آگهی فراخوان شناسایی شماره ۱۰/۱۴۰۱/۰۱۶

شرکت پتروشیمی اروند در نظر دارد جهت تکمیل بانک اطلاعاتی پیمانکاران خود، از طریقآگهی فراخوان عمومی شرکت‌های واجد شرایط و دارای صلاحیت در زمینه **تعمیر و نگهداری خطوط لوله و اتصالات GRP** (Glass Reinforced Plastic) مطابق مشخصات فنی مندرج در سایت پتروشیمی اروند به نشانی الکترونیکی (www.arvandpvc.ir)، را با شرایط ذیل شناسایی نماید:

۱. متقاضیان از روز چهار شنبه ۱۴۰۱/۱۱/۱۲ لغایت چهارشنبه ۱۴۰۱/۱۱/۱۹ از ساعت ۰۸:۰۰ صبح تا ساعت ۱۸:۰۰ عصر با مراجعه به سایت پتروشیمی اروند به نشانی الکترونیکی www.arvandpvc.ir بخش کمیسیون معاملات یا به نشانی مستقیم Tender.arvandpvc.ir:5661 و پس از بارگذاری اطلاعات مربوطه، نسبت به ثبت نام اقدام نمایند.

۲. متقاضیان میبایست اسناد و مدارک ذیل ، حداکثر تا ساعت ۱۴:۰۰ روز چهارشنبه مورخ ۱۴۰۱/۱۱/۲۶ به نشانی استان خوزستان – بندر امام خمینی – منطقه ویژه اقتصادی پتروشیمی- سایت ۳ – کد پستی ۶۳۵۶۱۷۸۷۳۴ کمیسیون معاملات-کمیته فنی و بازرگانی شرکت پتروشیمی اروند تحویل نمایند:

الف - اساسنامه ، آگهی تاسیس ،آگهی آخرین تغییرات، پروانه فعالیت/پروانه بهره برداری/ گواهی صلاحیت پیمانکاری،گواهی صلاحیت ایمنی

ب- سوابق اجرایی کارهای مشابه و یا سوابق مرتبط در ۵ سال گذشته

ج- معرفی کارخانه یا کارگاه

د- سوابق گواهی حسن انجام کارهای مشابه

ه- پروپوزال توانمندی متقاضی در خصوص موضوع فراخوان

و- توان مالی(صورت های مالی حسابرسی شده در ۵ سال گذشته یا اظهارنامه های مالیاتی/فیش بیمه هایتامین اجتماعی پرداخت شده یا علی الحساب پرداخت شده در ۵ سال گذشته/ فیش مالیات های پرداخت شده در ۵ سال گذشته)

ز- توان فنی و برنامه ریزی(چارت سازمانی-مشخصات و مدارک اعضای هیات مدیره و نفرات کلیدی با مدارک تحصیلی)

۳. شرکتهایی که قصد ارائه مدارک را دارند بر روی پاکت ارسالی موضوع و شماره فراخوان را مندرج نمایند.

۴. پیشنهاد دهندگان می بایست اعلام آمادگی و نماینده فنی (با قید شماره تماس مستقیم) خود را بصورت مکتوب اعلام و بهمراه مدارک ارسال نمایند.

۵. شرکتهای متقاضی در صورت نیاز به اطلاعات بیشتر ، جهت سوالات فنی میتوانند با شماره تلفن:(۰۶۱۵۲۱۲۶۴۷۷) (۰۹۱۶۵۷۷۹۲۱۴ آقای بشارتی) و جهت تحویل مدارک با کمیسیون معاملات با تلفن: ۰۶۱۵۲۱۲۶۴۷۷ تماس حاصل نمایند.

۶. به پاکت ارسالی متقاضیانی که پس از تاریخ مندرج در بند ۲ آگهی تحویل گردد ترتیب اثر داده نخواهد شد و عیناً عودت می گردند.

توضیح : لازم به ذکر است این آگهی فقط به منظور شناسایی شرکتهای توانمند در خصوص موضوع فرخوان می باشد.

Krupp Uhde	Piping PIPING OF GLASS-FIBRE-REINFORCED PLASTICS (FRP) BASED ON POLYESTER UNSATURATED RESINS, WITH AND WITHOUT LINING Technical specification	UN 3030-16 Part 1

Rohrleitungen; Rohrleitungen aus glasfaserverstärkten Kunststoffen (GFK) auf Basis von UP-Harzen mit und ohne Auskleidung; Technische Lieferbedingungen

Supersedes 97-02

This standard was elaborated by

BASF Aktiengesellschaft
Bayer AG
Chemische Werke Hüls AG
Hoechst Aktiengesellschaft
Th. Goldschmidt AG
Krupp Uhde GmbH
and members of AVK (Arbeitsgemeinschaft Verstärkte Kunststoffe e.V.) Association of reinforced plastics)

under the chairmanship of Krupp Uhde GmbH.

Other companies are free to adopt the unmodified version of this standard provided that the procedures specified in the supplement to this standard are observed.

This supplement, which is distributed on request only, lists all companies who have adopted this standard.

Contents

Continued on pages 2 to 7

Date	Prepared	Date	Checked	Date	Approved
01.06.2001	Hoffmann	10.06.2001	Müller	11.06.2001	Hülsen

Technical discipline: Piping

1 Scope

This standard applies to wound pipes, pipe joints and fittings of glass-fibre-reinforced plastics on the basis of unsaturated polyester resins (UP-GF), vinyl ester resins and het acid resins, hereinafter generally termed UP resins, with and without lining, according to the dimensions specified in DIN 16965 and DIN 16966 et seq.

This technical specification is based on DIN standards 16964, 16867 and 16966 Parts 1 and 7. In addition to this standard, all applicable regulations and accepted engineering practices shall be observed, particularly the codes and standards listed as well as the processing instructions of the resin manufacturers.

This technical specification covers additional, supplementary or deviating requirements with respect to the stipulations contained in the quoted DIN standards.

If the requirements of this standard are in contradiction with those specified in the purchase order, the latter shall take precedence.

If the manufacturer desires or has to deviate from the requirements specified below, he shall obtain prior written approval of the orderer. This standard does not absolve the manufacturer from his full responsibility for the design and fabrication of the pipes.

2 Requirements

2.1 Materials

2.1.1 Pipes and fittings

The requirements as per DIN 16964 and DIN 16966 Part 1 shall be met.

The type of UP resin used depends on the chemical and thermal stress. Different types of resin may be used for the inner coating, carrying laminate wall and for the surface covering. The desired types of resin are specified in the purchase order. The glass content depends on the structure of the laminate (see 2.2 - Laminate structure). Hydrolysis-proof glass-fibre non-wovens of C and E-CR glass shall be used as well as textile glass mats and textile glass fabrics of E or E-CR glass, each with a suitable binder (e.g. polyester powder) and suitable size (e.g. Metacrylsilane) according to the technical delivery conditions outlined in DIN 61853 Part 1, DIN 61854 Part 1 and DIN 61855 Part 1. Emulsified mats are not permitted.

Liner: The requirements as per DIN 16965 Part 2, para. 3.2, shall be met.

Lined fittings shall be seamless and extensively stress-relieved. Other types shall be as agreed upon with the orderer.

2.1.2 Collars and flanges

The requirements as per DIN 16966 Part 7 shall be met.

Collars and loose flanges of glass-fibre-reinforced plastics or loose flanges of steel with surface protection according to the purchase order shall be used. (Fixed flanges of UP-GF shall only be used if agreed upon.)

2.2 Laminate structure

2.2.1 Pipe type A

The inner coating of the pipes and fittings of max. 1 mm thickness shall comprise a resin layer of 0.2 mm to 0.4 mm thickness, reinforced by C glass non-wovens (min. 25 g/m^2.). The further build-up shall consist of textile glass mats. Rovings or fabrics are not permitted.

Measures shall be taken to prevent the curing of the inner coating from being affected by air. A structure comprising rovings only is not permitted. Complete adhesion over the entire surface area shall be ensured between inner coating and carrying body.

The glass content, referred to the entire wall thickness, shall be min. 45%. The carrying body shall be fabricated by the manufacturer to meet the requirements according to Section 3 (Mechanical strength).

The surface covering shall comprise a layer of C glass non-wovens or synthetic non-wovens and a weatherproof and temperature-resistant resin layer of 0.2 mm thickness. The laminate shall be free of cracks and virtually free of pits. Its structure shall be uniform over the entire length and circumference of the pipes and fittings.

2.2.2 Pipe type B

The laminate structure shall correspond to DIN 16965 Part 2, para. 3. For pipes with a liner of PVC-U or PVC-C, the outside surface of the liner shall be cleaned and roughened. Thereafter, a bonding layer consisting of a

suitable special resin, reinforced by textile glass mats, shall be applied.

