SLOVENSKI STANDARD
SIST EN ISO 14692-2:2004

01-maj-2004

Industrija za predelavo nafte in zemeljskega plina - S steklenimi vlakni ojačeni polimerni cevovodi (GRP) - 2. del: Kvalificiranje in proizvodnja (ISO 14692-2:2002)

Petroleum and natural gas industries - Glass-reinforced plastics (GRP) piping - Part 2: Qualification and manufacture (ISO 14692-2:2002)

Erdöl- und Erdgasindustrie - Glasfaserverstärkte Kunstoffrohrleitungen (GFK) - Teil 2: Zulassung und Herstellung (ISO 14692-2:2002)

Industries du pétrole et du gaz naturel - Canalisations en plastique renforcé de verre (PRV) - Partie 2: Conformité aux exigences de performance et fabrication (ISO 14692-2:2002)

Ta slovenski standard je istoveten z: **EN ISO 14692-2:2002**

ICS:

75.200	Oprema za skladiščenje nafte, naftnih proizvodov in zemeljskega plina	Petroleum products and natural gas handling equipment
83.140.30	Cevi, fitingi in ventili iz polimernih materialov	Plastics pipes, fittings and valves

SIST EN ISO 14692-2:2004 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN ISO 14692-2

December 2002

ICS 75.200; 83.140.30

English version

Petroleum and natural gas industries - Glass-reinforced plastics (GRP) piping - Part 2: Qualification and manufacture (ISO 14692-2:2002)

Industries du pétrole et du gaz naturel - Canalisations en plastique renforcé de verre (PRV) - Partie 2: Conformité aux exigences de performance et fabrication (ISO 14692-2:2002)

This European Standard was approved by CEN on 2 December 2002.

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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 Management Centre has the same status as the official versions.

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COMITÉ EUROPÉEN DE NORMALISATION
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Foreword

This document (EN ISO 14692-2:2002) has been prepared by Technical Committee ISO/TC 67 "Materials, equipment and offshore structures for petroleum and natural gas industries" in collaboration with Technical Committee CEN/TC 12 "Materials, equipment and offshore structures for petroleum and natural gas industries", the secretariat of which is held by AFNOR.

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 June 2003, and conflicting national standards shall be withdrawn at the latest by June 2003.

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, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

NOTE FROM CMC The foreword is susceptible to be amended on reception of the German language version. The confirmed or amended foreword, and when appropriate, the normative annex ZA for the references to international publications with their relevant European publications will be circulated with the German version.

Endorsement notice

The text of ISO 14692-2:2002 has been approved by CEN as EN ISO 14692-2:2002 without any modifications.

INTERNATIONAL STANDARD

ISO 14692-2

First edition
2002-12-15

Petroleum and natural gas industries — Glass-reinforced plastics (GRP) piping —

Part 2: Qualification and manufacture

Industries du pétrole et du gaz naturel — Canalisations en plastique renforcé de verre (PRV) —
Partie 2: Conformité aux exigences de performance et fabrication

Reference number
ISO 14692-2:2002(E)

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Published in Switzerland

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 14692-2 was prepared by Technical Committee ISO/TC 67, *Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries*, Subcommittee SC 6, *Processing equipment and systems*.

ISO 14692 consists of the following parts, under the general title *Petroleum and natural gas industries — Glass-reinforced plastics (GRP) piping*:

— *Part 1: Vocabulary, symbols, applications and materials*

— *Part 2: Qualification and manufacture*

— *Part 3: System design*

— *Part 4: Fabrication, installation and operation*

Introduction

The objective of this part of ISO 14692 is to enable the purchase of GRP components with known and consistent properties from any source. Main users of the document will be the principal and the manufacturer, certifying authorities and government agencies.

Petroleum and natural gas industries — Glass-reinforced plastics (GRP) piping —

Part 2: Qualification and manufacture

1 Scope

This part of ISO 14692 gives requirements for the qualification and manufacture of GRP piping and fittings in order to enable the purchase of GRP components with known and consistent properties from any source.

It is applicable to qualification procedures, preferred dimensions, quality programmes, component marking and documentation.

This part of ISO 14692 is intended to be read in conjunction with ISO 14692-1.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 834-1, *Fire-resistance tests — Elements of building construction — Part 1: General requirements*

ISO 1172, *Textile-glass-reinforced plastics — Prepregs, moulding compounds and laminates — Determination of the textile-glass and mineral-filler content — Calcination methods*

ISO 4901, *Reinforced plastics based on unsaturated polyester resin — Determination of residual styrene monomer content*

ISO 6721-1, *Plastics — Determination of dynamic mechanical properties — Part 1: General principles*

ISO 7822:1990, *Textile glass reinforced plastics — Determination of void content — Loss on ignition, mechanical disintegration and statistical counting methods*

ISO 10467:—[1]), *Plastics piping systems for pressure and non-pressure drainage and sewerage — Glass-reinforced thermosetting plastics (GRP) systems based on unsaturated polyester (UP) resin*

ISO 10639:—[1]), *Plastics piping systems for water supply, with or without pressure — Glass-reinforced thermosetting plastics (GRP) systems based on unsaturated polyester (UP) resin*

ISO 11357-2, *Plastics — Differential scanning calorimetry (DSC) — Part 2: Determination of glass transition temperature*

1) To be published.

