SLOVENSKI STANDARD
SIST EN 12007-2:2000

01-julij-2000

Sistemi oskrbe s plinom - Cevovodni sistemi za najvišji delovni tlak do vključno 16 bar - 2. del: Posebna funkcionalna priporočila za polietilen (najvišji delovni tlak do vključno 10 bar)

Gas supply systems - Gas pipelines for maximum operating pressure up to and including 16 bar - Part 2: Specific functional recommendations for polyethylene (MOP up to and including 10 bar)

Gasversorgungssysteme - Rohrleitungen mit einem maximal zulässigen Betriebsdruck bis einschließlich 16 bar - Teil 2: Besondere funktionale Empfehlungen für Polyethylen (MOP bis einschließlich 10 bar)

Systemes d'alimentation en gaz - Canalisations pour pression maximale de service inférieure ou égale a 16 bar - Partie 2: Recommandations fonctionnelles spécifiques pour le polyéthylene (MOP inférieure ou égale a 10 bar)

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Gas supply systems — Pipelines for maximum operating pressure up to and including 16 bar — Part 2: Specific functional recommendations for polyethylene (MOP up to and including 10 bar)

Systèmes d'alimentation en gaz — Canalisations pour pression maximale de service inférieure or égale à 16 bar — Partie 2: Recommendations fonctionnelles spécifiques pour le polyéthylène (MOP inférieure ou égale à 10 bar)

Gasversorgungssysteme — Rohrleitungen mit einem maximal zulässigen Betriebsdruck bis einschließlich 16 bar — Teil 2: Besondere funktionale Empfehlungen für Polyethylen (MOP bis einschließlich 10 bar)

This European Standard was approved by CEN on 9 April 1999.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Contents

	Page
Foreword	**3**
1 Scope	**4**
2 Normative references	**4**
3 Definitions and abbreviations	**5**
4 Design	**5**
4.1 General	5
4.2 Materials and components	5
4.3 Maximum operating pressure	6
4.4 Assembly techniques	7
4.5 Material properties for flow stopping by squeeze-off	7
4.6 Pipework inside buildings	7
5 Construction	**8**
5.1 Storage, handling and transportation	8
5.2 Jointing	8
5.3 Laying	9
5.4 Connection to existing systems	10
6 Quality control	**11**
6.1 Inspection prior to installation	11
6.2 Inspection during laying	11
7 Pressure testing	**11**
Annex A (INFORMATIVE) Storage, handling and transportation	**12**
Annex B (INFORMATIVE) Fusion joint integrity	**15**
Annex C (INFORMATIVE) Bibliography	**21**

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 234 "Gas supply", the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by July 2000, and conflicting national standards shall be withdrawn at the latest by July 2000.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

There is a complete suite of functional standards prepared by CEN/TC 234 "Gas Supply" to cover all parts of the gas supply system from the input of gas to the transport system up to the inlet connection of the gas appliances,whether for domestic, commercial or industrial purposes.

In preparing this standard a basic understanding of gas supply by the user has been assumed.

Gas supply systems are complex and the importance on safety of their construction and use has led to the development of very detailed codes of practice and operating manuals in the member countries. These detailed statements embrace recognized standards of gas engineering and the specific requirements imposed by the legal structures of the member countries.

1 Scope

This standard describes the specific functional recommendations for polyethylene (PE) pipelines in addition to the general functional recommendations of EN 12007-1 for:

a) a maximum operating pressure (MOP) up to and including 10 bar;

b) an operating temperature between -20 °C and +40 °C.

This European Standard specifies common basic principles for gas supply systems. Users of this European Standard should be aware that more detailed national standards and/or codes of practice can exist in the CEN member countries.

This European Standard is intended to be applied in association with these national standards and/or codes of practice setting out the above mentioned basic principles.

2 Normative references

This European Standard incorporates by dated or undated references, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

prEN 1555-1 Plastics piping systems for gaseous fuels supply - Polyethylene (PE) - Part 1: General

prEN 1555-2 Plastics piping systems for gaseous fuels supply - Polyethylene (PE) - Part 2: Pipes

prEN 1555-3 Plastics piping systems for gaseous fuels supply - Polyethylene (PE) - Part 3: Fittings

prEN 1555-4 Plastics piping systems for gaseous fuels supply - Polyethylene (PE) - Part 4: Valves

prEN 1555-5 Plastics piping systems for gaseous fuels supply - Polyethylene (PE) - Part 5: Fitness for purpose of the system

EN 12007-1 Gas supply systems - Pipelines for maximum operating pressure up to and including 16 bar – Part 1: General functional recommendations

EN 12327 Gas supply systems - Pressure testing, commissioning and decommissioning procedures – Functional requirements

ISO 12176-1 Plastics pipes and fittings - Equipment for fusion jointing polyethylene systems - Part 1: Butt fusion

ISO/DIS 12176-2 Plastics pipes and fittings - Equipment for fusion jointing polyethylene systems – Part 2: Electrofusion

3 Definitions and abbreviations

For the purposes of this standard, the following definitions, symbols and abbreviations apply :

3.1 nominal outside diameter (d_n): The specified outside diameter in millimetres (mm).