In the case of PP-H and PE liners, the outside surface shall be plasticized after cleaning and a layer of wide-meshed fabric (approx. 50% open area) shall be incorporated into the surface to attain a good mechanical bond between the fabric and the liner. (Overheating shall be avoided.) Embedding of the fabric shall be such as to attain the shear strength specified in DIN 16964, para. 3.9, for the bond between liner and carrying laminate (see Figure 1).

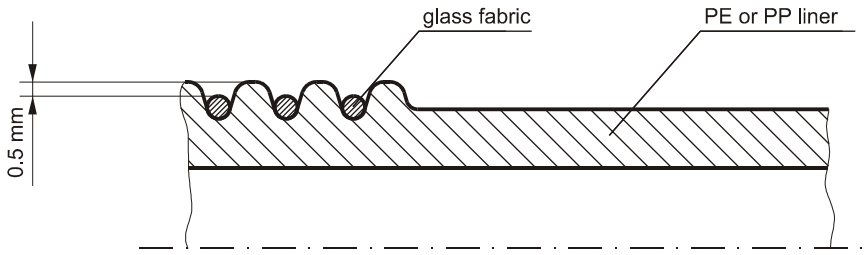

Figure 1.

The shear strength specified in DIN 16964 for the bond may also be attained by chemical pre-treatment of the outer surface of the liner material, e.g. in the case of PVDF.

After proper pre-treatment of the liner, the build-up of the carrying laminate shall be started with a mat. This shall be followed by placing further mats and/or fabrics and/or rovings of textile glass on top of this base mat until the required wall thickness has been obtained and the requirements according to Section 3 (Mechanical strength) have been met. A structure comprising rovings only is not permitted. Complete adhesion over the entire surface area shall be attained between liner and carrying laminate.

The surface covering shall comprise a layer of C glass non-wovens or synthetic non-wovens and a weather-proof and temperature-resistant resin layer of max. 0.2 mm thickness.

For pipes and fittings which are to be subsequently rubberlined, the inner layer shall consist of a wide-meshed fabric (approx. 50% open area) or a textile glass mat (450 g/m^2. and 20 tex). The further build-up of the laminate shall be as described above.

The laminate shall be free of cracks and virtually free of pits. Its structure shall be uniform over the entire length and circumference of the pipes and fittings.

2.2.3 Pipe type D

The inner coating (chemoresistant coating) of the pipes and fittings of min. 2.5 mm thickness shall comprise a resin layer of 0.2 mm to 0.4 mm thickness, reinforced by C glass non-wovens. The further build-up shall consist of textile glass mats. Rovings or fabrics are not permitted. The glass content shall be between 25 and 35% by weight and shall be distributed uniformly over the entire circumference and shall increase radially from the inside to the outside. Measures shall be taken to prevent the curing of the inner coating from being affected by air. Complete adhesion over the entire surface area shall be ensured between inner coating and carrying body.

The carrying body shall be fabricated by the manufacturer to meet the requirements specified in Section 3 (Mechanical strength). A structure comprising rovings only is not permitted.

The surface covering shall comprise a layer of C glass non-wovens or synthetic non-wovens and a weather-proof and temperature-resistant resin layer of 0.2 mm thickness. The laminate shall be free of cracks and virtually free of pits. Its structure shall be uniform over the entire length and circumference of the pipes and fittings.

2.2.4 Pipe type E

The inner coating of the pipes and fittings shall comprise a resin layer of approx. 0.4 mm thickness, reinforced by C glass non-wovens. The further build-up shall consist of textile glass mats. For wall thicknesses of &gg. 6.5 mm, fabrics may also be used as a reinforcement after a layer thickness of approx. 3 mm has been reached. The glass content, referred to the entire wall thickness, shall be between 30 and 40% by weight and shall be distributed uniformly over the entire circumference. Measures shall be taken to prevent the curing of the inner coating from being affected by air.

The entire pipe wall shall be fabricated by the manufacturer to meet the requirements specified under 3 (Mechanical strength). Complete adhesion over the entire surface area shall be ensured between inner coating and carrying body.

The surface covering shall comprise a layer of C glass non-wovens or synthetic non-wovens and a weather-proof and temperature-resistant resin layer of max. 0.2 mm thickness.

The laminate shall be free of cracks and virtually free of pits. Its structure shall be uniform over the entire length and circumference of the pipes and fittings.

2.3 Collars and loose flanges

Collars and loose flanges shall be fabricated to meet the requirements specified in DIN 16966 Part 7. Complete adhesion over the entire surface area shall be ensured between the collar and the pipe or fitting. When using bondable collars, the transition of the pipe to the tapered shoulder of the collar shall be smoothed. If, owing to special stresses or requirements to be met by bondable collar sleeves, an overlaminate is required at the shaft end, its length should not exceed one third of the shaft length. This overlaminate shall be covered with C glass non-wovens.

For pipes without a liner, the structure of the collar sealing face shall correspond to the inner coating of the pipe, reinforced by textile glass mats.

For pipe type B, the liner shall be folded back over the sealing surface of the collar without making a face joint. Other types shall be agreed upon with the orderer.

2.4 Laminated joints

The requirements as per DIN 16966 Parts 7 and 8 shall be met.

2.4.1 Pipe types A, D and E

The ends of the pipes and fittings to be joined shall be machined to size and checked for perpendicularity and concentricity. The butt ends of the components shall be sealed with the appropriate type of resin, joined and cemented with filler material. The materials used shall have the same resistance to thermal and chemical stresses as the the piping material.

After the cemented joint has set sufficiently, a resin coating shall be applied to the surfaces to be laminated. The laminate structure shall be built up further by placing at least one textile glass mat on top of the resin coating. This shall be followed by the carrying body comprising further textile glass mats and fabrics until the required wall thickness has been attained and the requirements according to Section 3 (Mechanical strength) have been met.

The surface covering shall comprise a layer of C glass non-wovens or synthetic non-wovens and a weather-proof and temperature-resistant resin layer of 0.2 mm thickness.

For fittings DN 300 and larger, and pipes DN 600 and larger, the butt joints (also for branches) shall be provided with an inner laminate comprising a textile glass mat and a layer of resin, reinforced by C glass non-wovens, of approx. 0.4 mm thickness, and cured under the exclusion of air (by adding paraffin, if necessary). The components shall not contain any fabrics. The surface shall be roughened prior to the application of the inner laminate.

2.4.2 Pipe type B

The ends of the pipes and fittings to be joined shall be machined and checked for perpendicularity and concentricity.

The ends of the liner to be joined by welding shall be free of resin and glass. PVC-U or PVC-C liner shall normally be welded using hot gas and filler material. The butt ends shall be prepared for welding in accordance with DIN 16960 Part 1. The filler material shall be of the same quality as the base material. Liners of PE and PP shall be joined by hot- tool welding (see DIN 16960 Part 1).

The welds shall only be performed by welders qualified according to DVS. The welded joints shall be tested according to DVS specification 2203 and subjected to a leakage test. For this purpose, the weld shall be backed with a permanently conductive material. The welding efficiency factor measured during the short-time test shall not be less than 0.9 for hot-tool welding and 0.8 for hot-gas welding.

In general, the welded joint shall not be dressed. If dressing is required, even minor notches in the weld and in the base material shall be avoided during this process in order to prevent breakage.

After completion of the weld, the laminate shall be built up as described under 2.2.2 (Pipe type B). Unevenness, if any, within the area of the weld shall first be smoothed using filler or mat strips. Complete adhesion over the entire surface area shall be ensured between liner and overlaminate.

2.5 Residual styrene content, behaviour under the influence of chemicals or fire
The requirements as per DIN 16964 and DIN 16966 Parts 1 and 7 shall be met.

2.6 Surface finish
The requirements as per DIN 16964 and DIN 16966 Parts 1 and 7 shall be met.

The sealing surfaces of the collars shall be sufficiently even so as to ensure the tightness of the joint according to the requirements. For pipes which are to be subsequently rubberlined, the surfaces to be rubberlined shall have no sharp edges (see DIN 28051).

2.7 Dimensions and permissible tolerances
The dimensions of pipes, joints and fittings are specified in the DIN standards. The wall thicknesses shall not fall short of those specified in these standards. The wall thickness of the liner (pipe type B) pulled over the collar sealing surface shall not be less than 30% of the wall thickness of the liner.

2.8 Perpendicularity
The permissible deviations of the sealing faces and of the ends of pipes and fittings from the plane perpendicular to the pipe axis are specified in DIN 16966 Part 7.

For pipe bends and tees, the deviations shall be understood as the max. permissible total deviations.

2.9 Behaviour when stored in a warm box
After storage in a warm box, the behaviour of thermoplastic liners shall meet the quality requirements of the piping material concerned.

