



SLOVENSKI STANDARD

SIST EN 12732:2000

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Sistemi oskrbe s plinom – Varjenje jeklenih cevovodov - Funkcionalne zahteve

Gas supply systems - Welding steel pipework - Functional requirements

Gasversorgungssysteme - Schweißen von Rohrleitungen aus Stahl - Funktionale Anforderungen

Systemes d'alimentation en gaz - Soudage des tuyauteries en acier - Prescriptions fonctionnelles

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EUROPEAN STANDARD
NORME EUROPÉENNE
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English version

Gas supply systems - Welding steel pipework - Functional requirements

Systèmes d'alimentation en gaz - Soudage des tuyauteries
en acier - Prescriptions fonctionnelles

Gasversorgungssysteme - Schweißen von Rohrleitungen
aus Stahl - Funktionale Anforderungen

This European Standard was approved by CEN on 16 August 1999.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

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.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

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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of an identical text or by endorsement, at the latest by October 2000, and conflicting national standards shall be withdrawn at the latest by October 2000.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 transmission 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 recognised standards of gas engineering and the specific requirements imposed by the legal structures of the member countries.

CEN/TC 234 will continue its work updating this Standard to the latest developments at regular intervals.

This European Standard has been prepared under mandate M/017 given to CEN by the Commission of the European Communities and the European Free Trade Association.

1 Scope

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This European Standard contains requirements for the production and testing of weld joints for the installation and modification of onshore steel pipelines and pipework used in gas supply systems, including in-service pipelines, for all pressure ranges for the carriage of processed, non-toxic and non-corrosive natural gas according to ISO 13686, where

- the pipeline elements are made of unalloyed or low-alloyed carbon steel;
- the pipeline is not located within commercial or industrial premises as integral part of the industrial process on those premises except for any pipelines and facilities supplying such premises;
- the pipework is not located within household installations according to EN 1775:1998;
- the design temperature of the system is between -40 °C and 120 °C inclusive.

With respect to production and testing of welds, this European Standard refers to basic standards drafted by CEN/TC 121 and CEN/TC 138 as they exist up to the date of issue of this standard.

This standard is not applicable to welds produced prior to the publication of this European standard.

Clauses 4 to 9 describe general requirements which relate to all areas of application mentioned.

The following clauses contain specific requirements:

Clause 10: Supply systems for a maximum operating pressure up to and including 16 bar (distribution)

Clause 11: Supply systems for a maximum operating pressure greater than 16 bar (transmission)

Clause 12: Metering, regulating and compressor stations

Table 1 assigns the application areas to quality requirement categories as a function of the working pressure and pipe materials used.

Table 1: Allocation to quality requirement categories

Quality requirement category	Area of activity applies to	
A	Pressure range and base material Examples of use	≤ 100 mbar Group 1 according to EN 288-3:1992 $R_{1,0,5} \leq 360$ N/mm ² Mains and service pipes in gas distribution systems
B	Pressure range and base material Examples of use	> 100 mbar ≤ 5 bar Group 1 according to EN 288-3:1992 $R_{1,0,5} \leq 360$ N/mm ² Mains and service pipes in gas distribution systems, pipework in stations
C	Pressure range and base material Examples of use	> 5 bar ≤ 16 bar Group 1 according to EN 288-3:1992 $R_{1,0,5} \leq 360$ N/mm ² Pipelines including pipework in stations and gas distribution systems
D	Pressure range or base material Examples of use	> 16 bar Group 1 to 3 according to EN 288-3:1992 Pipelines including pipework in stations and gas transmission systems
<p>Note:</p> <p>$R_{1,0,5}$ specified minimum yield strength according to EN 10208-2:1996.</p> <p>Pipelines having hoop stresses at design pressure up to 30 % of specified minimum yield strength and operated at a pressure up to 24 bar can be allocated to quality requirement category C by the pipeline operator.</p>		

Additional requirements may be specified when, for example

- the strain on pipelines and systems;
- the materials;
- the line routing;
- the design or the welding technique

are considered critical.

This European Standard specifies common basic principles for gas supply systems. Users of this European Standard should be aware that there can exist more detailed national standards and/or

codes of practice 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.

In the event of conflicts in terms of more restrictive requirements in national legislation/regulation with the requirements of this standard, the national legislation/regulation shall take precedence.

2 Normative references

This European Standard incorporates by dated or undated reference, 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.

