SLOVENSKI STANDARD
SIST EN ISO 10439:2004

01-maj-2004

Petroleum, chemical and gas service industries - Centrifugal compressors (ISO 10439:2002)

Petroleum, chemical and gas service industries - Centrifugal compressors (ISO 10439:2002)

Erdöl-, Chemie- und Erdgasindustrie - Radial-Turbokompressoren (ISO 10439:2002)

Industries du pétrole, de la chimie et du gaz - Compresseurs centrifuges (ISO 10439:2002)

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ICS:

23.140	Kompresorji in pnevmatiļ ni stroji	Compressors and pneumatic machines
75.180.20	Predelovalna oprema	Processing equipment

SIST EN ISO 10439:2004 **en**

EUROPEAN STANDARD

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EN ISO 10439

October 2002

ICS 75.180.20

English version

Petroleum, chemical and gas service industries - Centrifugal compressors (ISO 10439:2002)

Industries du pétrole, de la chimie et du gaz - Compresseurs centrifuges (ISO 10439:2002)

This European Standard was approved by CEN on 7 October 2002.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

Foreword

This document (EN ISO 10439:2002) has been prepared by Technical Committee ISO/TC 118 "Compressors, pneumatic tools and pneumatic machines" in collaboration with Technical Committee CEN/TC 12 "Materials, equipment and offshore structures for petroleum and natural gas industries", the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2003, and conflicting national standards shall be withdrawn at the latest by April 2003.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

NOTE FROM CMC The foreword is susceptible to be amended on reception of the German language version. The confirmed or amended foreword, and when appropriate, the normative annex ZA for the references to international publications with their relevant European publications will be circulated with the German version.

Endorsement notice

The text of ISO 10439:2002 has been approved by CEN as EN ISO 10439:2002 without any modifications.

INTERNATIONAL STANDARD

ISO 10439

First edition
2002-10-15

Corrected version
2003-06-15

Petroleum, chemical and gas service industries — Centrifugal compressors

Industries du pétrole, de la chimie et du gaz — Compresseurs centrifuges

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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 3.

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 International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 10439 was prepared by a Joint Working Group of Technical Committees ISO/TC 118, *Compressors, pneumatic tools and pneumatic machines*, and ISO/TC 67, *Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries*, Subcommittee SC 6, *Processing equipment and systems*.

Annexes C, D and G form a normative part of this International Standard. Annexes A, B, E, F, H, I and J are for information only.

In this corrected version of ISO 10439 an oversight which saw the words “Final Draft” and its abbreviation left in the header of page 1 has been corrected.

Introduction

This International Standard is based on the sixth edition of the American Petroleum Institute standard API 617.

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 applicable 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.

Petroleum, chemical and gas service industries — Centrifugal compressors

1 Scope

This International Standard specifies requirements and gives recommendations for the design, materials, fabrication, inspection, testing and preparation for shipment of centrifugal compressors for use in the petroleum, chemical and gas service industries. It is not applicable to machines that develop less than 35 kPa above atmospheric pressure, nor is it applicable to packaged, integrally geared centrifugal air compressors, which are covered in ISO 10442.

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

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 1940-1:—[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 3977-5, *Gas turbines — Procurement — Part 5: Applications for petroleum and natural gas industries*

ISO 5389, *Turbocompressors — Performance test code*

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

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

ISO 9614 (both parts), *Acoustics — Determination of sound pressure levels of noise sources using sound intensity*

ISO 10437, *Petroleum and natural gas industries — Special-purpose steam turbines for refinery service*

ISO 10438 (all parts), *Petroleum and natural gas industries — Lubrication, shaft sealing and control-oil systems*

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*

1) To be published. (Revision of ISO 1940-1:1986)

IEC 60079-10, *Electrical apparatus for explosive gas atmospheres — Part 10: Classification of hazardous areas*

API[2] RP 550, *Manual on installation of refinery instruments and control systems*

API Std 670, *Machinery protection systems, fourth edition*

ASME[3] PTC 10, *Test code on compressors and exhausters*

ASTM[4] A 388/A 388M, *Standard practice for ultrasonic examination of heavy steel forgings*

ASTM A 578/A 578M, *Standard specification for straight-beam ultrasonic examination of plain and clad steel plates for special applications*

ASTM A 609/A 609M, *Standard practice for casting, carbon, low-alloy, and martensitic stainless steel, ultrasonic examination thereof*

ASTM E 94, *Standard guide for radiographic examination*

ASTM E 165, *Standard test method for liquid penetrant examination*

ASTM E 709, *Standard guide for magnetic particle examination*

ISA[5] RP 12.4, *Pressurized enclosures*

NACE[6] MR 0175, *Sulfide stress cracking resistant metallic materials for oilfield equipment*

NFPA[7] 496, *Standard for purged and pressurized enclosures for electrical equipment*

3 Terms and definitions

For the purposes of this International Standard, the following terms and definitions apply.

