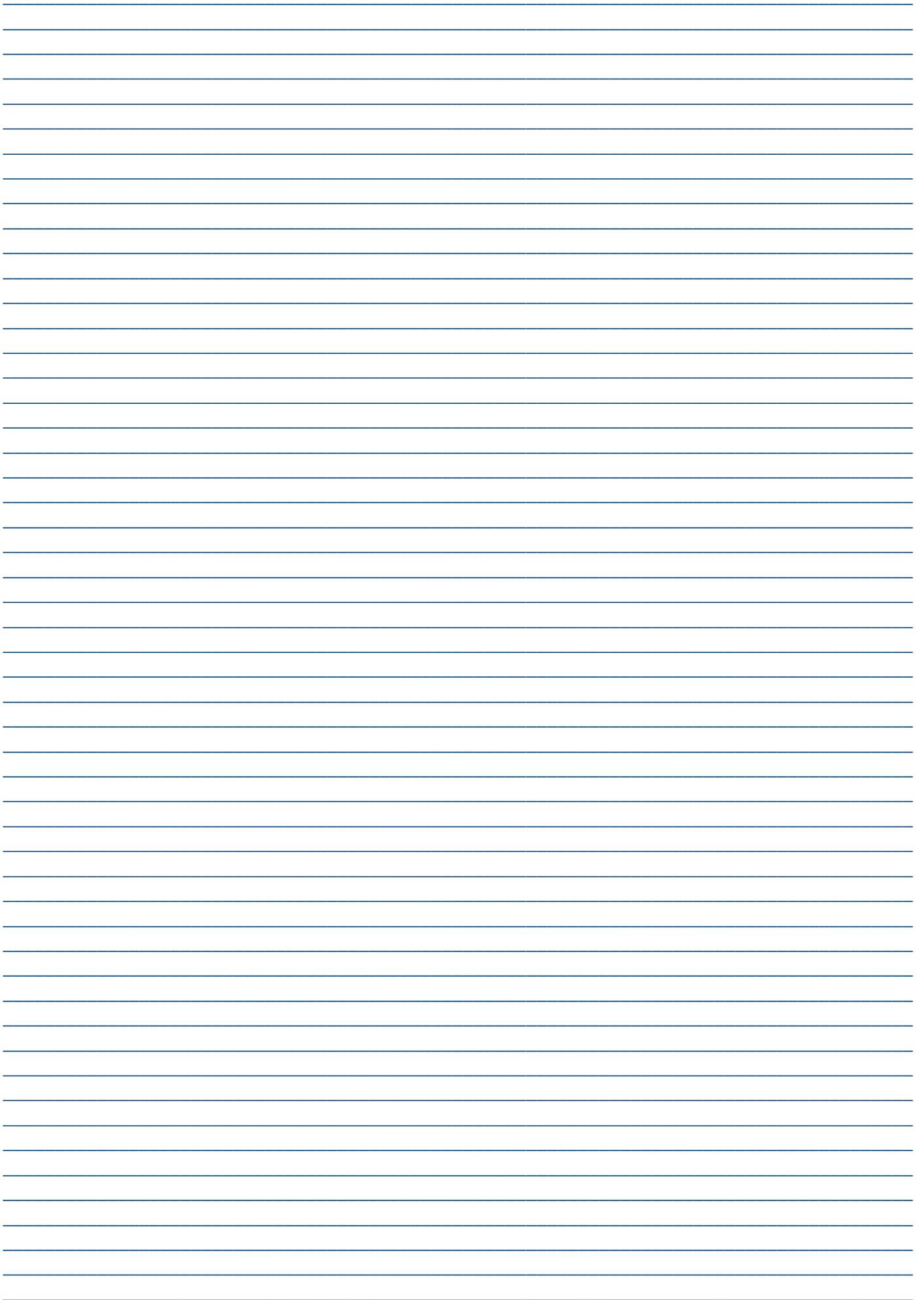
Nominal pipe size		PN (bar)									
Inch	mm	10	12	14	16	20	25	32	40	50	200M 700M
2	50	1	1	1	1	1	1	1	1	1	
3	80	1	1	1	1	1	1	1	1	1	
4	100	1	1	1	1	1	1	1	1	1	
6	150	1	1	1	1	1	1	1	1	1.5	
8	200	1	1	1	1	1	1	1	1.5	2	1
10	250	1	1	1	1	1	1	1.5	2	3	1
12	300	1	1	1	1	1	1.5	2	3	4	1
14	350	1	1	1	1	1	1.5	2	3		1
16	400	1	1	1	1	1.5	2	3	4		1
18	450	1	1	1	1.5	1.5	2	3	4		1.5
20	500	1	1	1.5	1.5	2	3	4	4		1.5
24	600	1	1.5	1.5	2	2	4	4			2
28	700	1	1.5	2	3						3
30	750	1.5	1.5	2	3						3
32	800	1.5	2	2	3						3
36	900	1.5	2	3	4						4
40	1000	2	3	4	4						4

Annex E2 Determine required curing time pipe to fittings joints

Curing time (hours) pipe to **fittings** joints

Nominal pipe size		PN (bar)									
Inch	mm	10	12	14	16	20	25	32	40	50	200M 700M
2	50	1	1	1	1	1	1	1	1	1	
3	80	1	1	1	1	1	1	1	1	1	
4	100	1	1	1	1	1	1	1	1	1.5	
6	150	1	1	1	1	1	1	1.5	2	3	
8	200	1	1	1	1	1	1.5	2	3	4	1
10	250	1	1	1	1.5	1.5	2	3	4	4	1.5
12	300	1	1	1.5	1.5	2	3	4	4		1.5
14	350	1	1	1.5	1.5	2	3	4	4		1.5
16	400	1	1.5	1.5	2	3	4	4			2
18	450	1.5	1.5	2	2	3	4	4			2
20	500	1.5	1.5	2	3	4	4				3
24	600	1.5	2	3	4	4					4
28	700	2	3	4	4						4
30	750	2	3	4	4						4
32	800	2	4	4	4						4
36	900	3	4	4							4
40	1000	4	4								4





National Oilwell Varco has produced this brochure for general information only, and it is not intended for design purposes. Although every effort has been made to maintain the accuracy and reliability of its contents, National Oilwell Varco in no way assumes responsibility for liability for any loss, damage or injury resulting from the use of information and data herein nor is any warranty expressed or implied. Always cross-reference the bulletin date with the most current version listed at the website noted in this literature.

North America

17115 San Pedro Ave. Suite 200
San Antonio, TX 78232 USA
Phone: +1 210 477 7500

South America

Estrada de Acesso à Zona
Industrial Portuária de Suape, s/no.
Recife, PE, Brazil 55.590-000
Phone: +55 81 3501 0023

Europe

P.O. Box 6, 4190 CA
Geldermalsen, The Netherlands
Phone: +31 345 587 587

Asia Pacific

No. 7A, Tuas Avenue 3
Jurong, Singapore 639407
Phone: +65 6861 6118

Middle East

P.O. Box 17324
Dubai, UAE
Phone: +971 4881 3566

www.fgspipe.com • fgspipe@nov.com

 **Fiber Glass Systems**

© 2012 National Oilwell Varco. All rights reserved.
INS2402 supersedes FP 1043 B November 2012