SLOVENSKI STANDARD
oSIST prEN ISO 15551-1:2014

01-januar-2014

Industrija za predelavo nafte in zemeljskega plina - Proizvodna oprema za vrtanje - 1. del: Električne potopne črpalke za prečrpavanje na površino (ISO/DIS 15551-1:2013)

Petroleum and natural gas industries - Drilling ans production equipment - Part 1: Electric submersible pump systems for artificial lift (ISO/DIS 15551-1:2013)

Industries du pétrole et du gaz naturel- Équipement de forage et de production- Partie 1: Systèmes électriques de pompes submersibles pour l'ascension artificielle (ISO/DIS 15551-1:2013)

Ta slovenski standard je istoveten z: **prEN ISO 15551-1**

ICS:

23.080	Črpalke	Pumps
75.180.10	Oprema za raziskovanje in odkopavanje	Exploratory and extraction equipment

oSIST prEN ISO 15551-1:2014 **en**

DRAFT INTERNATIONAL STANDARD

ISO/DIS 15551-1

ISO/TC **67**/SC **4** Secretariat: **ANSI**

Voting begins on: **2013-08-29**

Voting terminates on: **2014-01-29**

Petroleum and natural gas industries — Drilling ans production equipment —

Part 1: Electric submersible pump systems for artificial lift

Industries du pétrole et du gaz naturel — Équipement de forage et de production —

Partie 1: Systèmes électriques de pompes submersibles pour l'ascension artificielle

ICS: 75.180.10

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
ISO/DIS 15551-1:2013(E)

Contents

Page

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/IEC 15551-1 was prepared by Technical Committee ISO/TC 67, *Materials, Equipment, and Offshore Structures for Petroleum, Petrochemical, and Natural Gas Industries*, Subcommittee SC 4, *Drilling and Production Equipment*.

Introduction

This part of ISO 15551 has been developed by users/purchasers and suppliers/manufacturers of electric submersible pumps and is intended for use in the petroleum and natural gas industry worldwide. ISO 15551-1 provides requirements and information to both parties in the selection, manufacturing, testing, and use of electric submersible pumps as defined in the scope. Further, ISO 15551-1 addresses supplier requirements, which set the minimum parameters for claiming conformity with this International Standard.

ISO 15551-1 provides grades of requirements for design validation, quality control and functional evaluations allowing the user/purchaser to select each for a specific application. There are two grades of design validation, three grades of quality control and up to three grades of functional testing, depending on the component. Design validation grade V2 is restricted to legacy products, and the highest grade is V1. Quality control grade 3 is the standard grade and grades 2 and 1 provide additional requirements. Of the three functional evaluation grades, the lowest grade is the standard grade and higher grades provide additional requirements. The user/purchaser can specify requirements supplemental to these grades.

Users of this International Standard are informed that requirements above those outlined in this International Standard can be needed for individual applications. This International Standard is not intended to inhibit a supplier/manufacturer from offering, or the user/purchaser from accepting, alternative equipment or engineering solutions. This can be particularly applicable where there is innovative or developing technology.

Petroleum and natural gas industries — Drilling and production equipment — Part 1: Electric submersible pump systems for artificial lift

1 Scope

This part of ISO 15551 provides requirements for the design, design verification and validation, manufacturing and data control, performance ratings, functional evaluations, handling and storage of tubing-deployed electrical submersible pump (ESP) systems as defined herein. This part of ISO 15551 is applicable to those components meeting the definition of centrifugal pumps including gas handling devices, discharge heads, seal chamber sections, intake systems, mechanical gas separators, induction motors (herein motor), shaft couplings, motor lead extension, pothead and power cables, as defined herein. Components supplied under the requirements of this part of ISO 15551 exclude previously used subcomponents. Additionally, this International Standard provides requirements for assembled ESP systems.

This part of ISO 15551 includes normative annexes addressing design validation performance rating requirements by component, requirements for determining ratings as an assembled system, functional evaluation: single component and cable reference information.

This part of ISO 15551 includes informative annexes addressing functional evaluation guidelines for assembled ESP systems, establishing recommended operating range (ROR) of the ESP system, example user/purchaser ESP functional specification form, considerations for the use of 3-phase low and medium voltage adjustable speed drives for ESP applications, analysis after ESP use, downhole monitoring of ESP assembly operation and information on permanent magnet motors for ESP applications.

Equipment not covered by this part of ISO 15551 includes: wireline and coiled tubing-deployed ESP systems, motor and pump shrouds, electric penetrators and feed-through systems, cable clamps and banding, centralizers, intake screens, passive gas separators, by-pass tools, check and bleeder valves, component adaptors, capillary lines, electric surface control equipment, downhole permanent magnet motors and non-conventionally configured ESP systems such as inverted systems. Repair and redress equipment requirements are not covered in this part of ISO 15551.

The terminology used within this standard is; ~~"E~~ESP assembly" for a system of products combined into an operational machine, ~~"c~~omponent" for individual products such as, pumps or seal chamber sections, and ~~"s~~ubcomponent" for individual parts or subassemblies that are used in the construction of an individual component.