2.10 Delivered state
The requirements as per DIN 16964 and DIN 16966 Parts 1 and 7 shall be met.

If pipes are pre-fabricated according to isometric drawings, the orderer shall specify the necessary field joints in the isometric drawings. Pipes shall have as circular a cross section as possible and be straight and not tapered. Pipe fittings may only be fabricated from segments if expressly specified. All UP-GF cutting edges and machined surfaces shall be sealed. The pipes shall not be dyed.

The following applies to laminated joints:

If possible, pipes and fittings shall be delivered with unlaminated ends and be provided with an additional length of 200 mm. The pipe ends shall be cut perpendicularly to the pipe axis.

3 Mechanical strength
3.1 General
The requirements as per DIN 16964 and DIN 16966 Parts 1 and 7 shall be met.

3.2 Shear strength
The interlaminar shear strength shall be at least be 8 N/mm^2.. Complete adhesion over the entire surface area shall be attained between resin-rich inner coating and carrying laminate, between overlay sleeve and pipe or fitting, and between collar and pipe or fitting when using bondable collars.

The shear strength shall be at least 8 N/mm^2. at all bonding surfaces.

3.2.1 Pipe type B
The requirements as per DIN 16964 and DIN 16966 Part 7 shall be met.

3.3 Strength of loose flanges of glass-fibre-reinforced plastics
The flanges shall withstand the bolt tightening torques specified in DIN 16966 Part 7 without any fracture.

4 Tests
4.1 General
The number of pipes, fittings and pipelines to be tested shall be agreed upon between between manufacturer and orderer. The purpose of the test is to determine whether the requirements according to 3 (Mechanical strength) are met.

DIN 16964 and DIN 16966 Parts 1 and 7 apply to the performance of the tests.

4.2 Shear strength

The interlaminar shear strength and the shear strength shall be tested between resin-rich inner coating and the carrying laminate, between the overlay sleeve and the pipe wall, and between collar and pipe wall if bondable collars are used.

The values for interlaminar shear strength specified under 3.2 (Shear strength) shall be attained when performing a tensile test as per EN ISO 14130.

All other values specified under 3.2 (Shear strength) shall be attained when performing a ring shear test.

For pipe type B, the test shall be performed as per DIN 53769.

For pipe types A, D and E, the test shall be performed according to the arrangements shown in Figure 2.

Test specimens and test arrangements:

a) between collar and pipe or fitting (arrangement 1)

b) between carrying laminate and overlaminate or between carrying laminate and resin-rich inner coating (arrangement 2)

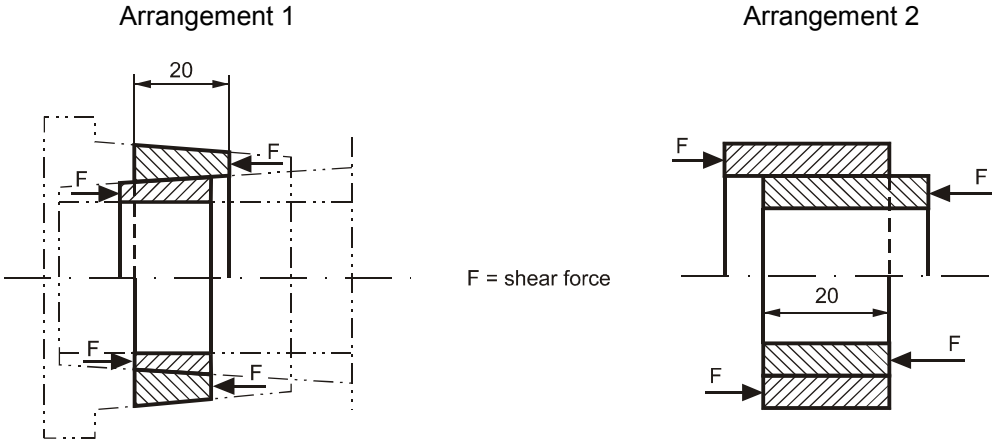

Figure 2

When testing the joint between collar and pipe or fitting, the compressive force shall be applied towards the larger outside diameter of the pipe.

4.3 Tightness of the weld of lined pipe fittings

Normally, the tightness of the weld shall be tested in a HV test.

4.4 Certification

If agreed upon, works certificates shall be issued as per EN 10204 for all tests performed in the manufacturer's works.

5 Marking

Pipes and fittings fabricated according to this standard shall be marked as per DIN 16867, para. 7. Marking shall be effected close to the joint and covered with a resin-impregnated non-woven.

Reference standards

DIN standards

DIN 16867 : 1982-07	Glass-fibre-reinforced polyester resin (UP-GF) pipes, fittings and joints for use in chemical pipelines; technical delivery conditions
DIN 16960 Part 1 : 1974-02	Welding of thermoplastics; principles
DIN 16964 Part 1 : 1988-11	Wound glass-fibre-reinforced polyester resins (UP-GF), pipes; general quality requirements and testing
DIN 16965 Part 1 : 1982-07	Wound glass-fibre-reinforced polyester resin (UP-GF); pipes, type A pipes; dimensions
DIN 16965 Part 2 : 1982-07	Wound glass-fibre-reinforced polyester resin (UP-GF); pipes, type B pipes; dimensions
DIN 16965 Part 4 : 1982-07	Wound glass-fibre-reinforced polyester resin (UP-GF); pipes, type D pipes; dimensions
DIN 16965 Part 5 : 1982-07	Wound glass-fibre-reinforced polyester resin (UP-GF); pipes, type E pipes; dimensions
DIN 16966 Part 1 : 1988-11	Glass-fibre-reinforced polyester resin (UP-GF) pipe fittings and joint assemblies; fittings; general quality requirements and testing
DIN 16966 Part 2 : 1982-07	Glass-fibre-reinforced polyester resin (UP-GF) pipe fittings and joints; elbows; dimensions
DIN 16966 Part 4 : 1982-07	Glass-fibre-reinforced polyester resin (UP-GF) pipe fittings and joints; tees, nozzles; dimensions
DIN 16966 Part 5 : 1982-07	Glass-fibre-reinforced polyester resin (UP-GF) pipe fittings and joints; reducers; dimensions
DIN 16966 Part 6 : 1982-07	Glass-fibre-reinforced polyester resin (UP-GF) pipe fittings and joint assemblies; collars, flanges, joint rings; dimensions
DIN 16966 Part 7 : 1995-07	Glass-fibre-reinforced polyester resin (UP-GF) pipe fittings and joint assemblies; bushings, flanges, flanged and laminated joints; general quality requirements and testing
DIN 16966 Part 8 : 1982-07	Glass-fibre-reinforced polyester resin (UP-GF) pipe fittings and joints; laminated joints, dimensions
DIN 28051 : 1997-07	Chemical apparatus; Organic coatings and linings on metal components; Design of metal components
DIN 53769 Part 1 : 1988-11	Testing of glass-fibre-reinforced plastics pipes; determination of the longitudinal shear strength of type B pipe fittings
DIN 61853 Part 1 : 1987-04	Textile glass; textile glass mats for plastics reinforcement; technical delivery conditions
DIN 61854 Part 1 : 1987-04	Textile glass; woven glass fabrics for plastics reinforcement; woven glass filament fabric and woven roving; technical delivery conditions
DIN 61855 Part 1 : 1987-04	Textile glass; glass roving for plastics reinforcement; technical delivery conditions

EN standards

EN 10204 : 1991 + A1 : 1995	Metallic products; Types of inspection documents
EN ISO 14130 : 1997	Fibre reinforced plastic composites – Determination of apparent interlaminar shear strength by short beam-method.

Uhde	Erection WELDING AND LAMINATION OF PLASTIC PIPING	UN 9253-07 Part 1

Montage; Schweißen und Laminieren von Kunststoff-Rohrleitungen Supersedes 02-03

Contents

1 Scope

This Uhde standard applies to the engineering and construction of industrial and chemical plants. It contains requirements for the fabrication to the joining of plastic piping components by welding and lamination. It contains general requirements which will be extended by specific instructions, if necessary. The instructions of the pipe manufacturers shall take precedence.

Deviations from this Standard shall be agreed between the Orderer and the Contractor in writing.

2 Units

The following units will be used:

Table 1. **Units**

General	SI units
Dimensions	mm

Continued on pages 2 to 14

Date	Prepared	Date	Checked	Date	Approved
25.09.2003	Kuhnke	25.09.2003	Hamelbeck	26.09.2003	Saalbach

3 Technical documents

The applicable standards, the essential welding data and the detailed instructions for joining fiber-glass-reinforced plastic piping (lamination) are summarized in a welding data sheet / technical specification.

As regards the handling and processing of plastic materials, the relevant standards (e.g. monitoring of the threshold values of noxious substances at work areas, ventilation of work areas, extraction of plastic dust) and the pipe manufacturer's instructions shall be observed.