ISO 14692-1:2002, *Petroleum and natural gas industries — Glass-reinforced plastics (GRP) piping — Part 1: Vocabulary, symbols, applications and materials*

ASTM C177, *Standard test method for steady-state heat flux measurements and thermal transmission properties by means of the guarded-hot-plate apparatus*

ASTM D257, *Standard test methods for DC resistance or conductance of insulating materials*

ASTM D696, *Standard test method for coefficient of linear thermal expansion of plastics between –30 °C and 30 °C with a vitreous silica dilatometer*

ASTM D1598, *Standard test method for time-to-failure of plastic pipe under constant internal pressure*

ASTM D1599, *Standard test method for resistance to short-time hydraulic failure pressure of plastic pipe, tubing, and fittings*

ASTM D2105, *Standard test method for longitudinal tensile properties of "fiberglass" (glass-fiber-reinforced thermosetting-resin) pipe and tube*

ASTM D2143, *Standard test method for cyclic pressure strength of reinforced, thermosetting plastic pipe*

ASTM D2412, *Standard test method for determination of external loading characteristics of plastic pipe by parallel-plate loading*

ASTM D2583, *Standard test method for indentation hardness of rigid plastics by means of a barcol impressor*

ASTM D2925, *Standard test method for beam deflection of "fiberglass" (glass-fiber-reinforced thermosetting resin) pipe under full bore flow*

ASTM D2992, *Standard practice for obtaining hydrostatic or pressure design basis for "fiberglass" (glass-fiber-reinforced thermosetting-resin) pipe and fittings*

ASTM D3567, *Standard practice for determining dimensions of "fiberglass" (glass-fiber-reinforced thermosetting resin) pipe and fittings*

ASTM D4024, *Standard specification for machine made "fiberglass" (glass-fiber-reinforced thermosetting resin) flanges*

ASTM D5421, *Standard specification for contact molded "fiberglass" (glass-fiber-reinforced thermosetting resin) flanges*

ASTM E1529, *Standard test methods for determining effects of large hydrocarbon pool fires on structural members and assemblies*

ASTM E2092, *Standard test method for distorsion temperature in three-point bending by thermomechanical analysis*

API Spec 15HR, *Specification for high pressure fiberglass line pipe*

API Spec 5B 14th edition, *Gauging and inspection of casing, tubing, and line pipe threads*

IMO Resolution A 653(16), *Recommendation on improved fire test procedures for surface flammability of bulkhead, ceiling and deck finish materials*

IMO MSC.61(67) *International code for application of fire test procedures (FTP code)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 14692-1 and the following apply.

3.1
fire endurance property
ability of an element of the structure or component to continue to perform its function as a barrier or structural component during the course of a fire for a specified period of time

3.2
fire reaction properties
material-related properties concerned with time to ignition, surface flame-spread characteristics including smouldering and post-fire-exposure flaming, and rate of heat, smoke and toxic gas release

4 Symbols and abbreviated terms

For the purposes of this part of ISO 14692, the symbols and abbreviated terms given in ISO 14692-1 apply.

5 Materials of construction and wall thickness limitations

5.1 General

Permissible materials of construction are identified in 5.2 to 5.4. These shall be qualified in accordance with the qualification programme given in Clause 6. Changes in materials of construction require components to be re-qualified in accordance with 6.2.8.

5.2 Fibre

The principal reinforcement material of the component wall shall be glass fibre, e.g. continuous and/or woven rovings. The application of this part of ISO 14692 to pipes manufactured with other reinforcement fibres shall be done with caution and in agreement with the principal.

Other types of fibre reinforcement, such as carbon or aramid fibre, may be used to provide local strengthening within fittings. Such components shall be qualified by survival tests according to 6.2.3.2.2. Use of low electrical resistivity fibres, e.g. carbon, for non-structural purposes to provide electrical conductivity shall be permitted.

NOTE 1 Glass fibre is the preferred reinforcement material because there is little information available about the long-term pressure retention, impact and fire performance of pipes manufactured from other reinforcement materials such as carbon or aramid fibre.

NOTE 2 If significant quantities of carbon are present, either as fibre or filler, it may be necessary to electrically insulate the surface of the component where it could come into contact with adjacent metal components with glass-fibre-reinforced material because of the risk of galvanic corrosion.

