INTERNATIONAL STANDARD

ISO 15551

First edition
2023-09

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

Industries du pétrole et du gaz naturel — Équipement de forage et de production — Systèmes de pompes submersibles électriques pour relevage artificiel

Reference number
ISO 15551:2023(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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 67, *Oil and gas industries including lower carbon energy*, Subcommittee SC 4, *Drilling, production and injection equipment,* in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 12, *Oil and gas industries including lower carbon energy,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This first edition cancels and replaces ISO 15551-1:2015, which has been technically revised.

The main changes are as follows:

— the relationship between the design verification/validation activities and the functional specification/technical specification has been revised. In this document, the design verification/validation activities have been tied to a “basis of design” rather than to the functional specification/technical specification;

— Annex E has been augmented to incorporate additional details, guidelines and options for completing functional evaluation of assembled systems;

— Annex L is a “user’s guide”, which has been added to this document to provide a simplified view of the practical workflow of the document.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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

1 Scope

This document specifies 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. Additionally, this document provides requirements for assembled ESP system.

This document is applicable to those ESP related components meeting the definition of centrifugal pumps, including gas handling devices, discharge heads, seal chamber sections, intake systems, mechanical gas separators, asynchronous 3 phase - 2 pole induction motors (herein motor), shaft couplings, downhole power cables (herein power cables), motor lead extension, and pothead. Components supplied under the requirements of this document exclude previously used subcomponents, except where the use of such subcomponents is as defined in this document (Clause 9).

This document addresses design validation performance rating requirements by component (see Annex A), requirements for determining ratings as an assembled system (see Annex B), functional evaluation: single component (see Annex C) and cable reference information (see Annex D).

This document addresses functional evaluation guidelines for assembled ESP systems, establishing recommended operating range (ROR) of the ESP system (see Annex F), example user/purchaser ESP functional specification form (see Annex G), considerations for the use of 3-phase low and medium voltage adjustable speed drives for ESP applications (see Annex H), analysis after ESP use (see Annex I), downhole monitoring of ESP assembly operation (see Annex J), information on permanent magnet motors for ESP applications (see Annex K) and users guide (see Annex L).

This document also includes a user guide that offers a high-level process workflow when applying this document.

This document does not apply to: wireline and coiled tubing-deployed ESP systems, motor shrouds 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. This document does not apply to Repair and redress equipment requirements.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

IEC 60228, *Conductors of insulated cables*

ISO 9000, *Quality management systems — Fundamentals and vocabulary*

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

API RP 11S2, *Electric Submersible Pump Testing*

API RP 11S6, *Recommended Practice for Testing of Electrical Submersible Pump Cable Systems*

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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*

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, *Standard Test Method for Rubber Property — Effect of Liquids*

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

ANSI/NEMA WC 53, *Standard Test Methods for Extruded Dielectric Power, Control, Instrumentation, and Portable Cables for Test*

ASTM D877, *ASTM D877M, Standard Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using Disk Electrodes*

ASTM D1816, *Standard Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using VDE Electrodes*

IEEE Std 1018, *Recommended Practice for Specifying Electric Submersible Pump Cable - Ethylene-Propylene Rubber Insulation*

IEEE Std 1019, *Recommended Practice for Specifying Electric Submersible Pump Cable-Polypropylene Insulation*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 9000 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

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

3.2
adjustable speed drive
device that controls an electric motor's speed by manipulating both the output voltage and the power frequency being supplied to the motor

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