For the storage of piping components and welding / lamination materials, UN 9250-01 Part 1 "Warehousing" shall apply.

4 Personnel

4.1 Qualification

The Contractor may only employ personnel who are familiar with the processing of plastics and who have passed a course of instruction in plastics processing.

Prior to the assignment of the personnel, a qualification test shall be performed in accordance with the specified standard. For it pipe sections / plates supplied by the Orderer shall be welded together. In order to assess the qualification, standard specimens shall be cut out of the welded pipe sections / plates and these shall then be subjected to destructive tests according to section 6.6.3. The assessment of the test specimen shall be documented in writing. The personnel shall not be entrusted with any work until the test specimens have been duly assessed and approved. Should the test results be negative, one re-test is admissible after appropriate re-training. The Contractor shall be responsible for cutting out and testing the specimens.

4.2 Identification symbols

After qualification, welders and laminators shall be issued with an identification card and an identification symbol. Unless otherwise agreed, the identification symbol shall be used for identifying all joints made by the particular welder or laminator, respectively. A color pen with weather-proof ink (e.g. felt pen) or weather-proof stickers shall be used for identification. The ink and adhesives must not attack the base material.

4.3 Supervision

For quality assurance and quality control, weld preparations and joining shall be supervised by the site management. The site management may permit deviations from this Standard on site.

The Contractor shall be responsible for the continuous supervision of his work. A piping specialist with proven experience in the processing of plastics shall be assigned by the Contractor for this task.

5 Work restrictions

Work on plastic pipelines shall only be performed under conditions which ensure that all requirements are met. The work shall be subjected to closer supervision at low temperatures and under inclement weather conditions. The following requirements shall be met:

- at temperatures < 5 °C and > 45 °C, welding shall only be allowed if the work area is adequately heated or cooled, respectively,
- the surface temperature of the material shall be at least 3 °C above the dew point of the ambient air,
- during periods of intense solar radiation, in rainy weather, during snowfall or under dusty conditions, the work area shall be adequately protected,
- in stormy weather and draught in the pipeline during welding, suitable protection shall be provided (e.g. covers on pipe ends).

These measures shall be anticipated and agreed with the site management. Any measures taken shall not restrict the personnel's mobility.

6 Welding

6.1 General notes

Prior to the commencement of welding operations, the following welding parameters shall be checked with regard to the chosen welding procedure and be documented, if specified:

- characteristics of the welding machinery,
- type of base material,
- pipe wall thickness,
- temperature of the heated tool,
- welding pressure,
- welding gas temperature,
- welding gas volume,
- environmental conditions.

The temperature shall be continuously monitored with the aid of a fast-display digital gauge. The temperature of the heated tool shall be monitored at several places on both sides of the tool. In the case of hot-gas welding, the temperature shall be measured about 5 mm deep in the gas stream within the nozzle. The gauge shall be equipped with suitable sensing elements.

To attain thermal equilibrium, the heated tool shall not be applied until 10 minutes after reaching the required temperature. The permissible temperature variation depends on the base material.

Load cells are suitable for monitoring the welding pressure.

The wall thickness of the components to be joined by welding shall be the same in the area of the weld. The contact surfaces of the components to be welded shall be machined (e.g. by cutting, planing, scraping, milling) as required for the welding procedure applied. The mismatch of the components on the outside may not exceed 10 % of the wall thickness. The contact surfaces shall be machined such as to render them plane and parallel. The components to be joined shall be aligned co-axially.

Components, the surfaces of which are damaged by erosion or chemical attack, shall be machined down to sound material.

The surfaces in the area of the joint shall be free of foreign matter (e.g. glass fabric, hand perspiration). Immediately prior to welding, these surfaces shall be cleaned with a scraper, the welding nozzles with a hand brush, and the heated tools with a degreasing agent (e.g. technically pure spirit) and an absorbent non-fraying paper.

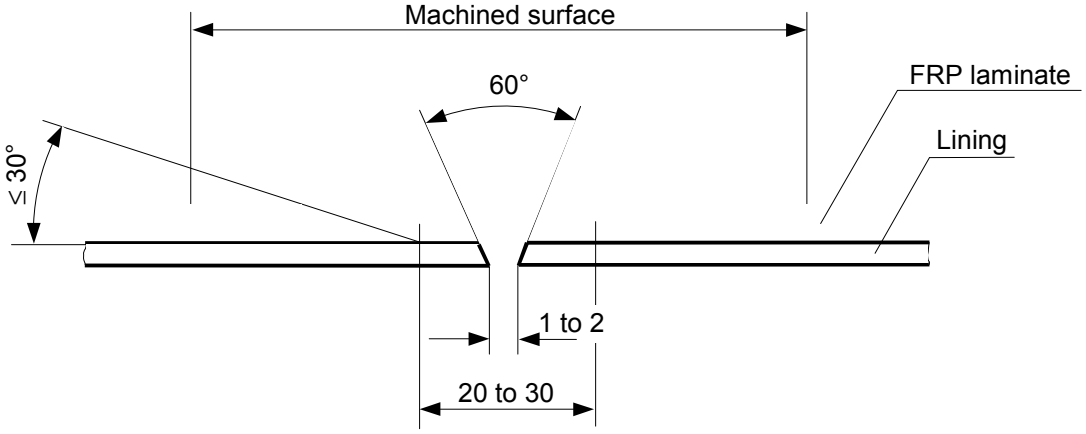

Figure 1. Weld preparation for hot-gas welding

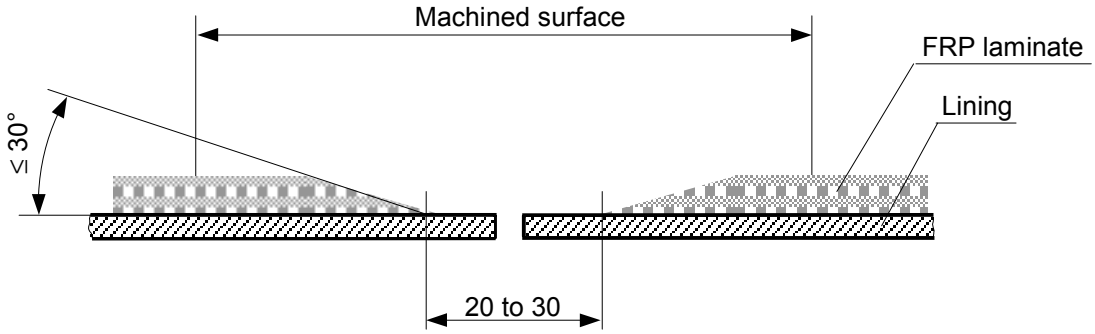

Figure 2. Weld preparation for heated-tool butt welding

6.2 Welding procedures

Irrespective of the welding procedure employed, only identical base metals may be joined by welding. To ensure an optimum joint, the components to be welded and the filler material shall be in a permissible melt index range (MFR = Melt Flow Rate). The welding zone shall be free of bending stress.

The welding procedures listed in Table 2 are approved for field welding. If the base material is suitable, all butt joints should be welded by means of the heated-tool welding (HS) method. Depending on the situation on site, exceptions may be agreed upon between the Orderer and the Contractor.

Table 2. **Approved welding procedures**

Welding procedure	Code	Material					
		PE-HD	PP-B	PP-H	PVC-U	PVC-C	PVDF
Heated-tool butt welding	HS	x	x	x		x	x
Hot-gas extrusion welding	WE	x	x	x			
Hot-gas welding with torch separate from filler rod	WF				x	x	
Hot-gas string-bead welding	WZ	x	x	x	x	x	x

Welds in piping without FRP laminate shall not be machined after welding. Welds in piping with FRP laminate shall be machined free of notches down to the pipe outside diameter after a visual examination.

Operating manuals and maintenance instructions for all machines and devices used shall be available on site. These documents shall include information about welding parameters and areas of usage as well as clearly understandable operating instructions.

6.3 Heated-tool butt welding (HS)

Piping components and plates with standard commercial wall thickness may be joined by heated-tool butt welding. The components to be joined shall be heated to the welding temperature in the welding zone and joined under pressure without any kind of filler material. This results in a homogeneous joint.

The welds shall be performed with suitable welding machines approved by the Orderer. The machines shall be capable of the following functions:

- clamping of the components to be welded,
- plane-parallel work on the joint areas,
- heating of the fusion faces by means of heated tools,
- generating the welding pressure by means of a hydraulic or mechanical device.

The specified welding parameters shall be verifiable. Readings of the parameters shall be taken and documented in a welding record, if specified.

Prior to the commencement of welding, the melt flow rate (MFR) and the correspondence of wall thickness in the welding zone shall be verified in particular.

