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| STN | Aplikácie plynových turbín Bezpečnosť (ISO 21789: 2022) | STN EN ISO 21789 08 8000 |
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Gas turbine applications - Safety (ISO 21789:2022)

Táto norma obsahuje anglickú verziu európskej normy.
This standard includes the English version of the European Standard.

Táto norma bola oznámená vo Vestníku ÚNMS SR č. 01/23

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21789:2022)

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European foreword

This document (EN ISO 21789:2022) has been prepared by Technical Committee ISO/TC 192 "Gas turbines" in collaboration with Technical Committee CEN/TC 399 "Gas Turbines applications - Safety" the secretariat of which is held by BSI.

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of an identical text or by endorsement, at the latest by April 2023, and conflicting national standards shall be withdrawn at the latest by April 2023.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a Standardization Request given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s) / Regulation(s).

For the relationship with EU Directive(s) / Regulation(s), see informative Annex ZA and ZB, which is an integral part of this document.

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Endorsement notice

The text of ISO 21789:2022 has been approved by CEN as EN ISO 21789:2022 without any modification.

Annex ZA (informative)

Relationship between this European Standard and the essential requirements of Directive 2006/42/EC aimed to be covered

This European Standard has been prepared under a Commission's standardization request "M/396 Mandate to CEN and CENELEC for Standardisation in the field of machinery" to provide one voluntary means of conforming to essential requirements of Directive 2006/42/EC of the European Parliament and of the Council of 17 May 2006 on machinery and amending Directive 95/16/EC (recast).

Once this standard is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of this standard given in Table ZA.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding essential requirements of that Directive, and associated EFTA regulations.

Table ZA.1 — Correspondence between this European Standard and Annex I of Directive 2006/42/EC

| The relevant Essential Requirements of Directive 2006/42/EC | Clause(s)/sub-clause(s) of this EN | Remarks/Notes |
|---|---|---------------|
| 1.1.2 | 5.1, 5.2, 5.5, 5.8, 7.5.2, 7.6.2, 7.7.1 | |
| 1.1.3 | 5.23.8.4, 5.24.3, 7.7.8 | |
| 1.1.4 | 5.14, 5.15.9, 7.6.4 | |
| 1.1.5 | 5.8.5 | |
| 1.1.6 | 5.20.3 | |
| 1.2.2 | 5.20.2, 5.20.8, 7.6.4 | |
| 1.2.4.1 | 5.20.8 | |
| 1.2.4.3 | 5.20.8 | |
| 1.2.4.4 | 5.20.8 | |
| 1.2.6 | 5.20.4, 5.20.8, 5.21.9.2, 5.21.2, 7.7.3 | |
| 1.3.1 | 5.8.5, 7.7.1 | |
| 1.3.2 | 5.8.3, 5.8.9, 5.8.15.1, 5.23.10, 7.5 | |
| 1.3.3 | 5.8, 5.20.7, 7.7 | |
| 1.3.7 | 5.8.1, 7.7.2 | |
| 1.4.1 | 5.8.1.1, 5.8.2 | |
| 1.4.2.1 | 5.8.1 | |
| 1.4.3 | | Not covered |
| 1.5.1 | 5.20, 5.21 | |
| 1.5.2 | 5.21.3, 7.4 | |

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| 1.5.3 | 5.10, 5.21.2, 5.23.8.5, 5.24.3, 5.24.4, 7.7.3 | |
| 1.5.4 | 5.8.12, 5.23.8, 7.7.2 | |
| 1.5.5 | 5.8.1.2, 5.8.3, 5.8.9, 5.9.3, 5.13.5, 5.16.3 | |
| 1.5.6 | 5.15 | |
| 1.5.7 | 5.16 | |
| 1.5.8 | 5.7 | |
| 1.5.10 | 5.20.2 | |
| 1.5.11 | 5.15.10, 5.21.6 | |
| 1.5.13 | 5.10.5.8, 5.10.6, 5.10.9, 7.7.8 | |
| 1.5.14 | 5.13.8, 5.13.9, 5.18.1, 7.6.2, 7.6.4, 7.7.1, 7.8 | |
| 1.5.15 | 5.8.2 | |
| 1.5.16 | 5.21.5 | |
| 1.6.2 | 5.8.2, 7.7 | |
| 1.6.3 | 5.21.2.1, 7.7.3 | |
| 1.6.4 | 5.2, 5.21, 5.23 | |
| 1.7.1 | 7.2, 7.8 | |
| 1.7.1.1 | 5.20.3, 7.2 | |
| 1.7.1.2 | 5.15.8, 5.20.3, 5.20.8, 7.5.1, 7.7.1, 7.8 | |
| 1.7.2 | 5.2, 7.3, 7.8 | |
| 1.7.3 | 6.2, 7.8 | |
| 1.7.4 | 7.2 | |
| 1.7.4.1 | 7 | |
| 1.7.4.2 | 7 | |
| 1.7.4.3 | 7.1 | |