- | | |
|---------------|---|
| EN 287-1:1997 | Approval testing of welders - Fusion welding - Part 1: Steels |
| EN 288-2:1992 | Specification and approval of welding procedures for metallic materials - Part 2: Welding procedure specification for arc welding |
| EN 288-3:1992 | Specification and approval of welding procedures for metallic materials - Part 3: Welding procedure tests for the arc welding of steels |
| EN 288-5:1994 | Specification and approval of welding procedures for metallic materials - Part 5: Approval by using approved welding consumables for arc welding |
| EN 288-6:1994 | Specification and approval of welding procedures for metallic materials - Part 6: Approval related to previous experience |
| EN 288-7:1995 | Specification and approval of welding procedures for metallic materials - Part 7: Approval by a standard welding procedure for arc welding |
| EN 288-8:1995 | Specification and approval of welding procedures for metallic materials - Part 8: Approval by a pre-production welding test |
| prEN 288-9 | Specification and approval of welding procedures for metallic materials - Part 9: Welding procedure test for on land and offshore site butt welding of transmission pipelines |
| EN 439:1994 | Welding consumables - Shielding gases for arc welding and cutting |
| EN 440:1994 | Welding consumables - Wire electrodes and deposits for gas-shielded metal arc welding of non-alloy and fine-grain steels - Classification |
| EN 473:1993 | Qualification and certification of NDT personnel. General principles |
| EN 499:1994 | Welding consumables - Covered electrodes for manual metal arc welding of non-alloy and fine-grain steels - Classification |
| EN 571-1:1997 | Non-destructive testing - Penetrant testing - Part 1: General principles |
| EN 583-1 | Non-destructive testing - Ultrasonic examination - Part 1: General principles |
| EN 719:1994 | Welding coordination - Tasks and responsibilities |
| EN 729-1:1994 | Quality requirements for welding - Fusion welding of metallic materials - Part 1: Guidelines for selection and use |
| EN 729-2:1994 | Quality requirements for welding - Fusion welding of metallic materials - Part 2: Comprehensive quality requirements |
| EN 729-3:1994 | Quality requirements for welding - Fusion welding of metallic materials - |

Part 3: Standard quality requirements

- EN 729-4:1994 Quality requirements for welding - Fusion welding of metallic materials - Part 4: Elementary quality requirements
- EN 756:1995 Welding consumables - Wire electrodes and wire-flux combinations for submerged arc welding of non-alloy and fine grain steels - Classification
- EN 757:1997 Welding consumables - Covered electrodes for manual metal arc-welding of high strength steels - Classification
- EN 758:1997 Welding consumables - Tubular cored electrodes for metal arc welding with or without a gas shield of non-alloy and fine grain steels - Classification
- EN 760:1996 Welding consumables - Fluxes for submerged arc welding - Classification
- EN 970:1997 Non-destructive examination of fusion welds - Visual examination
- EN 1290:1998 Non-destructive examination of welds - Magnetic particle examination of welds
- EN 1418:1997 Welding personnel - Approval testing of welding operators for fusion welding and resistance weld setters for fully mechanized and automatic welding of metallic materials
- EN 1435:1997 Non-destructive examination of welds - Radiographic examination of welded joints
- EN 1668:1997 Welding consumables - Rods, wires and deposits for tungsten inert gas welding of non alloy and fine grain steels - Classification
- prEN 1708-1 Welding - Basic weld joint details in steel - Part 1: Pressurized components
- EN 1714:1997 Non-destructive examination of welds - Ultrasonic examination of welded joints
- EN 1775:1998 Gas supply - Gas pipework for buildings - Maximum operating pressure \leq 5 bar - Functional recommendations
- EN 10002-1:1990 Metallic materials - Tensile testing - Part 1: Method of test
- EN 10204:1995 Metallic products - Types of inspection documents
- EN 10208-1:1997 Steel pipes for pipelines for combustible fluids - Technical delivery conditions - Part 1: Pipes of requirement class A
- EN 10208-2:1996 Steel pipes for pipelines for combustible fluids - Technical delivery conditions - Part 2: Pipes of requirement class B
- EN 24063:1992 Welding, brazing, soldering and braze-welding of metals - Nomenclature of processes and reference numbers for symbolic representation on drawings (ISO 4063:1990)
- EN 25817:1992 Arc-welded joints in steel - Guidance on quality levels for imperfections (ISO 5817:1992)
- EN 26520:1991 Classification of imperfections in metallic fusion welds with explanations (ISO 6520:1982)
- EN 27963:1992 Welds in steel - Calibration block No. 2 for ultrasonic examination of welds (ISO 7963:1985)
- EN 29692:1994 Metal-arc welding with covered electrode, gas-shielded metal-arc welding and gas welding - Joint preparations for steel (ISO 9692:1992)
- EN 45001:1989 General criteria for the operation of testing laboratories