Table 3. **Melt flow rate**

Material	Melt flow rate g/10 min	Permissible melt index values
PE	190/5	0.3 to 1.7 g/10min
PP	190/5	0.4 to 1.0 g/10min
PVDF	230/5	1.0 to 25 g/10min

6.4 Hot-gas welding

6.4.1 Hot-gas extrusion welding (WE)

Hot-gas extrusion welding is suitable for welding of piping components and plates with a wall thickness > 10 mm. The components to be joined shall be heated to the welding temperature in the welding zone by means of hot gas and joined under pressure with a filler material. This results in a homogeneous joint. The hot gas for welding (as a rule air) shall be free from water, dust and oil.

The welds shall be performed with suitable welding machines approved by the Orderer. The machines shall be capable of the following functions:

- plasticize the filler material (wire or granulate),
- preheating of the fusion faces,
- welding of the seams with a suitable extruder and a welding shoe adapted to the type of weld.

The specified welding parameters shall be verifiable. Readings of the parameters shall be taken and documented in a welding record, if specified.

The extruder is placed onto the tacked joint by means of the welding shoe. The fusion faces are heated to the welding temperature by means of hot gas and the homogeneous plasticized filler material is pressed into the welding groove. The emanating material pushes the device forward and thus determines the welding rate. This means that the heating of the fusion faces and the welding rate have to be precisely attuned.

After welding, the weld has to be protected against excessively rapid cooling.

6.4.2 Hot-gas welding with torch (WF) / Hot-gas string-bead welding (WZ)

Hot-gas welding with torch separate from filler rod and hot-gas string-bead welding are suitable for welding of piping components and plates with a wall thickness of up to approximately 10 mm. Hot-gas string-bead welding shall be the preferred method. The fusion faces of the components to be joined and the exterior zones of the filler material are plasticized by means of hot gas and joined under pressure. This results in a homogeneous joint. The hot gas for welding (as a rule air) shall be free from water, dust and oil.

The welds shall be performed with suitable welding machines approved by the Orderer. The machines shall be capable of the following functions:

- supply of the hot gas by stationary or movable blowers,
- pressure control of the hot gas,
- electronically controlled heating of the hot gas (heating cartridges),
- attachment of suitable welding nozzles.

In the case of hot-gas welding with torch separate from the filler rod (WF), a hot gas streams out of the round nozzle. The nozzle shall be moved in a weaving motion in the direction of the weld in order to distribute the hot gas flow evenly over the base and filler material. The filler material shall be forced in the direction of the weld by pressing it against the surface as perpendicularly as possible. The filler material may neither be stretched nor compressed and shall only be heated in its lower curved part. A “bow wave” forms in front of the filler material and a weld border on either side.

In the case of hot-gas string-bead welding (WZ), the filler material is heated in the nozzle and pressed into the welding groove with a beak-like attachment at the lower end of the nozzle. The cross-section of the welding nozzle shall correspond to that of the filler material. Only circular cross-sections are admissible for the filler material.

The welding nozzle is moved forward and the filler material is simultaneously drawn after it under controlled pressure. The filler material may neither be stretched nor compressed. The welding rate is approximately 3-4 times higher than that of the hot-gas welding with torch, the pressure distribution and the temperature distribution are more uniform.

A V-butt weld is normally specified for both welding procedures. Prior to welding of PP, the filler material shall be cleaned by scraping. For all other base materials the cleaning of the filler material is recommended.

The root pass shall be welded with a filler rod of 3 mm in diameter. The root pass shall be checked for leakage according to section 6.6. The following weld layers may be performed with a larger diameter of the filler rod. The welding zone shall be cleaned before applying a new pass. Care shall be taken during cleaning that no notches or score marks are created. A sealing run shall be welded from the inside whenever possible.

In the case of PMMA and PVC-C base materials, the welds shall be subjected to thermal post-treatment.

6.5 Quality of the welds

If no standards are specified for the assessment of the weld seam quality, the bulge shall be of uniform shape over the entire length of the seam. Influences detrimental to the quality of the seam shall already be prevented during welding. Such influences might be:

- welding rates that are excessively rapid or slow will result in insufficient bulge and inadequate fusion,
- excessively high welding temperatures cause staining, deformation or foamy bulge,
- excessively low temperatures cause vitreous patches and no weld border,
- excessively high welding pressures result in deformed or excessive bulge,
- excessively low welding pressures result in inadequate or no bulge,
- root defects (no penetration, notches, gas pores, inclusions),
- defects in filler and cover passes (notches, gas pores, inclusions),
- mismatch.

Subsequent repairs are permissible with the approval of the site management only.

6.6 Examination of welds

If not specified by standards, the extent of the weld examination will be stipulated by the Orderer. The minimum requirements according to sections 6.6.1 to 6.6.3 shall be met. Performed examinations require documentary evidence. Special examinations shall be agreed between the Orderer and the Contractor.

6.6.1 Visual examination

The exterior of all welds and, if possible, the interior of the welds shall be subjected to a visual examination (properly filled weld, surface condition, full penetration of the root pass, mismatch of the welded components) before any other test. Visual examinations shall be performed during weld preparation and welding.

Welds shall be assessed in accordance with the quality criteria described under section 6.5.

6.6.2 Non-destructive testing

For all welding procedures, a completed joint shall be tested for leaks prior to any further processing. In the case of hot-gas welding, every root weld shall be additionally tested for leaks.

Leakage testing shall be performed with high voltage according to Table 4. The manufacturer's operating instructions (e.g. persons with cardiac pace-makers may not perform the tests) and any statutory regulations shall be complied with.

For the purpose of high-voltage testing, an electrically conducting object (e.g. a metal strip with string for withdrawal after the test) shall be attached to the inside of the weld. At the specified voltage the electrode connected to the test set shall be moved at a uniform rate at a distance of approx. 5 mm over the weld. An electric arc is formed along with increased crackling whenever the electrode is moved over a permeable area.

Welds that cannot be subjected to a high-voltage test shall be leakage-tested according to UN 9253-21 Part 1 "Pressure and leakage testing of piping". The test pressure should be ≤ 0.1 bar. The welds shall be coated with a soap solution.

Ultrasonic or radiographic examinations may be specified in special cases.

Table 4. **Test voltages for high-voltage testing**

Material	Test voltage in kV	Test speed in cm/s
PE, PP, PVC	15 kV + 5 kV/mm wall thickness	max. 40
PVDF, FEP, ECTFE, PFA	10 kV + 5 kV/mm wall thickness	max. 40
All materials with a wall thickness > 10 mm	max. 55 kV	

Objects inserted into the piping components for test purposes shall be removed completely.

6.6.3 Destructive testing

During the welding operations, the Orderer shall be entitled to request the preparation of 2 test welds from each welder. Test specimens shall be cut out of these test welds and be subjected to destructive testing. The following destructive test methods may be used according to DVS 2203-1:

- technological bending test,
- tensile test,
- tensile impact test,
- tensile creep test.

Upon the Orderer's special demand, completed welds may be cut out of a pipeline for the purpose of obtaining test specimens. Only if deficiencies that are attributable to the Contractor are discovered during the subsequent testing of the specimens the Contractor will be made responsible for

- cutting out the pipe section with the weld,
- preparation of the test specimens,
- testing of the test specimens,
- installation and welding of a new pipe section.

In the technological bending test, a standard test specimen shall be bent by a standard procedure until rupture. The bending angle thus determined shall be compared with specified minimum bending angles in dependence on the material, the material thickness and the welding procedure applied. The comparison provides data on the quality attained.

In the various tensile tests, a standard test specimen shall be tested by a standard procedure until destruction of the welded joint as a result of tension or impact. The quotient of the tensile strength of the welded joint and the tensile strength of the base material (welding efficiency factor) shall be compared with the welding efficiency factor specified in Table 5. The comparison provides data on the quality attained.

Table 5. **Minimum welding efficiency factors**

Welding procedure	Welding efficiency factors					
	PE-HD	PP	PVC-C	PVC-HI	PVC-U	PVDF
Heated-tool butt welding	0.9	0.9	0.8	0.9	0.9	0.9
Hot-gas welding	0.8	0.8	0.7	0.8	0.8	0.8

Destructive testing procedures may only performed by approved institutions experienced in such procedures. The Contractor is responsible for preparing the test specimens, whereas the Orderer is responsible for providing the pipe sections / plates and the performance of the tests. Section 6.6.4 applies to the enhanced scopes of testing.

The site management may permit simplified bending tests. Five test specimens of identical dimensions (20 to 30 mm wide) shall be cut out of the weld specially made for testing. The test specimen shall be placed onto two rollers spaced at a specified distance. A mandrel with a rounded tip shall be used to bend the test specimen at a uniform rate up to commencement of the rupture. The bending angle can be derived from the mandrel displacement and the distance between the rollers. The bending angle thus determined shall be compared with the minimum bending angles specified in Table 5 in dependence on the material, the material thickness and the welding procedure applied.