3.1
alarm condition
preset value of a parameter at which an alarm is actuated to warn of a condition requiring corrective action

3.2
axially split
casing or other component in which the main joint is parallel to the axis of the shaft

3.3
compressor rated point
point on the 100 % speed curve at the highest capacity of any specified operating point

NOTE The use of the word “design” in any term (such as design power, design pressure, design temperature, or design speed) should be avoided in the purchaser's specification. This terminology should be used only by the equipment designer and manufacturer.

2) American Petroleum Institute.

3) American Society of Mechanical Engineers.

4) American Society for Testing and Materials.

5) Instrument Society of America.

6) US National Association of Corrosion Engineers.

7) US National Fire Protection Association.

3.4
head
specific compression work

3.5
inlet volume flow
volume flow rate determined at the conditions of pressure, temperature, compressibility and gas composition, including moisture, at the compressor inlet flange

3.6
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 the specified pressure

3.7
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 it is operating at the maximum allowable temperature

3.8
maximum continuous speed
highest rotational speed at which the machine is capable of continuous operation

3.9
maximum sealing pressure
highest pressure the seals are required to seal during any specified static or operating conditions and during start-up and shutdown

3.10
minimum allowable speed
lowest speed at which the manufacturer's design will permit continuous operation

3.11
normal operating point
point at which usual operation is expected and optimum efficiency is desired

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

3.12
normal speed
speed corresponding to the requirements of the normal operating point

3.13
100 % speed
highest speed required for any specified operating point

3.14
pressure design code
recognized pressure vessel standard specified or agreed by the purchaser (e.g. ASME VIII)

3.15
radially split
casing or other component in which the main joint is perpendicular to the axis of the shaft

3.16
stability
difference in inlet volume flow (as percentage of rated inlet volume flow) between the rated inlet volume flow and the surge point at rated speed

3.17
settling out pressure
pressure of the compressor system when the compressor is shut down

3.18
shutdown condition
preset value of a parameter requiring automatic or manual shutdown of the system

3.19
trip speed
speed at which the independent emergency overspeed device operates to shut down a prime mover

NOTE For constant speed motor drivers, this is the speed corresponding to the synchronous speed of the motor at the maximum frequency of the electrical supply.

3.20
turndown
percentage of change in inlet volume flow (referred to rated inlet volume flow) between the rated inlet volume flow and the surge point inlet volume flow at the rated head, when the unit is operating at rated suction temperature and gas composition

3.21
unit responsibility
responsibility for coordinating the technical aspects of the equipment train and all auxiliary systems

4 Basic design

4.1 General

4.1.1 A bullet (•) at the beginning of a clause indicates that the purchaser is required to make a decison or provide information. This information should be indicated on the data sheets (see annex A).

4.1.2 The equipment (including auxiliaries) covered by this International Standard shall be designed and constructed for a minimum service life of 20 years and at least 3 years of uninterrupted operation.

4.1.3 Unless otherwise specified, the compressor vendor shall assume unit responsibility.

4.1.4 The compressor shall be designed to deliver required head and capacity at the normal operating point without negative tolerance. The input power at the above condition shall not exceed 104 % of the predicted value for this point.

