
**Petroleum, petrochemical and natural
gas industries — Steam turbines —
Special-purpose applications**

*Industries du pétrole, de la pétrochimie et du gaz naturel — Turbines à
vapeur — Usage spécial*

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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 10437 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*.

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This second edition cancels and replaces the first edition (ISO 10437:1993), which has been technically revised.

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Introduction

This International Standard is based on API Std 612, fourth edition, June 1995.

Users of this International Standard should be aware that further or differing requirements may be needed for individual applications. This International Standard is not intended to inhibit a vendor from offering, or the purchaser from accepting, alternative equipment or engineering solutions for the individual application. This may be particularly appropriate where there is innovative or developing technology. Where an alternative is offered, the vendor should identify any variations from this International Standard and provide details.

This International Standard requires the purchaser to specify certain details and features.

A bullet (●) at the beginning of a clause or subclause indicates that either a decision is required or further information is to be provided by the purchaser. This information or decision should be indicated on the data sheets; otherwise it should be stated in the quotation request (inquiry) or in the order.

In this International Standard, where practical, US Customary units have been included in brackets for information.

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Petroleum, petrochemical and natural gas industries — Steam turbines — Special-purpose applications

1 Scope

This International Standard specifies requirements and gives recommendations for the design, materials, fabrication, inspection, testing and preparation for shipment of steam turbines for special-purpose applications. It also covers the related lube-oil systems, instrumentation, control systems and auxiliary equipment. It is not applicable to general-purpose steam turbines, which are covered in ISO 10436.

NOTE For the purpose of this provision, API Std 611 is equivalent to ISO 10436.

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 7-1, *Pipe threads where pressure-tight joints are made on the threads — Part 1: Dimensions, tolerances and designation.*

ISO 10437:2003

ISO 261, *ISO general-purpose metric screw threads — General plan*

ISO 262, *ISO general-purpose metric screw threads — Selected sizes for screws, bolts and nuts*

ISO 724, *ISO general-purpose metric screw threads — Basic dimensions*

ISO 965 (all parts), *ISO general-purpose metric screw threads — Tolerances*

ISO 1940-1, *Mechanical vibration — Balance quality requirements of rigid rotors — Part 1: Determination of permissible residual unbalance*

ISO 3744, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Engineering method in an essentially free field over a reflecting plane*

ISO 7005-1, *Metallic flanges — Part 1: Steel flanges*

ISO 7005-2, *Metallic flanges — Part 2: Cast iron flanges*

ISO 8068, *Petroleum products and lubricants — Petroleum lubricating oils for turbines (categories ISO-L-TSA and ISO-L-TGA) — Specifications*

ISO 8501-1, *Preparation of steel substrates before application of paints and related products — Visual assessment of surface cleanliness — Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings*

ISO 8821, *Mechanical vibration — Balancing — Shaft and fitment key convention*

ISO 10437:2003(E)

ISO 10438 (all parts)¹⁾, *Petroleum and natural gas industries — Lubrication, shaft sealing and control oil systems for special-purpose applications.*

ISO 10441, *Petroleum and natural gas industries — Flexible couplings for mechanical power transmission — Special purpose applications*

ISO 13691, *Petroleum and natural gas industries — High-speed special-purpose gear units*

ISO 15649, *Petroleum and natural gas industries — Piping*

IEC 60045-1, *Steam turbines — Part 1: Specifications*

IEC 60072, *Dimensions and output series for rotating electrical machines*

IEC 60079, *Electrical apparatus for explosive atmospheres*

IEC 60953, *Rules for steam turbine thermal acceptance tests*

EN 287, *Approval testing of welders — Fusion welding*²⁾

EN 288, *Specification and approval of welding procedures for metallic materials*

API RP 520 PT I, *Sizing, selection, and installation of pressure-relieving systems in refineries, Part I — Sizing and selection.*³⁾

API RP 520 PT II, *Sizing, selection, and installation of pressure-relieving systems in refineries, Part II — Installation*

API Std 526, *Flanged steel pressure relief valves*

API Std 613, *Special-purpose gear units for petroleum, chemical and gas industry services*

API Std 670, *Machine protection systems*

API Std 671, *Special-purpose couplings for petroleum, chemical and gas industry services*

API RP 686 (First edition, April 1996), *Recommended Practices for machinery installation and installation design*

ASME, *Boiler and pressure vessel code, Section V — Nondestructive examination.*⁴⁾

ASME, *Boiler and pressure vessel code, Section VIII — Pressure vessels*

ASME, *Boiler and pressure vessel code, Section IX — Qualification standard for welding and brazing procedures, welders, brazers, and welding and brazing operators*

ASME B1.1, *Unified screw threads (UN and UNR Thread Form)*

ASME B16.1, *Cast iron pipe flanges and flanged fittings, Class 25, 125 and 250*

1) To be published.

