SLOVENSKI STANDARD

oSIST prEN ISO 14692-3:2015

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Industrija za predelavo nafte in zemeljskega plina - S steklenimi vlakni ojačeni polimerni cevovodi (GRP) - 3. del: Načrtovanje sistema (ISO/DIS 14692-3:2015)

Petroleum and natural gas industries - Glass-reinforced plastics (GRP) piping - Part 3: System design (ISO/DIS 14692-3:2015)

Erdöl- und Erdgasindustrie - Glasfaserverstärkte Kunststoffrohrleitungen (GFK) - Teil 3: Systemauslegung (ISO/DIS 14692-3:2015)

Industries du pétrole et du gaz naturel - Canalisations en plastique renforcé de verre (PRV) - Partie 3: Conception des systèmes (ISO/DIS 14692-3:2015)

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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

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

Part 3: **System design**

Industries du pétrole et du gaz naturel — Canalisations en plastique renforcé de verre (PRV) —

Partie 3: Conception des systèmes

ICS: 75.200; 83.140.30

ISO/CEN PARALLEL PROCESSING

This draft has been developed within the International Organization for Standardization (ISO), and processed under the **ISO lead** mode of collaboration as defined in the Vienna Agreement.

This draft is hereby submitted to the ISO member bodies and to the CEN member bodies for a parallel five month enquiry.

Should this draft be accepted, a final draft, established on the basis of comments received, will be submitted to a parallel two-month approval vote in ISO and formal vote in CEN.

To expedite distribution, this document is circulated as received from the committee secretariat. ISO Central Secretariat work of editing and text composition will be undertaken at publication stage.

Reference number
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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 14692-3 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*.

This second/third/... edition cancels and replaces the first/second/... edition (), [clause(s) / subclause(s) / table(s) / figure(s) / annex(es)] of which [has / have] been technically revised.

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

- *Part 3: System design*
- *Part [n]:*
- *Part [n+1]:*
- *Part 1: Vocabulary, symbols, applications and materials*
- *Part 2: Qualification and manufacture*
- *Part 3: System design*
- *Part 4: Fabrication, installation, inspection and maintenance*

Introduction

The objective of this part of ISO 14692 is to ensure that piping systems, when designed using the components qualified in ISO 14692-2, will meet the specified performance requirements. These piping systems are designed for use in oil and natural gas industry processing and utility service applications. The main users of the document will be the principal, design contractors, suppliers contracted to do the design, certifying authorities and government agencies.

Petroleum and natural gas industries — Glass-reinforced plastics (GRP) piping — Part 3: System design

1 Scope

This part of ISO 14692 gives guidelines for the design of GRP piping systems. The requirements and recommendations apply to layout dimensions, hydraulic design, structural design, detailing, fire endurance, spread of fire and emissions and control of electrostatic discharge..

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

Guidance on the use of Part 3 can be found in Figure 1 which is a more detailed flowchart of steps 5 and 6 in Figure 1 of Part 1.

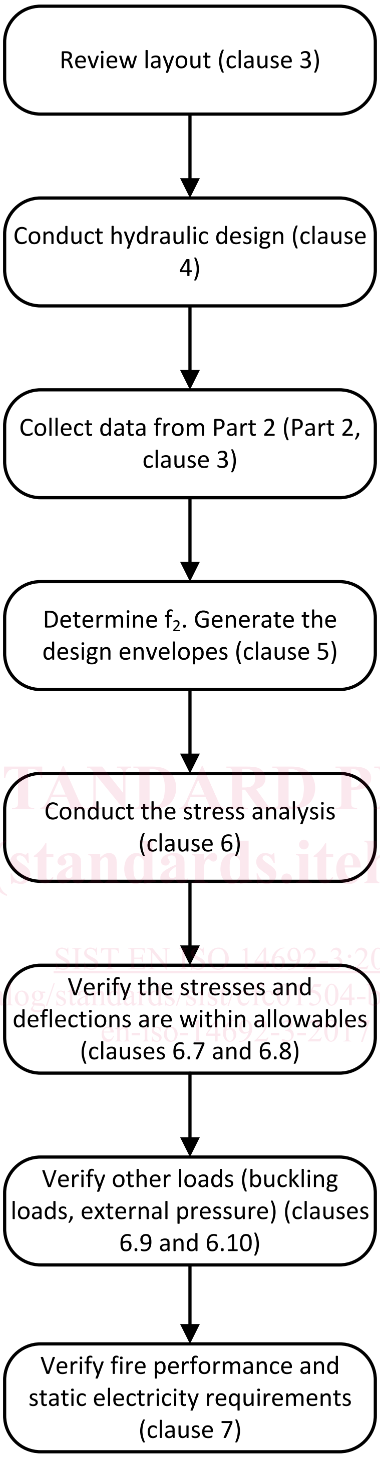

Figure 1 – Guidance on the use of Part 3

2 Terms, definitions, symbols and abbreviated terms

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

3 Layout requirements

3.1 General

GRP products are proprietary, and the choice of component sizes, fittings and material types may be limited depending on the supplier. Potential vendors should be identified early in design to determine possible limitations of component availability. The level of engineering support that can be provided by the supplier should also be a key consideration during vendor selection.

Where possible, piping systems should maximize the use of prefabricated spoolpieces to minimize the amount of site work. Overall spool dimensions should be sized taking the following into consideration:

— limitations of site transport and handling equipment;

— installation and erection limitations;

— limitations caused by the necessity to allow a fitting tolerance for installation ("cut to fit" requirements).

