
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.

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 21789 was prepared by Technical Committee ISO/TC 192, *Gas turbines*.

Introduction

This document is a type C standard as stated in ISO 12100 (all parts). A type C standard is “a standard dealing with the detailed safety requirements for a particular machine or group of machines”.

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

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

The extent of the applicability of the references may be limited by the context of the text within ISO 21789. 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 standard. Where a reference is made to a specific clause in a standard only the text of that clause and references therein apply.¹⁾

In addition to covering the relevant safety requirements, this International Standard has also been produced to assist designers, manufacturers and others by providing methods of compliance with the relevant, essential safety requirements of the following European Legislation for gas turbine applications without prejudicing compliance with this International Standard outside the European Union:

- Machinery Directive (2006/42/EC);
- ATEX (Equipment) Directive (94/9/EC);
- Pressure Equipment Directive (97/23/EC).

Methods are also provided as far as practical and where relevant for compliance with the relevant, essential safety requirements of the following European Legislation:

- ATEX (Workplace) Directive (1999/92/EC);
- Low Voltage Directive (2006/95/EC);
- Electromagnetic Compatibility Directives (91/236/EEC – 92/31/EEC – 93/68/EEC – 2004/108/EC);
- Integrated Pollution Prevention and Control Directive (96/61/EC);
- Environmental Noise Directive (2002/49/EC);
- Chemical Agents Directive (98/24/EC);
- Classification, Packaging, and Labelling of Dangerous Substances Directive (97/69/EC).

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 International Standard covers the safety requirements for gas turbine 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 International Standard applies to driven machinery only where it is an integral part of the gas turbine (e.g. a gearbox integral to the gas turbine), or is located within the gas turbine enclosure and forms part of the enclosure hazardous area classification (e.g. a generator within the gas turbine enclosure), or where the driven machinery has a direct effect on the operational safety of the gas turbine.

This International Standard details the anticipated significant hazards associated with gas turbines and specifies the appropriate preventative measures and processes for reduction or elimination of these hazards. This International Standard 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.

Gas turbine packages are generally specified using International Standards and national standards. Achieving safety is promoted by using additional safety codes and standards, which are shared by gas turbines with other technologies. It is necessary to recognize that local legislation in the country in which the equipment is to be put to use may not be covered by this International Standard.

This International Standard 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. Where local or national legislation accepts other established codes or standards, or an alternative international or national standard providing equivalent requirements for achieving the desired tolerable level of risk, the use of these alternative codes or standards in place of the references provided in Clause 2 is permissible.

This International Standard excludes gas turbines used primarily for direct and indirect propulsion, special heat source applications and in research and development programmes. It also excludes gas turbines for closed-cycle and semi-closed cycle applications, and compressed-air energy storage plants. Where appropriate, this International Standard can be used to give general guidance in such applications.

This document is not applicable to machinery or safety components that were manufactured before the date of its publication as an International Standard.

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 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 21789:2009(E)

ISO 4413:1998, *Hydraulic fluid power — General rules relating to systems*

ISO 4414:1998, *Pneumatic fluid power — General rules relating to systems*

ISO 4871:1996, *Acoustics — Declaration and verification of noise emission values of machinery and equipment*

ISO 6183:1990, *Fire protection equipment — Carbon dioxide extinguishing systems for use on premises — Design and installation²⁾*

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

ISO 10494:1993, *Gas turbines and gas turbine sets — Measurement of emitted airborne noise — Engineering/survey method*

ISO 11086:1996, *Gas turbines — Vocabulary*

ISO 12100-1:2003, *Safety of machinery — Basic concepts, general principles for design — Part 1: Basic terminology, methodology*

ISO 12100-2:2003, *Safety of machinery — Basic concepts, general principles for design — Part 2: Technical principles*

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

ISO/TR 13387-7:1999, *Fire safety engineering — Part 7: Detection, activation and suppression*