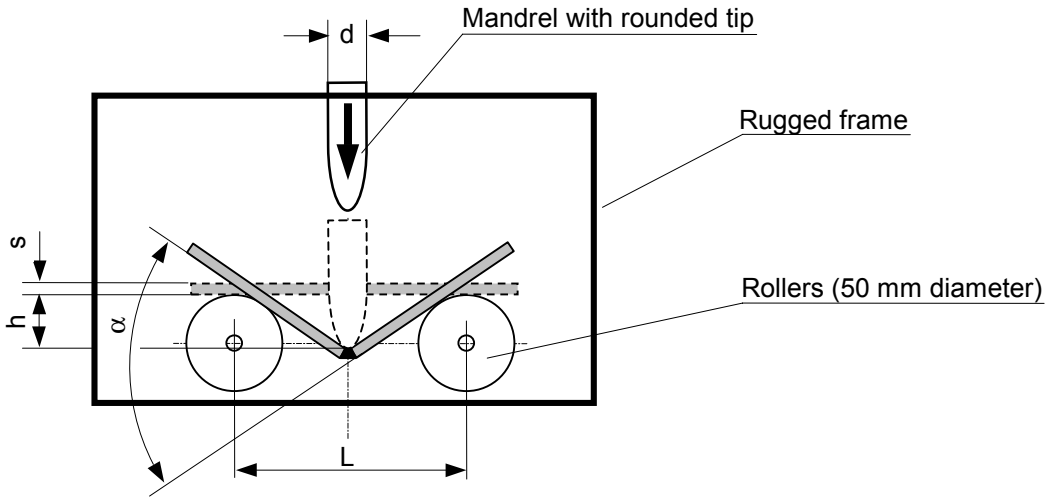

Figure 3. Simplified bending device

Table 6. **Minimum bending angle**

Bending displacement / bending angle (according to DVS 2203-5)					
Bending mandrel	**4**	**4**	**8**	**8**	**8**
Support spacing L	**80**	**80**	**90**	**90**	**90**
Specimen thickness s	**4**	**≤ 5**	**6**	**8**	**≤ 10**
Bending displacement s in mm			**Bending angle α**		
1	2	2	2	2	2
2	5	5	5	5	5
3	8	8	7	7	7
4	11	11	10	10	10
5	15	15	13	13	13
6	18	18	16	16	16
7	21	21	18	18	18
8	24	24	21	21	21
9	27	28	24	24	24
10	31	31	27	27	27
11	34	34	30	30	30
12	38	38	33	33	34
13	41	41	36	36	37
14	44	45	39	39	40
15	48	48	42	43	43
16	51	52	45	46	46
17	55	55	48	49	50
18	58	59	51	52	53
19	62	63	55	55	56
20	65	66	58	59	60
21	69	70	61	62	63
22	72	73	64	65	66
23	76	77	67	68	70
24	79	80	70	72	73
25	83	84	73	75	77
26	86	87	76	78	80
27	89	90	79	81	83
28	92	94	82	84	87
29	95	97	85	87	90
30	98	100	88	90	93
31	101	103	91	93	96
32	104	106	94	96	100
33	107	109	96	99	103
34	109	111	99	102	106
35	112	114	102	105	109

Table 6. **Continued**

Bending displacement / bending angle (according to DVS 2203-5)					
Bending mandrel	**4**	**4**	**8**	**8**	**8**
Support spacing L	**80**	**80**	**90**	**90**	**90**
Specimen thickness s	**4**	**≤ 5**	**6**	**8**	**≤ 10**
Bending displacement s in mm			**Bending angle α**		
36	114	116	104	108	112
37	117	119	107	110	114
38	119	121	109	113	117
39	121	123	111	115	120
40	123	125	113	117	122
41	125	127	116	120	125
42	127	129	118	122	127
43	129	131	120	124	129
44	130	133	122	126	131
45	132	135	123	128	133
46	134	136	125	130	135
47	135	138	127	131	137
48	137	139	128	133	139
49	138	140	130	135	140
50	139	142	131	136	142
51	140	143	133	138	143
52	142	144	134	139	144
53	143	145	136	140	146
54	144	146	137	141	147
55	145	147	138	143	148
56	146	148	139	144	149
57	147	149	140	145	150
58		150	141	146	151
59	148	151	142	147	152
60	149		143	148	153
61	150	152	144	149	154
62	151	153	145	150	155
63			146		
64	152	154	147	151	156
65	153	155	148	152	157
66				153	
67	154	156	149		158
68			150	154	159
69	155	157			
70			151	155	160
71	156	158	152	156	
72					
73	157	159	153	157	
74					
75	158	160	154	158	
76					
77	159		155	159	
78					
79			156		
80	160			160	
81			157		
82					
83					
84			158		
85					
86			159		
87					
88					
89			160		

6.6.4 Enhanced scope of tests

Deficiencies detected in a weld according to sections 6.6.1.and 6.6.2 may not be repaired without consulting the site management.

In the event that obvious deficiencies are detected in welds specially made for a destructive test according to section 6.6.3, the welder concerned shall be re-qualified according to section 4.1. If the welder fails this re-qualification test he may not continue to be employed for welding. As opposed to the qualification test, this test may not be repeated.

Even if the welder passes such a test, the Orderer may demand that the welder is only employed under specific conditions to be defined.

The costs incurred in connection with the enhanced scope of tests according to section 6.6.3 as well as with the repair of defective welds shall be borne by the Contractor.

7 FRP joints

7.1 General notes

Diamond-coated or hard-metal-coated tools shall be preferred for cutting fiber-glass-reinforced plastics (FRP). A rubber plate and coarse abrasive paper shall be used for mechanical grinding. Personnel employed for these tasks shall wear dust masks and appropriate protective clothing. The dust formed during such work shall be exhausted at the place of work.

Once the Contractor has taken over from the Orderer all or some of the materials required for making adhesive compound-based joints and lamination, he shall be responsible for their proper temporary storage. The storage of adhesive compounds, resins, accelerators and hardeners shall conform with the manufacturers' instructions and the national regulations for the storage of hazardous goods. Hardeners and accelerators shall be stored separately. In view of the flammability of the resins, any work constituting a fire risk and work which might involve sparks are prohibited in the storage areas, during the mixing and processing of these materials and in the vicinity of uncured joints (within a radius of approx. 15 m).

Adhesive compounds, resins, accelerators and hardeners shall be stored at temperatures of 15 °C to 20 °C. Their shelf life is limited. Data on their shelf life are contained in the manufacturers' processing instructions. Particular attention shall be paid to the starting date governing the shelf life. Fiber-glass materials shall be kept dry during storage. Fiber-glass materials that once became damp may no longer be used, even after they have been dried.

The components shall be mixed in the order specified as and when required in accordance with the manufacturer's instructions, if possible using a mechanical mixer. Mixing shall continue until smears can no longer be seen on the surface. Metal or plastic buckets or pots are suitable for mixing.

The wall thickness of the components to be joined shall be identical in the area of the joint. The mismatch of the components on the outside may not exceed 10 % of the wall thickness. The contact surfaces shall be machined such as to render them plane and parallel. The components to be joined shall be aligned co-axially. The angle of the bevel at the supporting layer is determined by the pipe type (see Figure 4 and Figure 5).

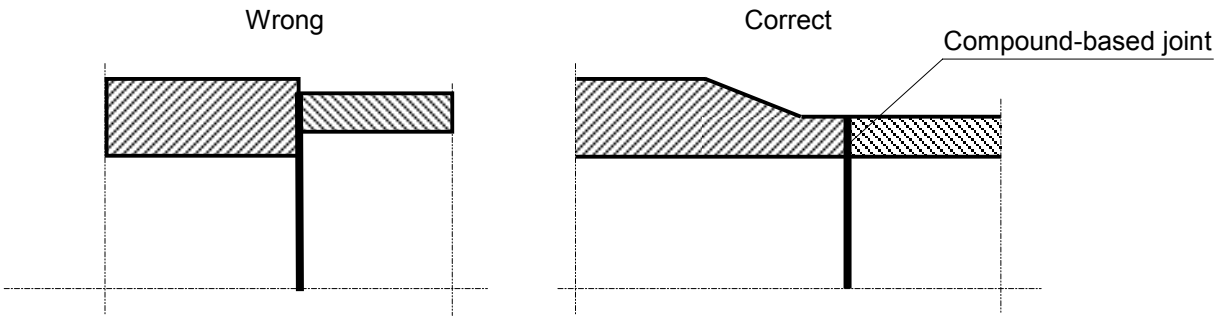

Figure 4. Mismatch at a joint

The tools used for applying adhesive compounds and lamination (e.g. trowels, scissors, brushes, lamb wool rollers, venting rollers, etc.) shall be cleaned immediately after use. Acetone is a suitable cleaning agent. When using previously cleaned tools, care shall be taken to ensure that no cleaning agent is introduced into the laminated joint.