3.2 nominal wall thickness (e_n): Numerical designation of the wall thickness of a component, which is a convenient round number, approximately equal to the manufacturing dimension in millimetres (mm).

3.3 standard dimension ratio (SDR): The number approximately equal to the quotient of the nominal outside diameter and the nominal wall thickness.

3.4 design pressure (DP): The pressure on which design calculations are based.

3.5 maximum operating pressure (MOP): The maximum pressure at which a system can be operated continuously under normal operating conditions.

NOTE: Normal operating conditions are: no fault in any device or stream.

3.6 maximum incidental pressure (MIP): The maximum pressure which a system can experience during a short time limited by the safety devices.

3.7 butt fusion joint: A method of jointing PE pipes and fittings where the two pipe ends are heated and brought together to be fused without the use of a separate fitting or filler material.

3.8 electrofusion joint: A method of jointing PE pipes, using fittings which have an integrated electric heating element.

3.9 squeeze-off: The act of squeezing a pipe to prevent the flow of gas.

3.10 minimum required strength (MRS): The value of the lower confidence limit rounded down to the next lower value of the R10 series when the lower confidence limit is below 10 MPa, or to the next lower value of the R20 series when the lower confidence limit is 10 MPa or greater.

NOTE: R10 and R20 series are the Renard number series conforming to ISO 3 and ISO 497.

3.11 lower confidence limit (LCL): A quantity, expressed in megapascals (MPa), which can be considered as a material property, representing the 97,5 % lower confidence limit of the predicted long term hydrostatic strength for water at 20 °C for 50 years.

3.12 critical rapid crack propagation pressure (P_{RCP}): The pressure level at which a rapid crack propagation (RCP) can occur in a PE pipeline, defined at a reference temperature.

NOTE: Reference temperature is usually 0 °C.

4 Design

4.1 General

The selection of materials, SDR series, dimensions and assembling techniques shall be the responsibility of the pipeline operator.

There are 2 SDRs in common use: SDR 17,6 and SDR 11. Other SDRs are also used.

EXAMPLE: Renovation.

4.2 Materials and components

The PE materials and components used shall comply with prEN 1555-1, prEN 1555-2, prEN 1555-3, prEN 1555-4 and prEN 1555-5.

Other components not covered by prEN 1555-1, prEN 1555-2, prEN 1555-3, prEN 1555-4 and prEN 1555-5 shall conform to the relevant European Standards or, in their absence, to national or other established standards and shall be fit for their purpose.

4.3 Maximum operating pressure

The MOP should be selected on this basis of the gas supply system operating requirements provided that MOP does not exceed 10 bar and the following conditions are satisfied:

a) Verification of the overall service (design) coefficient:

The overall service (design) coefficient *C* shall be calculated using the equation as given below and shall be greater than or equal to 2. This coefficient *C* takes into consideration service conditions as well as the properties and components of a pipeline.

$$C = \frac{20 \times \mathrm{MRS}}{\mathrm{MOP} \times (\mathrm{SDR} - 1) \times D_F}$$

NOTE: Derating factor (D_F) is a coefficient used in the calculation of MOP which takes into account the influence of operating temperature. Derating factors are listed in prEN 1555-5.

b) Verification of the RCP criterion

The ratio of critical RCP pressure to MOP shall be greater than or equal to 1,5.

The RPC criterion is the critical RCP pressure is dependant upon pipe size and material and should be determined in accordance with prEN 1555-2.

The critical RCP pressure is based on a temperature of 0 °C.

Where pipe temperature decreases below 0 °C the P_{RCP}/MOP ratio should be recalculated in accordance with prEN 1555-5 using a value of RCP pressure determined from the minimum expected operating temperature of the pipe. If necessary the value of MOP should be reduced so as to maintain the P_{RCP}/MOP ratio at a value greater than or equal to 1,5. See figure 1.