WARNING 1 — Presumption of conformity stays valid only as long as a reference to this European Standard is maintained in the list published in the Official Journal of the European Union. Users of this standard should consult frequently the latest list published in the Official Journal of the European Union.

WARNING 2 — Other Union legislation may be applicable to the product(s) falling within the scope of this standard.

EN ISO 21789:2022 (E)**Annex ZB**
(informative)**Relationship between this European Standard and the essential requirements of EU Directive 2014/34/EU**

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the New Approach Directive 2014/34/EU.

Once this standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the clauses of this standard given in Table ZB.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding Essential Requirements of that Directive and associated EFTA regulations.

Table ZB.1 — Correspondence between this European Standard and Directive 2014/34/EU

| Clause(s)/sub-clause(s) of this EN | Essential Requirements of Directive | Qualifying remarks/Notes |
|---|--|---------------------------------|
| 5.1 | A | |
| 5.16, 5.16.4, 5.17 | 1.0.1 | |
| 5.1, 5.4, 7.5.2 | 1.0.2 | |
| 5.1, 5.20.2 | 1.0.4 | |
| 5.9.5, 5.16.1 | 1.0.5 | |
| 5.4, 5.9.7, 5.16, 7.1, 7.4, 7.5, 7.5.2, 7.7, 7.7.1, 7.7.4, 7.11 | 1.0.6 | |
| 5.16.4 | 1.1.1 | |
| 5.18.3 | 1.1.2 | |
| 5.8.9 | 1.1.3 | |
| 5.5 | 1.2.1 | |
| 5.3 | 1.2.2 | |
| 5.8.3, 5.10.6.6, 5.10.9, 5.22, 5.23.8.4 | 1.2.3 | |
| 5.17.7 | 1.2.4 | |
| 5.20.2 | 1.2.5 | |
| 7.7.1 | 1.2.6 | |
| 5.8.1.2, 5.8.6, 5.16.4.3, 5.21.8 | 1.2.7 | |
| 5.20.7 | 1.2.8 | |
| 5.16.5.3.3 | 1.2.9 | |
| 5.16.5.3.2 | 1.3.1 | |
| 5.21.3 | 1.3.2 | |

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| 5.21.3.3 | 1.3.3 | |
| 5.18.3 | 1.3.4 | |
| 5.1, 5.20.2 | 1.4.1 | |
| 5.20.2 | 1.4.2 | |
| 5.20.4, 5.20.8, 5.23.9.1 | 1.5.1 | |
| 5.8.18, 5.20.4 | 1.5.2 | |
| 5.20.8 | 1.5.3 | |
| 5.20.3 | 1.5.4 | |
| 5.1 | 1.5.5 | |
| 5.20.5 | 1.5.6 | |
| 5.19.3 | 1.5.7 | |
| 5.20.4 | 1.5.8 | |
| 5.20.8 | 1.6.1 | |
| 5.20.8 | 1.6.2 | |
| 5.21.9 | 1.6.3 | |
| 5.19 | 1.6.5 | |
| 5.16.4, 5.16.5, 5.17 | 2.2.1.1 | |
| 5.13.4, 5.20.2 | 2.2.1.2 | |
| 5.8.2, 5.8.18 | 2.2.1.3 | |
| 5.16.4, 5.16.5, 5.17 | 2.3.1.1 | |
| 5.13.4, 5.20.2 | 2.3.1.2 | |

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INTERNATIONAL STANDARD

ISO 21789

Second edition
2022-07

Gas turbine applications — Safety

Applications des turbines à gaz — Sécurité



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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 documents 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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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 192, *Gas turbines*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 399, *Gas Turbines applications*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 21789:2009), which has been technically revised.

The main changes are as follows:

- modified to include required annexes for ISO version;
- general update to simplify text;
- updated all cross references.

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.

ISO 21789:2022(E)

Introduction

This document is a type-C standard as stated in ISO 12100:2010.