7.2 Adhesive compound-based joints

The joint surfaces shall be wetted with resin before the adhesive compound, which had previously been prepared in accordance with the manufacturer's instructions, is applied with the aid of a trowel. The pipe sections shall be fixed in place when the adhesive compound has been applied. To prevent the penetration of unwanted quantities of adhesive compound into the pipe, mandrels or internal rings should be used.

The permissible gap widths are specified in Table 7.

Table 7. **Permissible gap widths**

Nominal diameter DN		Pipe outside diameter	Gap width (mm)
≤ 350	≤ 14“	≤ 355	0.5
400 to 600	18“ to 24“	400 to 630	1.0
> 600 to 800	> 24“ to 32“	> 630 to 800	1.3
> 800 to 1000	> 32“ to 40“	> 800 to1000	1.5
> 1000	> 40“	> 1000	2.0

After hardening of the adhesive compound, the surface shall be roughened in the area of the reinforcing laminate.

Unless otherwise specified, those areas of fittings ≥ DN 300 and of accessible piping ≥ DN 600, to which adhesive compounds have been applied, shall be laminated on the inside. The inside laminate should consist of at least a glass mat, a surface fleece and a pure resin layer of approx. 0.2 mm thickness.

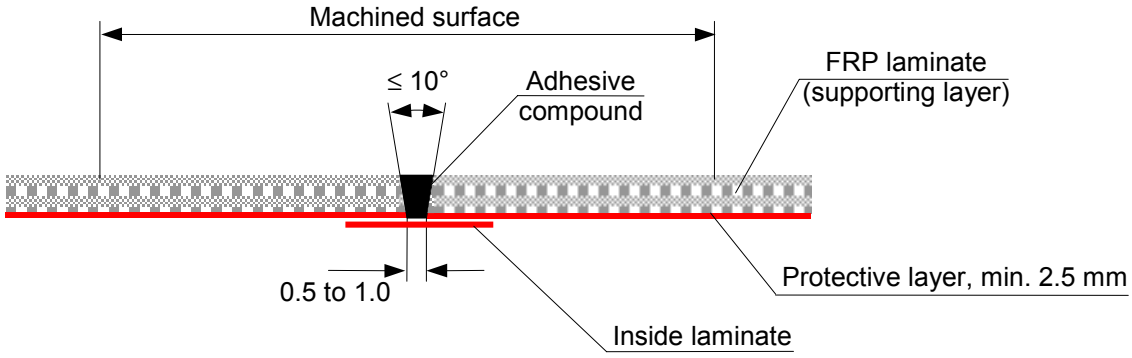

Figure 5. Adhesive compound-based joint preparation (pipe type E)

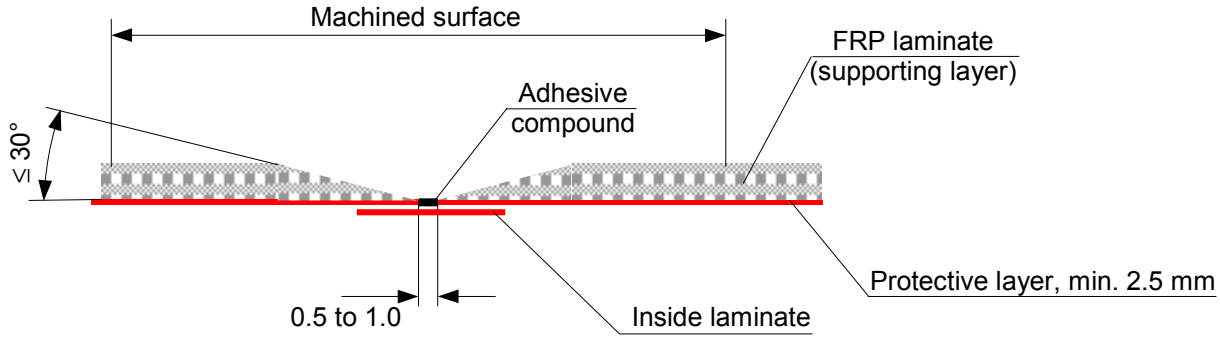

Figure 6. Adhesive compound-based joint preparation (pipe type D)

7.3 Reinforcing laminates

The reinforcing laminate (lamination) is always applied manually.

7.3.1 Preparation

The quantity of resin prepared by mixing with accelerator in accordance with the expected day-time temperatures should not exceed the quantity required for one day. The components shall be mixed in accordance with the manufacturer's instructions, if possible using a mechanical mixer. Mixing shall continue until smears can no longer be seen on the surface. Metal or plastic buckets or pots are suitable as mixing containers. The containers shall be appropriately marked. The quantity of resin required for a particular joint shall only be

mixed with hardener at the point of application. Only such quantities shall be stored at the work area that are directly required.

7.3.2 Laminated joints

The construction, minimum thickness and width of the laminate depend on the nominal diameter, pressure rating and the manufacturer's instructions. In the case of laminates on PVC base materials, the first layer to be applied shall be an adhesive resin. Precise instructions regarding the laminate structure with laminate length (L) and laminate thickness (s) are set forth in the piping specification applicable to the job site concerned.

The area to be prepared for the laminate shall be roughened by grinding. The area shall be dry, free from grease and dust and have no shiny spots. Impurities and greasy residues shall be removed with the aid of solvents (e.g. acetone).

Ready-made glass mats, fabric and fleece strips shall be used for the laminate. The strips shall be wound onto the pipe in an overlapping manner and free from air bubbles in a sequence specified by the manufacturer. If the fiber-glass materials are supplied in the form of mats, the Contractor shall cut strips therefrom. The fiber-glass material shall be soaked with the resin mixture and wound onto the pipe always in the same direction.

In the case of laminates of > 10 mm thickness, the applied laminate shall be allowed to harden before the next layer is applied. The joints must not be moved until the hardening process is completed.

After hardening, a pure resin layer (sealing) of approx. 0.2 mm thickness shall be deposited on the laminate.

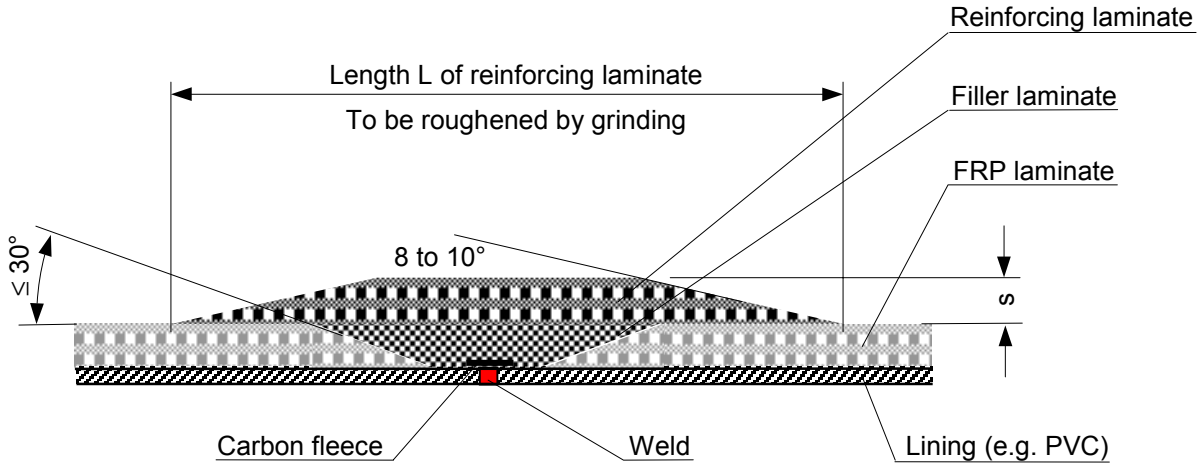

Figure 7. Laminate for pipe type B (glass content ≥ 40 %)

In order to be able to perform a HV leakage test for pipe type B, a carbon fleece shall be placed prior to applying the filler laminate. Unless otherwise specified, the construction of the reinforcing laminate shall correspond to that for the pipe type E.