2) Comité Européen de Normalisation, 36, rue de Stassart, B-1050 Brussels, Belgium.

3) American Petroleum Institute, Publications and Distribution Section, 1220 L Street Northwest, Washington DC 20005, USA.

4) ASME International, 3 Park Avenue, New York, NY 10016-5990, USA.

ASME B16.5, *Pipe flanges and flanged fittings, NPS 1/2 through NPS 24*

ASME B16.11, *Forged fittings, socket-welding and threaded*

ASME B16.42, *Ductile iron pipe flanges and flanged fittings, classes 150 and 300*

ASME B16.47, *Large diameter steel flanges NPS 26 through NPS 60*

ASME B17.1, *Keys and keyseats*

ASME PTC 6, *Performance test code 6 on steam turbines*

ASME PTC 20.2, *Overspeed trip systems for steam turbine-generator units*

ASTM A 194, *Standard specification for carbon and alloy steel nuts for bolts for high-pressure or high-temperature service, or both⁵⁾*

ASTM A 247, *Standard test method for evaluating the microstructure of graphite in iron castings*

ASTM A 278, *Standard specification for gray iron castings for pressure-containing parts for temperatures up to 650 °F (350 °C)*

ASTM A 307, *Standard specification for carbon steel bolts and studs, 60 000 psi tensile strength*

ASTM A 395, *Standard specification for ferritic ductile iron pressure-retaining castings for use at elevated temperatures*

ASTM A 418, *Standard test method for ultrasonic examination of turbine and generator steel rotor forgings*

ASTM A 472, *Standard test method for heat stability of steam turbine shafts and rotor forgings*

ASTM A 536, *Standard specification for ductile iron castings*

AWS D1.1, *Structural welding code — Steel⁶⁾*

NEMA SM 23, *Steam turbines for mechanical drive service.⁷⁾*

NFPA 70, *National electrical code.⁸⁾*

NACE MR0175, *Sulfide stress cracking resistant metallic materials for oilfield equipment.⁹⁾*

SSPC-SP6/NACE No. 3, *Commercial blast cleaning.¹⁰⁾*

5) American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103-1187.

6) American Welding Society, 550 NW Le Jeune Road, PO Box 351040, Miami, FL 33130, USA.

7) National Electrical Manufacturers Association, 1300 N 17th Street; Suite 1847, Rosslyn, VA 22209, USA.

8) National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02269, USA.

9) NACE International, 1440 South Creek Drive, Houston, TX 77084, USA.

10) SSPC: The Society for Protective Coatings, 40 24th Street 6th floor, Pittsburgh, PA 15222-4656, USA.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply. (See Annex B for a guide to steam turbine nomenclature.)

3.1 alarm point

preset value of a measured parameter at which an alarm is actuated to warn of a condition that requires corrective action

3.2 anchor bolts

bolts used to attach the mounting plate to the support structure or foundation

3.3 axially split

split with the principal joint parallel to the shaft centreline

3.4 control mechanism

all of the equipment between the speed governor and the governor-controlled valve(s) (such as linkages, pilot valves, power servos, and so forth)

3.5 critical speed

shaft rotational speed at which the rotor-bearing-support system is in a state of resonance

3.6 design

equipment manufacturer's description of various parameters relevant to the equipment

NOTE This terminology is for use only by the equipment manufacturer and is not intended to appear in the purchaser's specifications.

3.7 fail safe system

system which causes the equipment to revert to a permanently safe condition (shutdown and/or depressurized) in the event of a component failure or failure of the energy supply to the system

3.8 field changeable

design feature that permits alteration of a function after the equipment has been installed

NOTE The alteration can be accomplished by the following:

- a) soldering jumper leads to terminal pins especially provided for this purpose;
- b) employing circuit-board-mounted switches or potentiometers;
- c) using a shorting or diode-pin-type matrix board;
- d) using prewired shorting plugs;
- e) using authorized controlled access.

3.9 gauge board

bracket or plate used to support and display gauges, switches, and other instruments

NOTE A gauge board is open and not enclosed.

