
**Petroleum and natural gas industries —
Progressing cavity pump systems for
artificial lift —**

**Part 2:
Surface-drive systems**

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*Industries du pétrole et du gaz naturel — Pompes de fond à cavité
progressive pour activation des puits —*

Partie 2: Systèmes d'entraînement en surface

ISO 15136-2:2006

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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 15136-2 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*.

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ISO 15136 consists of the following parts: **(standards.iteh.ai)**

- *Downhole equipment for petroleum and natural gas industries — Progressing cavity pump systems for artificial lift — Part 1: Pumps*
<https://standards.iteh.ai/catalog/standards/sist/49326064-c33d-4ba5-81f5-5a51ca3f0a4/iso-15136-2-2006>
- *Petroleum and natural gas industries — Progressing cavity pump systems for artificial lift — Part 2: Surface-drive systems*

Introduction

This part of ISO 15136 has been developed by users/purchasers and suppliers/manufacturers of progressing cavity pump surface-drive systems and is intended for use in the petroleum and natural gas industry worldwide. ISO 15136-2 provides requirements and information to both parties in the selection, manufacturing, testing, and using progressing cavity pump surface-drive systems as defined in the scope. Further, ISO 15136-2 addresses supplier requirements, which set the minimum parameters with which suppliers shall comply to claim conformity with this International Standard.

ISO 15136-2 has been structured to allow for grades of increased requirements in quality control documentation. These variations allow the user/purchaser to select the grade that is required for a specific application.

There are two quality control documentation grades, which provide the user/purchaser the choice of requirements to meet their preference or application. Quality control documentation grade Q2 is the standard grade offered and quality control documentation grade Q1 provides additional documentation. Additional requirements can be specified by the user/purchaser as supplemental requirements.

Users of this International Standard should be aware that requirements above those outlined in this International Standard may 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 may be particularly applicable where there is innovative or developing technology. Where an alternative is offered, the vendor should identify any variations from this part of ISO 15136-2 and provide details.

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Petroleum and natural gas industries — Progressing cavity pump systems for artificial lift —

Part 2: Surface-drive systems

1 Scope

This part of ISO 15136 provides requirements for the design, design verification and validation, manufacturing and data control, performance ratings and repair of progressing cavity pump surface-drive systems for use in the petroleum and natural gas industry. This part of ISO 15136 is applicable to those products meeting the definition of surface-drive systems. Additionally, informative annexes provide information on brake system selection, installation, and operation; and sucker rod selection and use.

Equipment not covered by this part of ISO 15136, unless integral by design, includes bottom drive systems, sucker rods, polished rod clamps, stuffing boxes, electrical controls, instrumentation, external power transmission devices, auxiliary equipment, such as belts, sheaves and equipment guards. These items might or might not be covered by other International Standards.

2 Normative references

[ISO 15136-2:2006](https://standards.iteh.ai/catalog/standards/sist/49326064-c33d-4ba5-81f5-5a51ca3f00a4/iso-15136-2-2006)

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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 2859-1, *Sampling procedures for inspection by attributes — Part 1: Sampling schemes indexed by acceptance quality level (AQL) for lot-by-lot inspection*

ISO 2859-2, *Sampling procedures for inspection by attributes — Part 2: Sampling plans indexed by limiting quality (LQ) for isolated lot inspection*

ISO 3601-1, *Fluid power systems — O-rings — Part 1: Inside diameters, cross-sections, tolerances and size identification code*

ISO 3601-3, *Fluid power systems — O-rings — Part 3: Quality acceptance criteria*

ISO 6506-1, *Metallic materials — Brinell hardness test — Part 1: Test method*

ISO 6507-1, *Metallic materials — Vickers hardness test — Part 1: Test method*

ISO 6508-1, *Metallic materials — Rockwell hardness test — Part 1: Test method (Scales A, B, C, D, E, F, G, H, K, N, T)*

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

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

ISO 15136-2:2006(E)

ISO 15156 (all parts), *Petroleum and natural gas industries — Materials for use in H₂S-containing environments in oil and gas production*

ASTM A370, *Standard Test Methods and Definitions for Mechanical Testing of Steel Products*