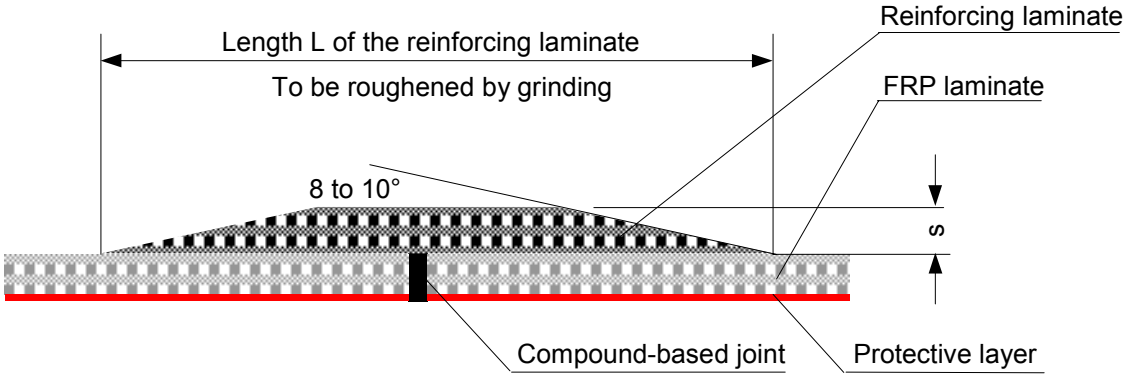

Figure 8. Laminate for pipe type E (glass content 30 to 45 %)

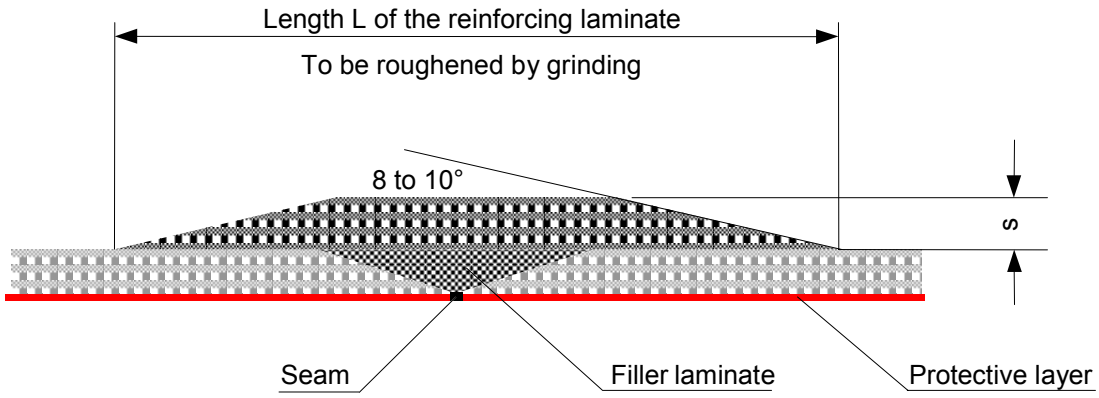

Figure 9. Laminate for pipe type D (glass content 30 to 45 %)

7.4 Quality of joints

The welds shall be tested as specified in section 6.6. Adhesive compound-based joints shall not be tested. The following minimum requirements apply for the assessment of the laminate quality:

- the outer surface shall be hard, dry (i.e. not tacky), and smooth,
- the outer surface must be covered by a closed resin layer (sealing),
- the laminate shall be free from cracks, blisters, folds and inclusions,
- the laminate shall have a uniform construction over its entire width and the pipe circumference,
- soaking and wetting defects (fiber-glass structure appears white) and resin agglomerations are inadmissible,
- surface cracks or delaminating caused by knocks and impacts are inadmissible.

Subsequent repairs are only permissible with the site management's approval.

7.5 Testing of joints

Unless otherwise specified in codes or standards, the scope of tests shall be specified by the Orderer. The minimum requirements according to section 7.4 shall be met. Tests performed shall be documented. Special tests shall be agreed upon between the Contractor and the Orderer.

7.5.1 Visual examination

Prior to any other tests, all joints shall be subjected to a visual examination on the outside and, as far as possible, on the inside. Visual checks shall be carried out during the preparation for and the performance of lamination.

Welds shall be assessed in accordance with the quality criteria described under section 6.5.

7.5.2 Non-destructive testing procedures

FRP piping shall be tested in accordance with UN 9253-21 Part 1 "Pressure and leakage testing of piping". The test pressure shall be specified by the Orderer. Specific instructions of the manufacturers shall be observed. The pressure and leakage tests may not commence earlier than 24 hours after complete hardening of the laminates.

If suitable equipment (Barcol hardness tester) is available, the laminate hardness should be checked.

7.5.3 Destructive testing procedures

Destructive tests (e.g. torsion shear test) shall only be performed in special cases specified by the Orderer. In such cases, the Contractor shall be responsible for preparing the test specimens. The Orderer shall be responsible for performing the tests and assessing the results.

Reference standards

Uhde standards

UN 9250-01 Part 1 : 1988-04	Erection; Warehousing
UN 9253-21 Part 1 : 2002-03	Erection; Pressure and leakage testing of piping

other standards

DVS 2203-1 : 2003-01	Testing of welded joints of thermoplastics sheet and pipes; Test methods; Requirements
DVS 2203-5 : 1999-08	Testing of welded joints of thermoplastics sheet and pipes; Technological bending test

Amendments

The following amendments were made compared with the version stated under “Supersedes” on page 1:

- Editorial review of Uhde standard

GRP TYPE	MAT	CLASS TYPE	CLASS	NO.SIZE	WALLTHICKNESS DIN 16965 PN	ALLOWABLE PRESS(BAR)	temp desing	FLUID	TYPE RESIN
B	GRP/PP	DGL	DGL ANN	1" TO 14",16" TO 20", 24" TO 40"	16-16-6	11.5-10-1.6	95 deg	CASTIC SODA 4%-32%	DERAKANE 441-400
			DGLANO	1" TO 14",16" TO 20", 24" TO 40"	16-16-6	11.5-10-1.6	95 deg	PURE BRINE-HEDROGEN AT CELL-HCL 7.5%	DERAKANE 441-400
			DGLANY	1" TO 14",16" TO 20", 24" TO 40"	16-16-6	11.5-10-1.6	95 deg	PURE BRINE	DERAKANE 441-400
	GRP/PVC-U	DGQ	DGQAMO	1" TO 20"	16	10/-0.1	87 deg	SODIUM BISULFITE-FLOCCULATION AGENT-ALPHA CELLULOSE-SODIUM CARBONATE-SLUDGE-	DERAKANE 441-400
			DGQANN	1" TO 20"	16	10/-0.1	87 deg	CHOLORINE WASTE AIR H2SO4-H2SO4 60-90%	DERAKANE 441-400
			DGQANO	1" TO 20"	16	10/-0.1	87 deg	CH OLORINE WASTE AIR HCL-HCL 32%-16%-WASTE WATER-	DERAKANE 441-400
	GRP/PVC-C	DGS	DGSANO	1" TO 3",4" TO 8", 10" TO 20",24"	16-16-6	7.0/-0.1,7.0/-0.1,4.0,4.0	95 deg	FLUE GAS-HEDROCHOLORIC ACID 5%-WASTE WATER-	DERAKANE 441-400
D	GRP	DGF	DGFAMO	1" TO 5",6" TO 24", 28" TO 40"	16	11.5/-0.1,11.5/-0.1,1.6/-0.1	87 deg	PLANT/ INSTRUMENT AIR-CLARIFIED BRINE-RAW BRINE-POLISHED BRINE-NITROGEN AT CELL-POTABLE WATER-RAW WATER-	DERAKANE 470-300
			DGFAMY	1" TO 5",6" TO 24", 28" TO 40"	16	11.5/-0.1,11.5/-0.1,1.6/-0.1	87 deg	POLISHED BRINE	DERAKANE 470-300
			DGFANO	1" TO 5",6" TO 24", 28" TO 40"	16	11.5/-0.1,11.5/-0.1,1.6/-0.1	87 deg	CH OLORINE WASTE AIR UP TO 80 DEG-FILTER BRINE-LEAN BRINE-CHLORINE GAS-	DERAKANE 470-300
		VGF	VGFAMO	1" TO 4",5" TO 20",	16	16.0/-1.0,16.0/-1.0	87deg	FLUE GAS-WASTE WATER-	DERAKANE 470-300
		DGR	DGRANO	1" TO 5",6" TO 20", 24" TO 40"	16	10/-0.1,10/-0.1, 1.6/-0.1	87 deg	CH OLORINE WASTE AIR NAOCL-CHLORINE GAS-SODUME HYPOCHLORITE	DERAKANE 441 -400 & 411-350
E	GRP	DGW	DGWANO	1" TO 6",8" TO 12", 14" TO 20",24" TO 40"	16-10-6-4	10/-0.1,10/-0.1,4/-0.1,1.6/-0.1	95 deg	CH OLORINE WASTE AIR > 80 DEG-ANOLYTE-LEAN BRINE-CONDENSATE CL2-CHLORINE GAS-	ALPHA COR 6000-4a
		VGW	VGWANO	1" TO 10",12" TO 20",	16	8.0/-1.0,8.0/-1.0	95 deg	ANOLYTE-LEAN BRINE-CHLORINE GAS-	ALPHA COR 6000-4a