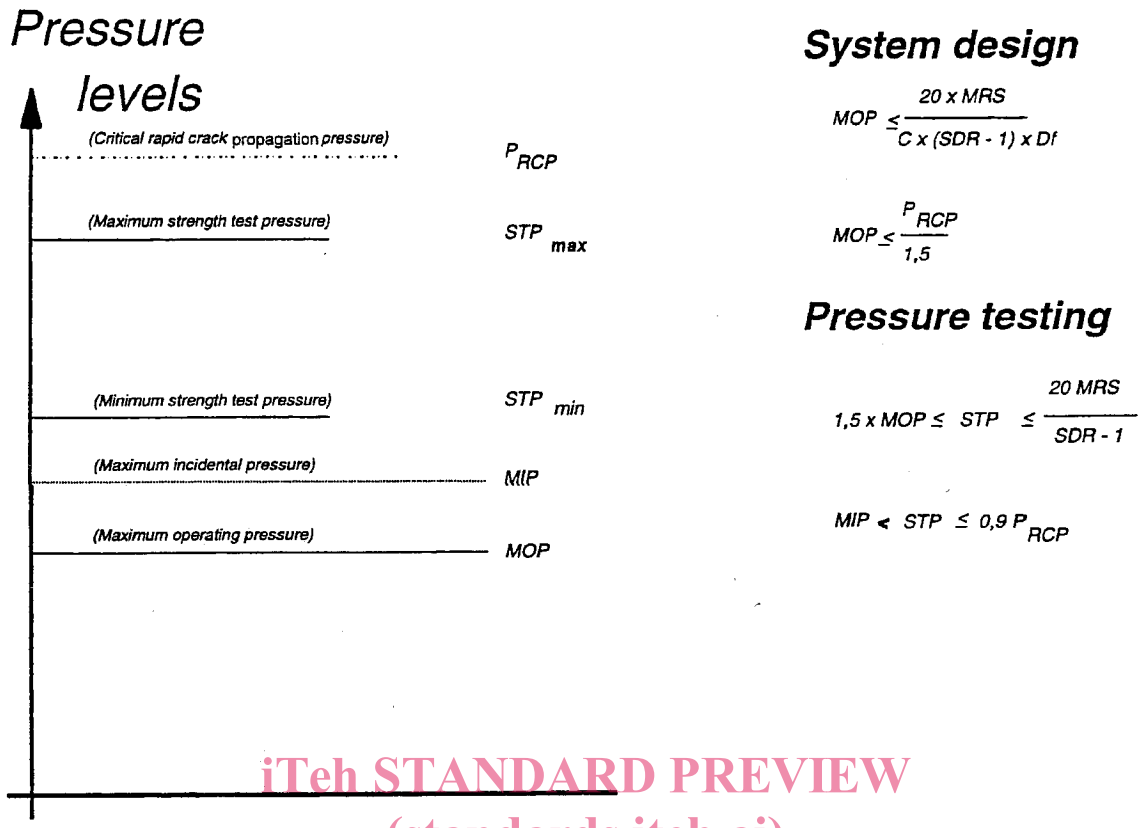

Figure 1 – Pressure conditions in a PE-system

4.4 Assembly techniques

Jointing procedures can vary depending upon the PE material and sizes used.

Fusion should be used as the jointing method. The fusion jointing techniques for the construction of PE pipelines shall be butt fusion and electrofusion.

Mechanical joints can also be used for making PE to PE joints. Mechanical joints shall be used for jointing PE to other materials such as cast iron or steel, these are often refered to as transition fittings (for definitions of mechanical joints see EN 12007-3).

Care shall be taken for fusion joints made on older PE materials which are not in accordance with prEN 1555-1.

Written jointing procedures, authorized by the pipeline operator, shall be available prior to the construction of a pipeline.

4.5 Material properties for flow stopping by squeeze-off

When squeeze-off techniques are considered, the suitability of pipe for squeeze-off should be established in accordance with prEN 1555-2.

4.6 Pipework inside buildings

The pipework element of the gas supply system situated in buildings shall be designed, constructed and protected so that the effects of a fire on pipework do not lead to an explosion or significant aggravation of the fire. For further guidance reference should be made to EN 12007-1.

In accessable areas service lines shall be protected from external interference.

5 Construction

5.1 Storage, handling and transportation

Care shall be taken during the transport, handling and storage of pipes, fittings and other components to ensure at all stages that their specified properties and conditions, which can be affected by environmental factors, are preserved and that physical damage and distortions are avoided.

EXAMPLE: At low temperatures, flexibility and fracture resistance are reduced.

Pipes and fittings shall be inspected and those with surface defects deeper than 10 % of the nominal wall thickness shall not be used.