5.3 Resin

The manufacture of components shall be limited to thermosetting resins. Typical resins are epoxy, polyester, vinyl ester and phenolic.

NOTE 1 See ISO 14692-1:2002, Clause 6.

Caution shall be applied to the use of fillers within the resin, since these can result in differing properties compared to the base resin, which will affect the long-term performance of the pipe.

The resin shall have a glass transition temperature, T_g, that is greater than or equal to 95 °C. The T_g shall be 30 °C above the standard qualification temperature, which is 65 °C.

The qualification requirements given in this part of ISO 14692 are not applicable to pipe systems that incorporate internal thermoplastic or elastomeric liners.

NOTE 2 The use of a thermoplastic liner will result in change of the failure mode for pressure retention. Such liners also have an influence on the fire endurance and electrostatic properties of the pipe.

Thermosetting resins that incorporate fibres or other filler material may be used as a liner on the inside of the pipe to provide enhanced performance, e.g. wear resistance and electrical conductivity. The liner material shall be compatible with the service conditions.

External coatings may be used to provide thermal insulation, fire resistance or electrical conductivity. However, consideration shall be given to identifying how such coatings affect the ability to detect possible leakage paths through the wall of the component during hydrotesting, or the effect that the additional mass of external coating may have on the overall stress analysis.

5.4 Joints

5.4.1 General

The joints are often the greatest area of concern with regard to the overall integrity of the piping system. The principal types of joint are:

a) adhesive/resin for bonded/laminated joints; and

b) mechanical joints.

The requirements given in 5.4.2 and 5.4.3 apply. The manufacturer shall apply an equivalent level of qualification requirements to new jointing systems that may be developed in the future.

5.4.2 Adhesive/resin for bonded/laminated joints

The adhesive to be used in the factory or field shall be the same as that used in the qualification tests. The adhesive/laminating resin shall have properties suitable for field assembly and shall fulfil the following requirements.

a) The adhesive or laminating resin shall have a suitable viscosity for application at site temperature and humidity conditions.

b) The degree of cure shall be determined in accordance with the procedures given in 6.8.2. The following shall apply, depending on the method used to determine degree of cure:

   — the glass transition temperature, T_g, of the cured adhesive or resin shall not be less than 95 % of the minimum value quoted by the manufacturer for the adhesive or resin system, as measured in accordance with 6.8.2.2;

   — the styrene content shall be no more than 2 % (mass fraction) of resin content, as measured in accordance with 6.8.2.3;

   — the Barcol hardness shall be at least 90 % of the minimum value quoted by the supplier and agreed with the principal, as measured in accordance with 6.8.2.4.

If an alternative method has been used to determine the baseline for degree of cure, then the acceptance criteria for quality control shall be in agreement with the principal.

c) The supplier shall record the test procedures used to determine the adhesive/resin properties.

5.4.3 Mechanical joints

The manufacturer shall ensure that the materials of construction of ancillaries such as O-rings, lubricants, gaskets, mastic and locking strips are suitable for the intended service conditions.

5.5 Wall thickness limitations

The structural calculations given in this part of ISO 14692 are only valid for thickness-to-diameter ratios that are in accordance with Equation (1).

$$\left(\frac{t_r}{D}\right) \leqslant 0{,}1 \tag{1}$$

where

t_r is the average reinforced thickness of the wall, in millimetres, i.e. excluding liner and added thickness for fire protection;

D is the mean diameter, in millimetres, of the structural portion of the wall.

In order to provide sufficient robustness during handling and installation, the minimum total wall thickness, t_{min}, of all components shall be defined as:

For $D_i \geqslant 100$ mm: $t_{min} \geqslant 3$ mm (2)

For $D_i < 100$ mm: $\left(\frac{t_{min}}{D_i}\right) \geqslant 0{,}025$ mm (3)

where D_i is the internal diameter of the reinforced wall of the component, in millimetres.

For more onerous applications, for example offshore, consideration should be given to increasing the minimum wall thickness to 5 mm.

The minimum wall thickness of the pipe at the joint, i.e. at the location of the O-ring or locking-strip groove, shall be at least the minimum thickness used for the qualified pipe body. Depending on location, the system design pressure and other design factors can significantly increase the required wall thickness.

6 Qualification programme

6.1 General

The qualification programme consists of standard methods for quantifying component performance with respect to static internal pressure, elevated temperature, chemical resistance, electrostatic and fire performance properties, with optional methods for quantifying potable water, impact, low temperature and limited cyclic pressure performance.

The manufacturer is required to determine a qualified pressure p_q, see 6.2.1.1, which is related to the manufacturer's nominal pressure rating p_{NPR} by the expression given in Equation (4).

$$p_{NPR} = f_2 \cdot f_{3,man} \cdot p_q \tag{4}$$

where

f_2 is a load factor (or safety factor);

$f_{3,man}$ is a factor to account for the limited axial load capability of GRP.