3.10**general-purpose turbines**

horizontal or vertical turbines used to drive equipment that is usually spared, is relatively small in size (power), or is in non-critical service

NOTE General-purpose steam turbines are intended for applications where the inlet gauge pressure does not exceed 4 800 kPa (48 bar) (700 psi) and the inlet temperature does not exceed 400 °C (750 °F), and where the speed does not exceed 6 000 r/min.

3.11**governor-controlled valve**

device that controls the flow of steam into or out of the turbine in response to the speed governor

3.12**hold-down bolts**

mounting bolts

bolts that hold the equipment to the mounting plate or plates

3.13**hydrodynamic bearings**

bearings that use the principles of hydrodynamic lubrication

NOTE The bearing surfaces are oriented so that relative motion forms an oil wedge, or wedges, to support the load without shaft-to-bearing contact.

3.14**local**

⟨device⟩ mounted on or near the equipment or console

3.15**maximum allowable speed**

highest speed at which the manufacturer's design permits continuous operation

3.16**maximum allowable temperature**

maximum continuous temperature for which the manufacturer has designed the equipment (or any part to which the term is referred) when handling the specified fluid at any specified operating conditions

3.17**maximum allowable working pressure**

maximum continuous pressure for which the manufacturer has designed the equipment (or any part to which the term is referred) when handling the specified fluid at the maximum allowable temperature

3.18**maximum continuous speed**

highest speed at which the turbine, as built and tested, is capable of continuous operation, at any of the specified steam conditions

3.19**maximum exhaust casing pressure**

highest exhaust steam pressure that the purchaser requires the casing to contain, with steam supplied at maximum inlet conditions

NOTE The turbine casing is subjected to the maximum temperature and pressure under these conditions.

3.20**maximum exhaust pressure**

highest exhaust steam pressure at which the turbine is required to operate continuously

**3.21
maximum inlet pressure and temperature**

highest inlet steam pressure and temperature conditions at which the turbine is required to operate continuously

**3.22
maximum sealing pressure**

highest pressure the seals are required to seal during any specified static or operating conditions and during startup and shutdown

**3.23
minimum allowable speed**

lowest speed at which the manufacturer's design permits continuous operation

**3.24
minimum exhaust pressure**

lowest exhaust steam pressure at which the turbine is required to operate continuously

**3.25
minimum inlet pressure and temperature**

lowest inlet steam pressure and temperature conditions at which the turbine is required to operate continuously

**3.26
normal operating point**

point at which usual operation is expected and optimum efficiency is desired

NOTE This point is usually the point at which the vendor certifies that performance is within the tolerances stated in this International Standard.

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**3.27
observed**

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test or inspection for which the purchaser requires notification of the timing and may wish to attend

NOTE This is not a hold point. The inspection or test is performed as scheduled, and if the purchaser or the purchaser's representative is not present, the vendor proceeds to the next step.

**3.28
owner**

final recipient of the equipment who may delegate another agent as the purchaser of the equipment

**3.29
panel**

enclosure used to mount, display and protect gauges, switches and other instruments

**3.30
potential maximum power**

approximate maximum power to which the turbine can be uprated at the specified normal speed and steam conditions when it is furnished with suitable (that is, larger or additional) nozzles and, possibly, with a larger governor-controlled valve or valves

**3.31
pressure casing**

composite of all stationary pressure-containing parts of the unit, including all nozzles and other attached parts

**3.32
purchaser**

agency that issues the order and specification to the vendor

NOTE The purchaser may be the owner of the plant in which the equipment is to be installed or the owner's appointed agent.

3.33**radially split**

split with the principal joint perpendicular to the shaft centreline

3.34**rated power**

greatest turbine power specified and its corresponding speed; it includes all the margin required by the specifications of the driven equipment

3.35**rated speed**

100 % speed

highest rotational speed required to meet any of the specified operating conditions

3.36**relief valve set pressure**

pressure at which a relief valve starts to lift

3.37**remote**

<device> located away from the equipment or console, typically in a control room

3.38**separation margin**

margin between a critical speed and the nearest required operating speed

3.39**shutdown set point**

preset value of a measured parameter at which automatic or manual shutdown of the system or equipment is required

3.40**slow roll**

speed recommended by the vendor (typically 400 r/min to 500 r/min) for warm-up and initial check of equipment integrity prior to full operation

3.41**special-purpose turbines**

horizontal turbines used to drive equipment that are usually not spared and are used in uninterrupted continuous operation in critical service

NOTE This category is not limited by steam conditions, power or turbine speed.

3.42**special tool**

tool which is not a commercially available catalogue item

3.43**standby service**

normally idle, or idling, piece of equipment that is capable of immediate automatic or manual startup and continuous operation