ISO 14001:2004, *Environmental management systems — Requirements with guidance for use*

ISO 14118:2000, *Safety of machinery — Prevention of unexpected start-up*

ISO 14120:2002, *Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards*

ISO 14121-1:2007, *Safety of machinery — Risk assessment — Part 1: Principles*

ISO 14123-1:1998, *Safety of machinery — Reduction of risks to health from hazardous substances emitted by machinery — Part 1: Principles and specifications for machinery manufacturers*

ISO 14520-1:2006, *Gaseous fire-extinguishing systems — Physical properties and system design — General requirements*

ISO 14691:1999, *Petroleum and natural gas industries — Flexible couplings for mechanical power transmission — General purpose applications²⁾*

ISO 19353:2005, *Safety of machinery — Fire prevention and protection*

IEC 60079-0:2007, *Explosive atmospheres — Part 0: Equipment — General requirements*

IEC 60079-4:1975, *Electrical apparatus for explosive gas atmospheres — Part 4: Method of test for ignition temperature, amended by IEC 60079-4-AM:1995*

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

²⁾ Replaced by ISO 14691:2008, *Petroleum, petrochemical and natural gas industries — Flexible couplings for mechanical power transmission — General-purpose applications.*

- IEC 60079-14:2007, *Explosive atmospheres — Part 14: Electrical installations design, selection and erection*
- IEC 60079-17:2007, *Explosive atmospheres — Part 17: Electrical installations inspection and maintenance*
- IEC/TR 60079-20:1996, *Electrical apparatus for explosive gas atmospheres — Part 20: Data for flammable gases and vapours, relating to the use of electrical apparatus*
- IEC 60079-29-1:2007, *Explosive atmospheres — Part 29-1: Gas detectors — Performance requirements of detectors for flammable gases*
- IEC 60079-29-2:2007, *Explosive atmospheres — Part 29-2: Gas detectors — Selection, installation, use and maintenance of detectors for flammable gases and oxygen*
- IEC 60204-1:2005, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements*
- IEC 60204-11:2000, *Safety of machinery — Electrical equipment of machines — Part 11: Requirements for HV equipment for voltages above 1 000 V a.c. or 1 500 V d.c. and not exceeding 36 kV*
- IEC 60529:2001, *Degrees of protection provided by enclosures (IP Code)*
- IEC 60695-1-1:1999, *Fire hazard testing — Part 1-1: Guidance for assessing the fire hazard of electrotechnical products — General guidelines*
- 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 61000-6-2:2005, *Electromagnetic compatibility (EMC) — Part 6: Generic standards — Section 2: Immunity for industrial environments*
- IEC 61000-6-4:2006, *Electromagnetic compatibility (EMC) — Part 6: Generic standards — Section 4: Emission standard for industrial environments*
- IEC 61508-1:1998, *Functional safety of electrical/electronic/programmable electronic safety related systems — Part 1: General requirements*
- IEC 61511-1:2003, *Functional safety — Safety instrumented systems for the process industry sector — Part 1: Framework, definitions, system, hardware and software requirements*
- EN 1127-1:2007, *Explosive atmospheres — Explosion prevention and protection — Part 1: Basic concepts and methodology*
- EN 13463-1:2001, *Non-electrical equipment for potentially explosive atmospheres — Part 1: Basic method and requirements*
- EN 50272-2:2001, *Safety requirements for secondary batteries and battery installations — Stationary batteries*
- NFPA 12:2008, *Standard on Carbon Dioxide Extinguishing Systems*
- NFPA 13:2007, *Installation of Sprinkler Systems*
- NFPA 15:2007, *Water Spray Fixed Systems for Fire Protection*
- NFPA 68:2007, *Standard on Explosion Protection by Deflagration Venting*
- NFPA 750:2006, *Standard on Water Mist Fire Protection Systems*
- NFPA 2001:2008, *Clean Agent Fire Extinguishing systems*