The designer shall evaluate system layout requirements in relation to the properties of proprietary pipe systems available from manufacturers, including but not limited to:

a) axial thermal expansion requirements;

b) ultraviolet radiation and weathering resistance requirements;

c) component dimensions;

d) jointing system requirements;

e) support requirements;

f) provision for isolation for maintenance purposes;

g) connections between modules and decks;

h) flexing during lifting of modules;

i) ease of possible future repair and tie-ins;

j) vulnerability to risk of damage during installation and service;

k) fire performance;

l) control of electrostatic charge.

The hydrotest provides the most reliable means of assessing system integrity. Whenever possible, the system should be designed to enable pressure testing to be performed on limited parts of the system as soon as installation of those parts is complete. This is to avoid a final pressure test late in the construction work of a large GRP pipe system, when problems discovered at a late stage would have a negative effect on the overall project schedule.

3.2 Space requirements

The designer shall take account of the larger space envelope of some GRP components compared to steel. Some GRP fittings have longer lay lengths and are proportionally more bulky than the equivalent metal component and may be difficult to accommodate within confined spaces. If appropriate, the problem can be reduced by fabricating the pipework as an integral spoolpiece in the factory rather than assembling it from the individual pipe fittings.

If space is limited, consideration should be given to designing the system to optimize the attributes of both GRP and metal components.

3.3 System supports

3.3.1 General

GRP piping systems can be supported using the same principles as those for metallic piping systems. However, due to the proprietary nature of piping systems, standard-size supports will not necessarily match the pipe outside diameters.

The following requirements and recommendations apply to the use of system supports.

a) Supports shall be spaced to avoid sag (excessive displacement over time) and/or excessive vibration for the design life of the piping system.

b) In all cases, support design should be in accordance with the manufacturer’s guidelines.

c) Where there are long runs, it is possible to use the low modulus of the material to accommodate axial expansion and eliminate the need for expansion joints, provided the system is well anchored and guided. In this case, the designer should recognize that the axial expansion due to internal pressure is now restrained and the corresponding thrust loads are partly transferred to the anchors.

d) Valves or other heavy attached equipment shall be adequately and, if necessary, independently supported. When evaluating valve weight, valve actuation torque shall also be considered.

NOTE Some valves are equipped with heavy control mechanisms located far from the pipe centreline and can cause large bending and torsional loads.

e) GRP pipe shall not be used to support other piping, unless agreed with the principal.

f) GRP piping should be adequately supported to ensure that the attachment of hoses at locations such as utility or loading stations does not result in the pipe being pulled in a manner that could overstress the material.

Pipe supports can be categorized into those that permit movement and those that anchor the pipe.

3.3.2 Pipe-support contact surface

The following guidelines to GRP piping support should be followed.

a) Supports in all cases should have sufficient length to support the piping without causing damage and should be lined with an elastomer or other suitable soft material.

b) Point loads should be avoided. This can be accomplished by using supports with at least 60 degrees of contact.

c) Clamping forces, where applied, should be such that crushing of the pipe does not occur. Local crushing can result from a poor fit and all-round crushing can result from over-tightening.

d) Supports should be preferably located on plain-pipe sections rather than at fittings or joints. One exception to this is the use of a "dummy leg" support directly on an elbow or tee (or piece of pipe).

Consideration shall be given to the support conditions of fire-protected GRP piping. Supports placed on the outside of fire protection could result in loads irregularly transmitted through the coating, which could result in shear/crushing damage and consequent loss of support integrity. Supports in direct contact with intumescent coatings may also alter the performance of the coating (i.e. prevent expansion of the coating under fire). This may require application of intumescent coatings to the pipe support itself in order to protect the pipe at the hanger or pipe support.

Pipe resting in fixed supports that permit pipe movement shall have abrasion protection in the form of saddles, elastomeric materials or sheet metal.

Anchor supports shall be capable of transferring the required axial loads to the pipe without causing overstress of the GRP pipe material. Anchor clamps are recommended to be placed between either a) a thrust collar laminated to the outer surface of the pipe or b) two double 180° saddles, adhesive-bonded to the outer surface of the pipe. The manufacturer's standard saddles are recommended and shall be bonded using standard procedures.

3.4 Isolation and access for cleaning

The designer should make provision for isolation and easy access for maintenance purposes, for example for removal of scale and blockages in drains. The joint to be used for isolation or access should be shown at the design stage and should be located in a position where the flanges can in practice be jacked apart, e.g. it should not be in a short run of pipe between two anchors.

3.5 Vulnerability

3.5.1 Point loads

Point loads should be minimized and the GRP piping locally reinforced where necessary.

3.5.2 Abuse

The designer should give consideration to the risk of abuse to GRP piping during installation and service and the need for permanent impact shielding.

Sources of possible abuse include:

a) any area where the piping can be stepped on or used for personnel support;

b) impact from dropped objects;

c) any area where piping can be damaged by adjacent crane activity, e.g. booms, loads, cables, ropes or chains;

d) weld splatter from nearby or overhead welding activities.

Small pipe branches (e.g. instrument and venting lines), which are susceptible to shear damage, should be designed with reinforcing gussets to reduce vulnerability. Impact shielding, if required, should be designed to protect the piping together with any fire-protective coating.

3.5.3 Dynamic excitation and interaction with adjacent equipment and piping

The designer should give consideration to the relative movement of fittings, which could cause the GRP piping to become overstressed. Where required, consideration shall be given to the use of flexible fittings.

The designer should ensure that vibration due to the different dynamic response of GRP (as compared with carbon steel piping systems) does not cause wear at supports or overstress in branch lines. The designer should ensure that the GRP piping is adequately supported to resist shock loads that may be caused by transient pressure pulses, e.g. operation of pressure safety valves, valve closure etc.

NOTE One reference of interest is "Guidelines for the avoidance of vibration induced fatigue failure in process pipework", 2nd edition, 2008 by the Energy Institute. While not written for plastics, the methodology may be effective in reducing the risk of pipe failure.