PE pipes and fittings stored outside are subjected to UV degradation when exposed to direct daylight. PE materials are stabilized to give protection for a UV radiation level of 3.5 GJ/m². National bodies should give recommendations for allowed storage times in their countries. The average radiation level for one year in European countries are given in figure 2.

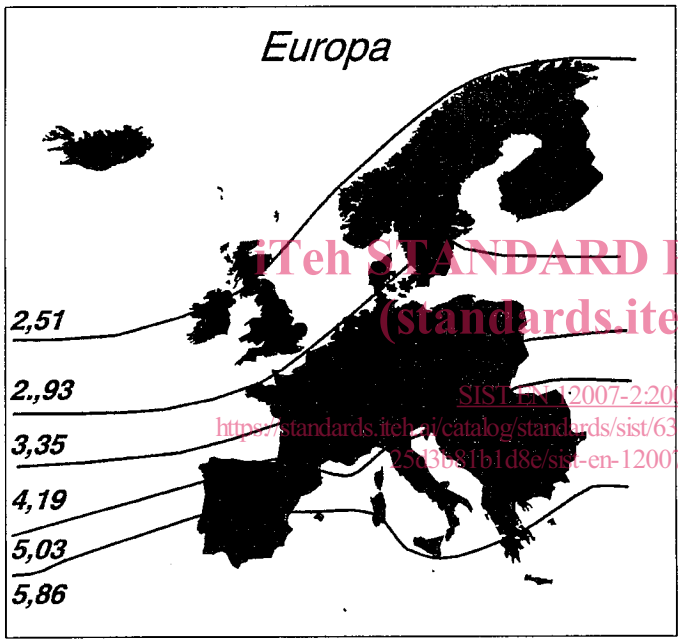

Figure 2 – Isobaric curves of global radiation in Gigajoules per m per year 2

Pipes shall not be used where it is considered that they have exceeded the maximum UV exposure limit, unless they have been tested to demonstrate acceptable performance in accordance with existing standards.

Further guidance on storage, handling and transportation of PE pipes and fittings is given in annex A.

5.2 Jointing

5.2.1 General

Personnel shall be competent in appropriate jointing methods.

Pipes and other pipeline components should be joined by fusion.

Jointing procedures shall be carefully followed to obtain good quality joints. Cleanliness and the absence of stress are essential for reliable joints.

5.2.2 Fusion jointing

Satisfactory fusion jointing procedures based upon recognized standards and experience of the pipeline operator can be used. In the absence of fusion jointing procedures ISO 11413 and ISO 11414 should be applied.

Fusion equipment shall conform with ISO 12176-1 for butt fusion and ISO/DIS 12176-2 for electrofusion. Consideration shall be given to the use of shielding, end caps or longer heating times when jointing in adverse weather conditions.

NOTE: Strong winds or cold weather can reduce the quality of the PE fusion joint if not protected.

Pipes and/or fittings with fusion ends of different SDR values shall not be jointed by butt fusion.

The following are minimum requirements for assembly of fusion joints:

- Cleaning of the pipe and/or fitting ends and the surface of the heated tools;
- Protection against dust and other contaminating influences;
- Clamping of the pipe and/or fitting ends;
- Verification of the alignment and the gap between fitting and/or pipe ends;
- Use of rerounding clamps where pipe ovality exists;
- Preparation of the fusion ends, by either scraping in case of electrofusion and planing in case of butt fusion;
- Marking for depth of penetration into the electrofusion sockets;
- Maintenance and correct functioning of the fusion equipment and check of its compatibility with the required parameters;
- Taking into account the fusion parameters as written in the jointing procedure.

5.2.3 Mechanical joints

5.2.3.1 General

All mechanical joints shall be resistant to end load in accordance with prEN 1555-3.

All mechanical joints shall be assembled in accordance with the manufacturer's instructions and the metallic parts of fittings shall be corrosion resistant or protected against corrosion.

Satisfactory mechanical jointing procedures based upon recognized standards and experience of the pipeline operator can be used. In the absence of mechanical jointing procedures ISO/DIS 10838-1 and ISO/DIS 10838- 2 should be applied.

5.2.3.2 Flanged joints

Flanged joints shall be made using the appropriate jointing material.

5.2.3.3 Threaded joints

PE pipes shall not be threaded.

5.2.3.4 Compression joints

Stiffener appropriate to the inside diameter of the PE-pipe shall be applied in joints with a compressive element. Only the stiffener supplied with a fitting shall be used for a given joint.

Lubricants shall only be used following the manufacturer´s specification.

Where relative movement can occur, anti-shear-sleeves should be fitted.

5.3 Laying

Care shall be taken to prevent damage to the pipes and fittings during the whole process of laying.