ASTM D1415, *Standard Test Method for Rubber Property — International Hardness*

ASTM D2240, *Standard Test Method for Rubber Property — Durometer Hardness*

ASTM E140, *Standard Hardness Conversion Tables for Metals Relationship Among Brinell Hardness, Vickers Hardness, Rockwell Hardness, Superficial Hardness, Knoop Hardness, and Scleroscope Hardness*

MIL STD 105E, *Sampling Procedures and Tables for Inspection by Attributes*

3 Terms and definitions

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

- 3.1 applied torque**
torque that is applied to the top of the drive string by the surface-drive system
- 3.2 auxiliary equipment**
equipment or components that are outside the scope of this part of ISO 15136 and are typically selected and/or installed by the user/purchaser; examples are sheaves and belts, motors, polished rod clamps, guards, motor controllers and torque limiting devices
- 3.3 axial-load capacity**
maximum allowable load that can be supported by the structure independent of auxiliary equipment capabilities
- 3.4 backspin**
process by which the progressing cavity pump, the drive string and the power train turn in the direction opposite to normal operation and which is driven by the release of the torsional and fluid potential energy
- 3.5 backspin-resisting torque**
torque applied to the drive string to resist backspin
- 3.6 brake-engagement speed**
rotational speed at which the brake system engages during backspin
- 3.7 bottom-drive system**
PCP drive system utilizing a downhole prime mover
- 3.8 brake system**
system that provides controlled resistance to backspin
- 3.9 drive string**
device transmitting power (usually sucker rods) between the surface-drive system and the PCP

3.10**dynamic fluid level**

depth from the wellhead to the top of the liquid column in the casing-tubing annulus under dynamic conditions

3.11**direct drive**

type of surface-drive system with no internal gear reduction

3.12**driver sheave**

pulley mounted on the prime mover shaft in belt driven surface-drive systems

3.13**driven sheave**

pulley mounted on the main shaft in belt-driven surface-drive systems

3.14**flow rate**

volume of fluid pumped per unit of time

3.15**fluid potential energy**

energy stored in the production system due to the difference in fluid levels between the production tubing and the tubing-casing annulus

3.16**fluid head**

pressure exerted by the fluid above the downhole pump

3.17**friction torque**

resistance to rotation of the drive string (inside the tubing) and the rotor (inside the stator) that is dependent upon factors including (but not limited to) well depth and trajectory, pump geometry and interference fit between rotor and stator, and stuffing box characteristics

3.18**gear-reduction drive**

type of surface-drive system with an internal gear reduction

3.19**heat capacity**

total energy absorbed by the surface-drive system divided by the change in surface-drive system temperature

3.20**heat dissipation rate**

rate at which energy is dissipated from the surface-drive system to its surroundings in the form of heat

3.21**hydraulic drive**

type of surface-drive system powered by a hydraulic prime mover

3.22**hydraulic torque**

torque induced by the differential pressure across the PCP acting on its effective cross-sectional area

3.23**input power rating**

maximum allowable power, which may be supplied to the surface-drive system

3.24

job lot

batch of material or components that have undergone the same process or series of processes

3.25

job-lot traceability

the ability of parts to be identified as originating from a job lot which identifies the included heat(s)

3.26

main shaft

central shaft of the surface drive that is connected to the drive string

3.27

maximum backspin speed

maximum speed allowed at the main shaft that will not compromise the integrity of the surface-drive system or auxiliary equipment

3.28

maximum dynamic fluid level

maximum operating fluid level in the annulus as measured from the surface that ensures that, after a shutdown, the rotating speed does not exceed the maximum backspin speed for the surface-drive system

3.29

maximum operating torque

maximum allowable operating torque applied at the main shaft as specified by the supplier/manufacturer

3.30

moment of inertia

ratio of the torque applied to the rotating components of the surface-drive system divided by the angular acceleration of those components about a common axis

3.31

operating speed range

range defined by the minimum and maximum operating speeds for the surface-drive system as specified by the supplier/manufacturer

3.32

operating temperature range

range defined by the minimum and maximum operating temperatures for the surface-drive system as specified by the supplier/manufacturer

3.33

polished-rod stick-up

length of polished rod extending above the top of the polished rod clamp

3.34

power train

components of the surface-drive system and auxiliary equipment which transmit power from the prime mover into the drive string

NOTE Includes belts, sheaves, gears, direct coupling or other combinations to achieve the required output.