This document is of relevance, in particular, for the following stakeholder groups representing the market players with regard to machinery safety:

- machine manufacturers (small, medium and large enterprises);
- health and safety bodies (regulators, accident prevention organisations, market surveillance etc.)

Others can be affected by the level of machinery safety achieved with the means of the document by the above-mentioned stakeholder groups:

- machine users/employers (small, medium and large enterprises);
- machine users/employees (e.g. trade unions, organizations for people with special needs);
- service providers, e.g. for maintenance (small, medium and large enterprises);
- consumers (in case of machinery intended for use by consumers).

The above-mentioned stakeholder groups have been given the possibility to participate at the drafting process of this document.

The machinery concerned and the extent to which hazards, hazardous situations or hazardous events are covered are indicated in the Scope of this document.

When requirements of this type-C standard are different from those which are stated in type-A or type-B standards, the requirements of this type-C standard take precedence over the requirements of the other standards for machines that have been designed and built according to the requirements of this type-C standard.

Where local or national legislation accepts other established codes or standards, or an alternative international or national standard providing equivalent requirements for achieving risk reduction the use of these alternative codes or standards is permissible.

The extent of the applicability of the references may be limited by the context of the text within this document. Where a dated standard is specified this does not preclude the use of later versions provided that the requirements continue to meet the safety issues and identified hazards detailed in this document. Where a reference is made to a specific clause in a standard only the text of that clause and references therein apply.¹⁾

1) References within NOTES are provisions but not normative provisions of this document and are listed in the Bibliography.

Gas turbine applications — Safety

1 Scope

This document covers the safety requirements for aero derivative and industrial gas turbine prime mover applications using liquid or gaseous fuels and the safety related control and detection systems and essential auxiliaries for all types of open cycles (simple, combined, regenerative, reheat, etc.) used in onshore and offshore applications including floating production platforms.

This document applies to mechanical, electrical, and pressure equipment components and systems necessary for the functionality of the prime mover. For example, but not limited to, a core gas turbine auxiliary gearbox, an output transmission gear box, combustion system, air filtration, gas turbine controls, oil systems, and fuel system. This document also covers integration of safety risks within the overall installation, e.g. exhaust purging or drainage.

This document details the anticipated significant hazards associated with aero derivative and industrial gas turbine prime movers and specifies the appropriate preventative measures and processes for reduction or elimination of these hazards. This document addresses the risks of injury or death to humans and risks to the environment. Equipment damage without risk to humans or the environment is not covered.

The overall objective of this document is to ensure that equipment is designed, constructed, operated and maintained throughout its life in accordance with ISO 12100:2010.

This document approaches gas turbine safety from an international perspective based on the content of existing, recognized ISO and IEC standards to the greatest extent possible. Where no ISO or IEC standard exists, other codes or standards (such as EN, NFPA, etc.) have been included.

Minimum functional safety levels cannot be addressed in this document, as minimum functional safety levels are both application and site specific.

This document excludes the following items;

- exhaust-system structural design;
- driven equipment;
- micro turbines as covered by ISO 19372:2015;
- gas turbines used primarily for direct and indirect propulsion;
- gas turbines used for mobile applications;
- special heat source applications;
- gas turbines in research and development programs;
- compressed-air energy storage plants.

Where appropriate, this document can be used to give general guidance in such applications.

This document is not applicable to machinery or safety components manufactured before the date of its publication.

ISO 21789:2022(E)

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.

ISO 1182:2020, *Reaction to fire tests for products — Non-combustibility test*

ISO 3977-1:1997, *Gas turbines — Procurement — Part 1: General introduction and definitions*

ISO 3977-3:2004, *Gas turbines — Procurement — Part 3: Design requirements*

ISO 3977-9:1999, *Gas turbines — Procurement — Part 9: Reliability, availability, maintainability and safety*

ISO 4413:2010, *Hydraulic fluid power — General rules and safety requirements for systems and their components*

ISO 4414:2010, *Pneumatic fluid power — General rules and safety requirements for systems and their components*

ISO 6184-4:1985, *Explosion protection systems — Part 4: Determination of efficacy of explosion suppression systems*

ISO 7010:2019, *Graphical symbols — Safety colours and safety signs — Registered safety signs*

ISO 9355-1:1999, *Ergonomic requirements for the design of displays and control actuators -Part 1: Human interactions with displays and control actuators*

ISO 10441:2007, *Petroleum, petrochemical and natural gas industries — Flexible couplings for mechanical power transmission — Special-purpose applications*