ISO 13686 Natural gas - Quality designation

3 Definitions and abbreviations

For the purposes of this standard, the following definitions apply.
Symbols used in formulae are defined where they occur.

3.1 design temperature (DT): The temperature on which the design calculations are based.

3.2 gas: The gaseous fuel which is in a gaseous state at a temperature of 15 °C under atmospheric pressure (1,013 25 bar absolute).

3.3 gas distribution system: The pipeline system including piping above and below ground and all other equipment necessary to supply the gas to the consumer.

3.4 gas distributor: The private or public organization authorized to distribute gas to consumers through a gas distribution system.

3.5 gas transmission: The activity intended to convey gas from one place to another through pipelines in order to supply gas to distribution systems or to industrial consumers.

3.6 installation: Equipment and facilities for the extraction, production, chemical treatment, measurement, control, storage or offtake of the transported gas.

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

Note: normal conditions are: no fault in any device or stream.

3.8 national requirements: Requirements following from national legislation or more detailed or stringent national standards

3.9 onshore pipeline: A buried and/or above ground pipeline including those sections laid in or across inland lakes or water courses.

3.10 pipeline: A system of pipework with all associated equipment and stations up to the point of delivery. This pipework is mainly below ground but also includes above ground parts.

3.11 pipeline components: The elements from which a pipeline is constructed. The following are distinct pipeline elements:

- pipe including cold-formed bends;
- fittings

EXAMPLE 1: reducers, tees, factory-made elbows and bends, flanges, caps, welding stubs, mechanical joints.

- fabrications, manufactured from elements referred above;

EXAMPLE 2: manifolds, slug catchers, pig launching/receiving stations, metering and control runs.

- equipment;

EXAMPLE 3: valves, expansion joints, insulating joints, pressure regulators, pumps, compressors.

- pressure vessels.

3.12 pipeline operator: The private or public organization authorized to design, construct, and/or operate and maintain the gas supply system.

3.13 pipework: An assembly of pipes and fittings.

3.14 pressure: The gauge pressure of the fluid inside the system, measured in static conditions.

3.15 station: A plant or facility for the operation and/or processing of gas supply systems.

3.16 test pressure (TP): The pressure to which the gas supply system is subjected, to ensure that it can operate safely.

4 Quality system

If required by the pipeline operator, a quality system shall be applied to pipeline welding. A set of recommended quality requirements according to EN 729 is provided in Table 2, which specifies the requirements of EN 729 for the different categories as defined in Table 1.

Table 2: Recommended quality requirements

Requirement relating to:	Quality requirement category in accordance with Table 1			
	A	B	C	D
Quality system according to:				
EN 729-1:1994 and EN 729-2:1994(complete)	+	+	*	*
EN 729-1:1994 and EN 729-3:1994 (standard)	+	+	*	*
EN 729-1:1994 and EN 729-4:1994 (elementary)	*	*	-	-
Welding coordination personnel:				
• according to EN 719:1994:				
welding engineer	+	+	+	*
welding technician ¹⁾	+	+	*	-
welding specialist ¹⁾	+	*	*	-
• Foreman welder with several years technical experience	*	*	-	-
Testing personnel according to EN 473:1993	*	*	*	*
Welding procedure specification (WPS): according to EN 288-2:1992 (except gas welding, procedure no. 311)	*	*	*	*
Approval of welding procedures according to one of the following standards:				
EN 288-3:1992 (welding procedure test)	+	+	*	*
EN 288-5:1994 (using approved welding consumables)	*	*	-	-
EN 288-6:1994 (previous experience)	*	-	-	-
EN 288-7:1995 (standard welding procedures) ¹⁾	+	+	*	*
EN 288-8:1995 (pre-production welding test)	+	*	*	*
prEN 288-9 (welding procedure test for site welding)	+	+	+	*
1) This may be applicable in category D for small projects or for materials with $R_{t0,5} \leq 360 \text{ N/mm}^2$.				
Explanation:	*	recommended		
	+	optional		
	-	not recommended		

4.1 Welding contractors

If required by the pipeline operator, contractors shall demonstrate their ability to perform the work. Reference can be made to EN 729.