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 9000, *Quality Management*

ISO 9712, *Non-destructive testing -- Qualification and certification of personnel*

API RP 11S2, *Electric Submersible Pump Testing*[1]

[1] American Petroleum Institute, 1220 L Street North West, Washington, DC 20005, USA

API RP 11S7, *Recommended Practice of Application and Testing of Electric Submersible Pump Seal Chamber Section*

API RP 11S8, *Practice on Electric Submersible Pump System Vibrations*

ASTM B3, *Standard Specification for Soft or Annealed Copper Wire*[2]

ASTM B8, *Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft*

ASTM B33, *Standard Specification for Tin Coated Soft or Annealed Copper Wire for Electrical Purposes*

ASTM B189, *Standard Specification for Lead-Coated and Lead-Alloy-Coated Soft Copper Wire for Electrical Purposes*

ASTM B193, *Standard Test Method for Resistivity of Electrical Conductor Materials*

ASTM B258, *Standard Specification for Standard Nominal Diameters and Cross-Sectional Areas of AWG Sizes of Solid Round Wires Used as Electrical Conductors*

ASTM B496, *Standard Specification for Compact-Round Concentric-Lay-Stranded Copper Conductors*

ASTM D471, *Rubber Property – Effect of Liquids, Test Method for*

ASTM E8, *Standard Test Methods for Tension Testing of Metallic Materials*

NEMA WC 53, *Standard Test Methods for Extruded Dielectric Power, Control, Instrumentation and Portable Cables for Test*[3]

3 Terms and definitions

For the purposes of this document the following definitions shall apply. For quality system related terms used in this document and not defined below see ISO 9000 for their definitions.

3.1
adapter
device used to connect components that are not directly compatible

3.2
adjustable speed drive
device which controls an electric motor's speed by manipulating the power frequency being supplied to the motor.

Note 1 to entry: The term —adjustable speed drive" is interchangeable with other common industry names for this device such as —variable frequency drive" or —variable speed drive".

3.3
ampacity
maximum current that can pass through a power cable without exceeding its temperature limit for a specific operating environment

3.4
ampacity coefficient
the temperature rise of the power cable divided by the square of the amperage for a specific operating environment

[2] American Society for Nondestructive Testing, 1711 Arlingate Lane, Columbus, OH 43228-0518, USA

[3] National Electrical Manufacturers Association, 1300 North 17th Street, Suite 1752, Rosslyn, Virginia 22209

3.5
armor
outer covering to the power cable that can provide protection from mechanical damage and provides mechanical constraint against swelling or expansion of underlying materials on exposure to well fluids

3.6
assembled ESP system
assembly of downhole equipment which includes some or all components as identified in this part of ISO 15551

3.7
auxiliary equipment
equipment or components that are outside the scope of this part of ISO 15551 and are typically selected and/or installed by the user/purchaser

EXAMPLES Cable protectors, motor shrouds, by-pass tools and electrical penetrators.

3.8
axial stage type
type of stage with inlet and exit flow path essentially parallel to the shaft axis

3.9
bag/bladder/bellows
the flexible subcomponent of a seal chamber section that functions as a positive barrier that isolates the wellbore production fluid from the motor fluid

3.10
bag/bladder/bellows chamber
chamber which houses the bag/bladder/bellows

3.11
barrier
subcomponent of an ESP power cable that can be applied over the insulated conductors and provides fluid protection, hoop strength or both

3.12
best efficiency point
BEP
pump performance values at the flow rate where the pump efficiency is highest

3.13
bleeder valve
valve placed above a check valve for the purpose of reducing pressure or draining the fluid from within the production tubing

3.14
braid
supplementary layer of material used to provide mechanical performance characteristics to the power cable system such as hoop strength for gas decompression

3.15
bubble point
the pressure at which gas begins to break out of under-saturated oil/fluid and form a free gas phase

3.16
by-pass tool
device that is installed into the wellbore along with the ESP assembly that divides the tubing system to permit the installation of additional tubing string parallel to the ESP

3.17
cable band
metal band which is used to secure ESP power cable to production tubing

3.18
cable clamp
device, usually of rigid material, for strengthening or supporting power cable to production tubing

3.19
capillary line
independent tubing string commonly used for hydraulic control of safety valves and sliding sleeves or for chemical injection

Note 1 to entry: This device is also commonly referred to as a chemical injection line or control line.

3.20
casing
pipe extending from the surface and intended to line the walls of a drilled well

3.21
casing size
nominal casing outside diameter (od), mass (weight), inside diameter (id), and/or drift diameter as specified in ISO 11960

3.22
centralizers
device used to keep the ESP assembly or other downhole equipment in the centre of the tubing, casing or wellbore

3.23
centrifugal pump
component of an ESP system that uses rotating impeller(s) to impart kinetic energy (velocity) by centrifugal force to a fluid and stationary diffusers to convert the kinetic energy to potential energy (pressure)

3.24
chamber
subcomponent of the seal chamber section

3.25
check valve
device that allows one-directional flow of fluid when a differential pressure exists

3.26
coefficient of determination
statistic used to determine the strength of a fit between a mathematical model and a set of observed data values

Note 1 to entry: The coefficient of determination is typically calculated using the following equation

$$R^2 = 1 - \frac{\sum_{i=1}^{n} (Y_i - y_i)^2}{\sum_{i=1}^{n} (y_i - \bar{y})^2}$$

3.27
coiled tubing
pipe typically supplied and installed in one continuous length and wound onto a reel or spool