ISO 10494:2018, *Turbines and turbine sets — Measurement of emitted airborne noise — Engineering/survey method*

ISO 11086:1996, *Gas turbines — Vocabulary*

ISO 11925-2:2020, *Reaction to fire tests — Ignitability of products subjected to direct impingement of flame — Part 2: Single-flame source test*

ISO 12100:2010, *Safety of machinery — General principles for design — Risk assessment and risk reduction*

ISO 12499:1999, *Industrial fans — Mechanical safety of fans — Guarding*

ISO 13732-1:2006, *Ergonomics of the thermal environment — Methods for the assessment of human responses to contact with surfaces — Part 1: Hot surfaces*

ISO 13732-3:2005, *Ergonomics of the thermal environment — Methods for the assessment of human responses to contact with surfaces — Part 3: Cold surfaces*

ISO 14118, *Safety of machinery — Prevention of unexpected start-up*

ISO 14120:2015, *Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards*

ISO 14122-1:2016, *Safety of machinery — Permanent means of access to machinery — Part 1: Choice of fixed means and general requirements of access*

ISO 14123-1:2015, *Safety of machinery — Reduction of risks to health resulting from hazardous substances emitted by machinery — Part 1: Principles and specifications for machinery manufacturers*

ISO 14691:2008, *Petroleum, petrochemical and natural gas industries — Flexible couplings for mechanical power transmission — General-purpose applications*

ISO 19353:2019, *Safety of machinery — Fire prevention and fire protection*

ISO/IEC 80079-20-1:2017, *Explosive atmospheres – Part 20-1: Material characteristics for gas and vapour classification – Test methods and data*

ISO 80079-36:2016, *Explosive atmospheres — Part 36: Non-electrical equipment for explosive atmospheres — Basic method and requirements*

ISO 80079-37:2016, *Explosive atmospheres — Part 37: Non-electrical equipment for explosive atmospheres — Non-electrical type of protection constructional safety "c", control of ignition sources "b", liquid immersion "k"*

IEC 60079-0:2017, *Explosive atmospheres — Part 0: Equipment — General requirements*

IEC 60079-10-1:2015, *Explosive atmospheres – Part 10-1: Classification of areas – Explosive gas atmospheres*

IEC 60079-13:2017, *Explosive atmospheres – Part 13: Equipment protection by pressurized room "p" and artificially ventilated room "v"*

IEC 60079-14:2013, *Explosive atmospheres — Part 14: Electrical installations design, selection and erection*

IEC 60079-17:2013, *Explosive atmospheres — Part 17: Electrical installations inspection and maintenance*

IEC 60079-29-1:2016+A1:2020, *Explosive atmospheres — Part 29-1: Gas detectors — Performance requirements of detectors for flammable gases*

IEC 60079-29-2:2015, *Explosive atmospheres — Part 29-2: Gas detectors — Selection, installation, use and maintenance of detectors for flammable gases and oxygen*

IEC 60079-32-2:2015, *Explosive atmospheres – Part 32-1: Electrostatics hazards - Tests*

IEC 60204-1:2016, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements*

IEC 60204-11:2018, *Safety of machinery — Electrical equipment of machines — Part 11: Requirements for equipment for voltages above 1 000 V AC. or 1 500 V DC. and not exceeding 36 kV*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 60695-1-10:2016, *Fire hazard testing – Part 1-10: Guidance for assessing the fire hazard of electrotechnical products – General guidelines*

IEC 60695-1-11:2014, *Fire hazard testing – Part 1-11: Guidance for assessing the fire hazard of electrotechnical products – Fire hazard assessment*

IEC TR 61000-5-1:1996, *Electromagnetic compatibility (EMC) — Part 5: Installation and mitigation guidelines — Section 1: General considerations — Basic EMC publication*

IEC TR 61000-5-2:1997, *Electromagnetic compatibility (EMC) — Part 5: Installation and mitigation guidelines — Section 2: Earthing and cabling*

IEC 61000-6-2:2016, *Electromagnetic compatibility (EMC) — Part 6-2: Generic standards - Immunity standard for industrial environments*

IEC 61000-6-4:2018, *Electromagnetic compatibility (EMC) — Part 6-4: Generic standards - Emission standard for industrial environments*

IEC 62305:2010 (all parts), *Protection against lightning*

IEC 62485-2:2010, *Safety requirements for secondary batteries and battery installations – Part 2: Stationary batteries*

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