4.2 Welders

All welders shall be qualified for the work they are required to undertake.

The qualification should be carried out in accordance with an appropriate specification (see clauses 10, 11 and 12).

The pipeline operator may accept welders provided it can be demonstrated that they have produced welds of the required quality within the essential variables of the welding procedure.

4.3 Welding supervisory/co-ordination personnel

Welding tasks and responsibilities for welding shall be assigned to personnel with the appropriate experience and technical knowledge. Where a quality system is required, these personnel should be qualified to EN 719:1994.

4.4 Testing personnel

Destructive testing and non-destructive examination personnel shall be employed either by the pipeline contractor or by the pipeline operator or by an independent testing company. All companies providing such personnel should be certified. All non-destructive examination personnel shall be qualified for the duties they are to perform in accordance with EN 473:1993 or skill recognition by the pipeline operator.

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5 Welding consumables [b3decbcf5eff/sist-en-12732-2000](https://standards.iteh.ai/catalog/standards/sist/453a586a-fa6a-459f-8e24-b3decbcf5eff/sist-en-12732-2000)

Welding consumables shall be in accordance with:

Shielded metal arc welding	(prodedure no. 111)	: EN 499:1994 and EN 757:1997
Gas metal arc welding	(procedures nos. 135, 141)	: EN 440:1994 and EN 1668:1997
Flux-cored arc welding	(procedures nos. 114, 136)	: EN 758:1997
Shielding gases		: EN 439:1994
Submerged arc welding	(prodedure no. 12)	: EN 756:1995
Fluxes for submerged arc welding	(prodedure no. 12)	: EN 760:1996

The numbering of the procedures given in brackets is in accordance with EN 24063:1992.

All filler materials shall be certified as conforming to the relevant European Standard. Batch testing of the filler materials can be required by the pipeline operator. The certificates shall be in accordance with EN 10204:1995, type 3.1.B. The chemical composition of the deposited weld metal shall be compatible¹⁾ with the parent metal.

Unless otherwise agreed, matching¹⁾ weld metal for girth welds shall be required. For the selection of consumables, the use of Table 3 is recommended.

After filler material has been removed from its original package, it shall be protected or stored in accordance with the manufacturer's requirements, so that its characteristics or welding properties are not affected.

¹⁾ taking into account any specific property requirements

Table 3: Matching filler material requirements

Steel specification to EN 10208-1:1997 and EN 10208-2:1996**			Filler material requirements to EN 440:1994/EN 499:1994/EN 757:1997			
Designation	$R_{t0,5}$	R_m	Designation	$R_{t0,5}$ or $R_{p0,2}$	R_m	KV
	N/mm ²	N/mm ²		N/mm ²	N/mm ²	J
L 210	210	335 - 475	E35	355	440 - 570	47/32
L 245	245 - 440	415	E35	355	440 - 570	
L 290	290 - 440	415	E35	355	440 - 570	
L 360	360 - 510	460	E42	420	500 - 640	
L 415'	415 - 565	520	E46	460	530 - 680	
L 450'	450 - 570	535	E46	460	530 - 680	
L 485'	485 - 605	570	E50	500	560 - 720	
L 555'	555 - 675	625	E55 E62	550 620	610 - 780 690 - 890	
<p>NOTES:</p> <p>iTeh STANDARD PREVIEW (standards.iteh.ai)</p> <p>* For wall thicknesses > 8 mm a lower strength consumable can be used for the root and hot pass.</p> <p>** Fitting materials are to be specified in accordance with the appropriate EN standard.</p> <p>$R_{t0,5}$ Specified minimum yield strength measured in N/mm².</p> <p>R_m Tensile strength according to EN 10208-2:1996 measured in N/mm².</p> <p>$R_{p0,2}$ 0,2 % proof strength according to EN 10002-1:1991 measured in N/mm².</p> <p>KV Impact test value (Charpy-V method) obtained for full size specimen (average/individual) measured in Joule.</p>						

6 Production welding

6.1 General requirements

All welding shall comply with the approved welding procedure specification.