3.35

prime mover

motor (typically hydraulic, electric or internal combustion) providing the torque to the power train

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3.36**production system**

assembly of equipment that includes the downhole pump, drive string, production tubing, well casing, surface-drive system, and auxiliary equipment

3.37**progressing cavity pump**

pump consisting of a stator and rotor whose geometry of assembly is such that it creates two or more series of lenticular, spiral, separated cavities

3.38**repair**

activities that include disassembly, re-assembly and testing with or without the replacement of parts and can include, machining, welding, heat treating or other manufacturing operations

3.39**surface-drive system**

assembly of equipment that, when installed, transmits torque from a prime mover into a progressing cavity pump drive string, supports the loads transmitted by the drive string and controls backspin of the drive string as applicable

3.40**thrust bearing**

device within a surface-drive system that supports the axial load transmitted by the drive string while allowing it to rotate

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3.41**thrust-bearing rating**

bearing manufacturer's published statistical ratings that serve as guidelines in the prediction of bearing life expectancies under given conditions

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3.42**torque-limiting device**

device that prevents the surface-drive system from applying a torque to the drive string greater than a prescribed value

3.43**torsional energy**

energy stored in the drive string due to torque-induced elastic deformation

4 Abbreviated terms

ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AQL	Acceptance quality limit
IEC	International Electrotechnical Commission
mo	month
NACE	National Association of Corrosion Engineers
NDE	Nondestructive examination
PCP	Progressing cavity pump

SAE	Society of Automotive Engineers
SNT (ASNT)	American Society for Nondestructive Testing
yr	year

5 Functional specification

5.1 General

The user/purchaser shall prepare a functional specification to order products which conform to this part of ISO 15136 and shall specify the following requirements and operating conditions as appropriate, and/or identify the supplier's/manufacture's specific product. This information is used by the supplier/manufacture to recommend the surface-drive systems and/or components for the application. These requirements and operating conditions may be conveyed by means of a dimensional drawing, data sheet, or other suitable communication in a format that conforms to this part of ISO 15136. An example of a functional specification form for this information is provided as Annex F.

The user/purchaser shall ensure that the expected operating axial load, torque, speed, surface-drive system temperature, power and braking requirements (where required) do not exceed the surface-drive system's ratings. The maximum operating torque and the maximum dynamic fluid level are a function of the ability of the surface-drive system to dissipate the energy stored in the production system after a shutdown, and may be determined by using the data provided with the surface-drive technical specifications in an analytical backspin model, such as the one described in Annex B.

5.2 Surface-drive system type selection

The user/purchaser shall select a drive system type (exclusive of prime mover type):

- a) gear-reduction drive; <https://standards.iteh.ai/catalog/standards/sist/49326064-c33d-4ba5-81f5-5a51ca3f00a4/iso-15136-2-2006>
- b) direct drive;
- c) hydraulic drive.

5.3 Functional characteristics

5.3.1 General

The user/purchaser shall provide the operating speed and input power (torque), and axial load.

5.3.2 Application parameters

Functional characteristics are typically determined based on application parameters. These parameters may include but are not limited to

- a) anticipated flow rate, tubing head pressure at surface of produced fluid and pump intake pressure;
- b) produced fluid composition (constituents, viscosity, specific gravity, temperature, *et al.*);
- c) anticipated PCP model to be used;
- d) PCP setting depth;
- e) tubular sizes/weights/materials;
- f) drive string diameter, type and material.

5.4 Environmental compatibility

User/purchaser shall specify the environmental compatibility requirements. The following are typical topics for consideration:

- a) ambient temperature;
- b) surface-drive start-up temperature;
- c) high ultraviolet exposure;
- d) high relative humidity (high dew point);
- e) dusty or sandy environment;
- f) areas with unique environmental or safety concerns;
- g) areas with salt spray;
- h) noise considerations;
- i) hazardous location classification.