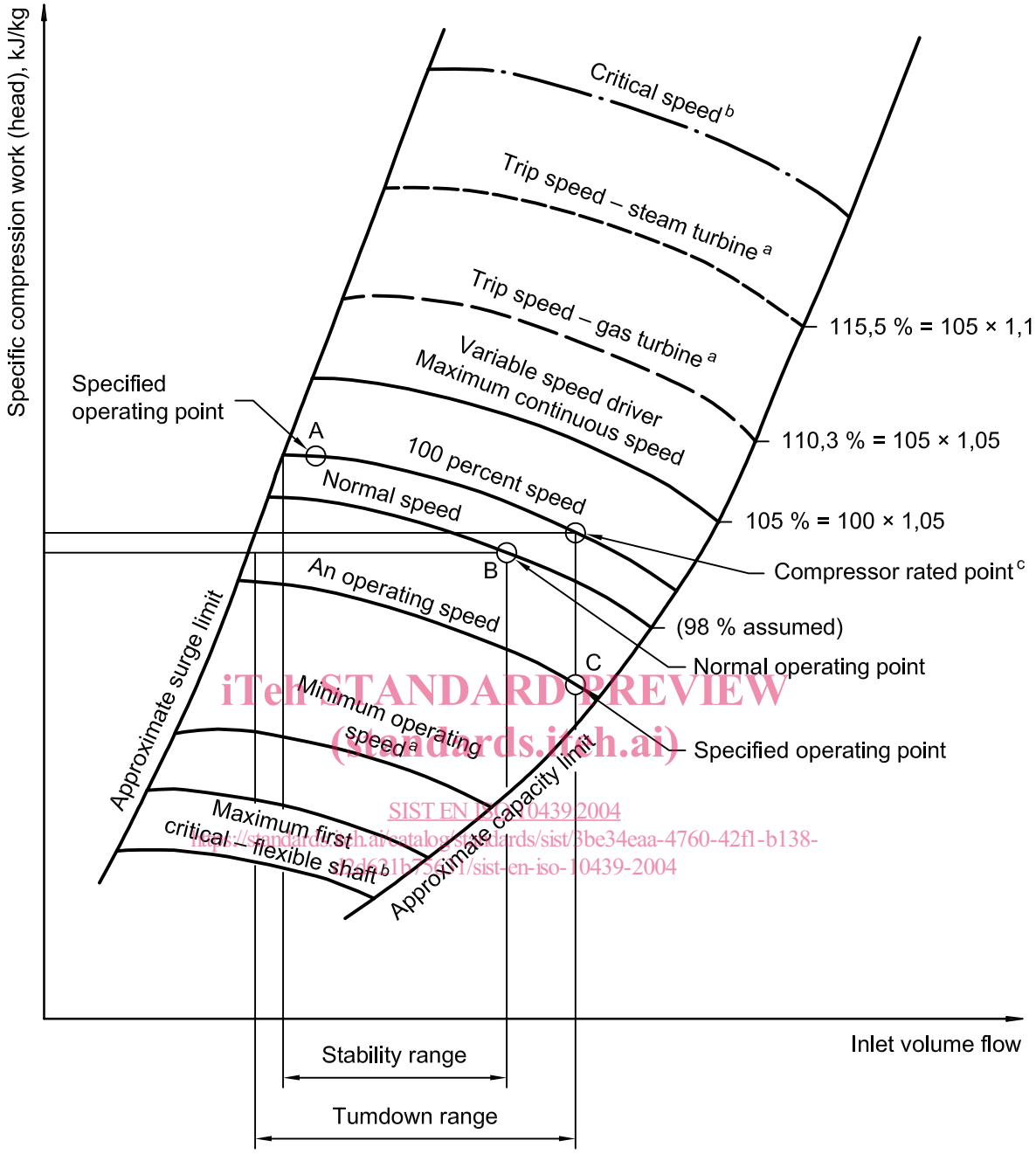
NOTE See the optional performance test criteria in 6.3.6.2 and handling of excess head for constant speed drivers.

4.1.5 The head versus capacity characteristic curve (see Figure 1) shall rise continuously from the rated point to the predicted surge. The compressor, without the use of a bypass, shall be suitable for continuous operation at any capacity at least 10 % greater than the predicted approximate surge capacity shown in the proposal.

4.1.6 Cooling water systems, if required, shall be designed for the conditions specified in Table 1 unless otherwise specified. Provision shall be made for complete venting and draining of the system.

The vendor shall notify the purchaser if the criteria for minimum temperature rise and velocity over heat exchange surfaces result in a conflict. The criterion for velocity overheat exchange surfaces is intended to minimize the use of cooling water. The purchaser shall approve the final selection.

4.1.7 The arrangement of the equipment, including piping and auxiliaries, shall be developed jointly by the purchaser and the vendor. The arrangement shall provide adequate clearance areas and safe access for operation and maintenance.



The head versus capacity curve at 100 % speed shall extend to at least 115 % capacity of the CRP. Head versus capacity curves at other speeds shall be extended to equivalent capacity at each speed. For example, the head versus capacity curve at 105 % speed shall be extended to 1,05 times 1,15 times capacity of the CRP; the head versus capacity curve at 90 % speed shall be extended to 0,9 times 1,15 times capacity at the CRP; and so on. These points define the “approximate capacity limit” curve.

Except where specific numerical relationships are stated, the relative values implied in this figure are assumed values for illustration only.

The 100 % speed is determined from the operating point requiring the highest head — point A in the illustration.

The compressor rated point (CRP) is the intersection on the 100 % speed line corresponding to the highest flow of any operating point — point C in the illustration.

a Refer to the applicable standard for the compressor driver (e.g. ISO 10437 or ISO 3977-5) for trip speed and minimum operating speed limits.

b See 4.9 for allowable margins of critical speeds to operating speeds.

c The maximum continuous speed shall be 105 % for variable speed drivers. The maximum continuous speed shall be the speed corresponding to the synchronous speed of the motor.

Figure 1 — Illustration of terms