6.1.1 Working area

The working space shall enable adequate access to the work area in order to provide a safe environment and to allow satisfactory production and testing of a weld joint.

6.1.2 Layout of weld joints

Weld joints, in particular tie-ins, shall be arranged and designed in a way suited to the planned welding and testing technique. The placement of tie-in welds is particularly important.

6.1.3 Types of weld joints

Unless otherwise agreed, pipes and pipeline fittings shall be connected using butt-welded joints.

6.1.4 Joint edge preparation

Joint edge preparations shall comply with the appropriate EN standards and the approved welding procedure. Appropriate EN standards include prEN 1708-1 and EN 29692:1994. The choice of joint configuration shall take into account the welding technique, the welding position and the accessibility of the joint.

6.1.5 Weld spacing

Weld spacing shall be sufficient to ensure the integrity of the joint.

6.1.6 Different wall thicknesses

When pipes of different wall thicknesses have to be joined together, special precautions shall be taken to avoid stress concentration and weld defects.

When butt welding pipework of different wall thicknesses has to be performed, 6.2.2 below and/or prEN 1708-1 shall apply. Annex C of this Standard should also be observed.

6.1.7 Pipe branches and nozzles

Forged fittings are preferred. Weld-on branches and nozzles are allowed.

6.1.8 Laminations

Additional precautions can be required where welding is performed in the area of laminations.

A recommended procedure for checking for laminations is given in Annex B.

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6.1.9 Butt welded cross joints

Unless otherwise agreed, butt welded cross joints shall be avoided.

6.2 Joint preparation

6.2.1 Pipe end preparation

To ensure that the required weld quality is achieved, all necessary details concerning the joint preparation have to be laid down in the welding procedure specification.

6.2.2 Alignment of the joints

Alignment clamps shall be used where possible; the details and how they are to be used shall be included in the welding procedure specification.

Root misalignment is acceptable as far as it is not affecting the integrity of the joint. For recommendations see Annex G.

Misalignment of pipes and pipelines made of steel grades with a minimum specified yield strength $R_{t0.5}$ less than or equal to 360 N/mm² which is outside the tolerance range of the tables given in Annex G may be compensated for by deformation, if agreed by the pipeline operator, by the use of special equipment or by transition pieces. The heat-treatment condition of the material shall be taken into account.

NOTE: The strength of thermomechanically treated as well as quenched and tempered steels is, in some cases, permanently reduced by heating to temperatures above 580 °C.

Root misalignment of pipes and pipelines of different wall thicknesses and made of steel grades with a specified minimum yield strength $R_{10,5}$ greater than 360 N/mm² which is outside the tolerance range of the tables given in Annex G shall be compensated for by using transition pieces.

During correction of excessive root misalignment, measures shall be taken to avoid defects. Examples of permissible weld configurations are given in Annex C.

6.3 Preheating

Preheating shall be applied in accordance with the welding procedure specification.

6.4 Tacking

Whenever tack welds are used, they shall be made using the welding procedure designed for the root pass. They shall be distributed equally around the circumference.

The tacks shall be free from cracks. Cracked tacks shall not be welded over, and shall be ground out and rewelded.

6.5 Welding

Precautions shall be taken to:

- minimize hydrogen pick-up in the work, in particular for steels which are sensitive to cold cracking;
- avoid condensation;
- avoid air movements in the pipe;
- avoid uncontrolled electrical current;
- minimize magnetic effects;
- avoid cold cracking;
- avoid arc strikes.

6.6 Actions after welding

After the weld is completed, weld spatter shall be removed. The weld surface shall be cleaned of slag. The cooling process shall not be accelerated beyond the rate specified in the welding procedure specification.

Where air temperatures are below 5 °C and/or poor climatic conditions like wind or rain prevail, or if the pipeline operator requires it, the weld joint shall be protected against excessively rapid cooling.

Stress-relief heat treatment may be necessary.

6.7 Repair of weld defects

Weld joints which do not meet the specified requirements shall be repaired or cut out. On each weld joint which requires repair, the faulty area shall be clearly marked. The marking shall not be removed until the defect has been repaired and the repair work has been inspected. If more than 20 % of the total weld exhibits defects requiring repair, or if several defective weld sections amount to this length overall, the weld joint in question shall be cut out and rewelded unless otherwise agreed by the pipeline operator.