5.5 Compatibility with related well equipment

The user/purchaser shall specify, where applicable, the interface connection designs and material requirements, and external dimensional limitations, needed to assure that the product shall conform to the intended application:

- a) size, type, material, configuration and interface dimensions of the connection between the product and other well equipment such as: stuffing box, polished rod, wellhead, *et al.*;
- b) size, type and configuration of other products passing through or over the product such as polished rod, sucker rods (see Annex H), *et al.*;
- c) size, type and configuration of other products used with or in conjunction with this product;
- d) proximity of unrelated equipment that can impact the delivery, installation, operation, servicing or removal of the product;
- e) wellhead-angle from the vertical;
- f) prime mover interface requirements.

5.6 Design validation and product functional testing

Design validation and product functional requirements are provided for these products; the user/purchaser is not required to select a grade for these requirements.

5.7 Quality control documentation

Two quality control documentation grades are stipulated in 7.4. The user/purchaser shall specify one of the following quality control documentation grades. If no quality control documentation grade is specified, grade Q2 shall be supplied.

- Q1: enhanced quality control documentation requirements, which include the requirements of Q2;
- Q2: standard quality control documentation requirements.

6 Technical specification

6.1 General requirements

The supplier/manufacturer shall prepare the technical specification that responds to the requirements defined in the functional specification.

6.2 Technical characteristics

The following data are included, as applicable, with units of measure:

- a) surface-drive system type;
- b) speed range;
- c) maximum operating torque;
- d) axial load capacity;
- e) sheave size range;
- f) main shaft dimensions;
- g) polished rod size capability;
- h) wellhead/drive connection type;
- i) main shaft type (hollow vs. solid);
- j) physical dimensions and weight;
- k) prime mover type and interface requirements;
- l) gear reduction ratio;
- m) operating temperature range;
- n) responses to special requirements requested by the user/purchaser as specified in Clause 5;
- o) system body maximum pressure, where applicable.

6.3 Design criteria

6.3.1 Materials

The supplier/manufacturer shall state that the defined materials have performance characteristics that are suitable for all parameters specified in the functional specification. This applies to metallic and non-metallic components. The supplier/manufacturer shall have documented specifications for all materials used in the manufacture of the product.

6.3.2 Performance ratings

6.3.2.1 General

The supplier/manufacturer shall establish the performance ratings of the surface drivehead, in the product's operating manual as applicable for the surface-drive system based upon objective evidence and evaluation. These include, as a minimum, the performance ratings listed below.

6.3.2.2 Brake system characteristics

6.3.2.2.1 General

The following parameters shall be supplied to the user/purchaser to aid in the evaluation of the suitability of the surface-drive system for the specific application.

6.3.2.2.2 Backspin-resisting torque

Mathematical expression, typically expressed in newton metres (foot-pounds), or graphical representation of the backspin-resisting torque, which is stated as a function of backspin speed and surface-drive system temperature.

6.3.2.2.3 Heat-dissipation rate

Mathematical expression or graphical representation of the heat dissipation rate, which is typically expressed in units of watts per degree Celsius (horsepower per degree Fahrenheit).

6.3.2.2.4 Heat capacity

Numeric value of the heat capacity, which is typically expressed in units of joules per degree Celsius (BTU per degree Fahrenheit).

6.3.2.2.5 Brake-engagement speed

Numeric value of the brake system engagement speed, which is typically expressed in units of revolutions per minute.

6.3.2.3 Moment of inertia

Numeric value of the moment of inertia, which is typically expressed in terms of square kilograms metre-square (pounds foot-square).

6.3.2.4 Thrust-bearing rating

Numeric value of the thrust-bearing rating, which is typically expressed in terms of kilonewtons (pounds) for a specified set of conditions.

6.3.2.5 Input-power rating

Numeric value of the input-power rating, which is typically expressed in units of kilowatt.

6.3.2.6 Maximum operating torque

Numeric value of the maximum operating torque, which is typically expressed in units of newton metre (foot-pounds).

6.3.2.7 Operating temperature range

Numeric value of the operating temperature range, which is typically expressed in units of degrees Celsius (degrees Fahrenheit).

6.3.2.8 Operating speed range

Numeric value of the operating speed range, which is typically expressed in units of revolutions per minute.