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Microturbines applications — Safety

Microturbines — 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 on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT), see the following URL: Foreword — Supplementary information.

The committee responsible for this document is ISO/TC 192, *Gas turbines*.

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Introduction

This International Standard is a type C standard as stated in ISO 12100. 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 can be limited by the context of the text within this International Standard. 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 International Standard. Where a reference is made to a specific clause in a standard, only the text of that clause and references therein apply. References within notes are provisions but not normative provisions of this International Standard and are listed in the bibliography.

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 New Appoach European Directives for microturbine 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).

— Low Voltage Directive (2006/95/EC);

— Electromagnetic Compatibility Directives (2004/108/EC).

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

— 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 (1999/45/EC);

— Exposure of workers to the risks arising from physical agents (noise) (2003/10/EC).

NOTE When this International Standard was issued, the currently quoted European directives were in force but are subject to updates which may add additional essential safety requirements and users of this standard should check, where applicable, if a later version of a directive is in force or has been released. A later released version of the directives can be used as an alternative before the listed directives are superseded.

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Microturbines applications — Safety

1 Scope

This International Standard covers the safety requirements for industrial, commercial, and residential automated stationary microturbine (micro gas turbine) engine generator assemblies with an individual system or subsystem output rating with nominal supply voltages not exceeding 1 000 V for alternating current (A.C.) and not exceeding 1 500 V for direct current (D.C.), 500 kW per individual unit/subsystem or less that are intended for installation and use in ordinary and hazardous location using liquid or gaseous fuels and the safety related control and detection systems and essential auxiliaries for all types of open cycles, closed-cycle, and semi-closed (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 microturbine (e.g. a gearbox integral to the microturbine), or is located within the microturbine enclosure and forms part of the enclosure hazardous area classification (e.g. a generator within the microturbine enclosure), or where the driven machinery has a direct effect on the operational safety of the microturbine.

This International Standard details the anticipated significant hazards associated with microturbines 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.

Microturbine 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 microturbines with other technologies.

NOTE It is necessary to recognize that local legislation in the country in which the equipment is to be put to use might not be covered by this International Standard.

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

This International Standard 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 documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3864-3, *Graphical symbols — Safety colours and safety signs — Part 3: Design principles for graphical symbols for use in safety signs*

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

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

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

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

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

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

ISO 6183, *Fire protection equipment — Carbon dioxide extinguishing systems for use on premises — Design and installation*

ISO 7000, *Graphical symbols for use on equipment — Registered symbols*

ISO 9772, *Cellular plastics — Determination of horizontal burning characteristics of small specimens subjected to a small flame*

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

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

ISO 11086, *Gas turbines — Vocabulary*

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

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

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

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

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

ISO 14123-1, *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, *Gaseous fire-extinguishing systems — Physical properties and system design — Part 1: General requirements*

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

ISO 16010, *Elastomeric seals — Material requirements for seals used in pipes and fittings carrying gaseous fuels and hydrocarbon fluids*

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

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

IEC 60034-22, *Rotating electrical machines — Part 22: AC generator for reciprocatinginternal combustion (RIC) engine driven generating sets*

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

IEC 60079-2, *Explosive atmospheres — Part 2: Equipment protection by pressurized enclosures "p"*

IEC 60079-4, *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*

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IEC 60079-14, *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, *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 60068-2-18, *Environmental testing — Part 2-18: Tests — Test R and guidance: Water*

IEC 60204-1:2009, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements*

IEC 60364-1, *Low-voltage electrical installations — Part 1: Fundamental principles, assessment of general characteristics, definitions*

IEC 60417 (all parts), *Graphical symbols for use on equipment*

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

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

IEC 60730-1 Ed. 4, *Automatic electrical controls for household and similar use — Part 1: General requirements*

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

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

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

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

EN 1127-1:2011, *Explosive atmospheres — Explosion prevention and protection — Part 1: Basic concepts and methodology*

EN 13463-1:2009, *Non-electrical equipment for potentially explosive atmospheres — Part 1: Basic method and requirements*

EN 953, *Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards*

EN 12845, *Fixed firefighting systems — Automatic sprinkler systems — Design, installation and maintenance*

EN 13478, *Safety of machinery — Fire prevention and protection*

EN 50272-2, *Safety requirements for secondary batteries and battery installations — Stationary batteries*

CEN/TS 14816, *Fixed firefighting systems — Water spray systems — Design, installation and maintenance*

NFPA 12:2008, *Standard on Carbon Dioxide Extinguishing Systems*

NFPA 13:2007, *Installation of Sprinkler Systems*

NFPA 15, *Water Spray Fixed Systems for Fire Protection*

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NFPA 68, *Standard on Explosion Protection by Deflagration Venting*

NFPA 750, *Standard on Water Mist Fire Protection Systems*

NFPA 2001, *Clean Agent Fire Extinguishing systems*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 3977-1, ISO 3977-3, ISO 3977-9, ISO 11086, ISO 21789, and ISO 12100, and the following apply.

3.1
auto-ignition temperature
AIT
lowest temperature in degrees Celsius of a heated surface at which the ignition of a combustible substance in the form of gas or vapour mixture with air can occur

Note 1 to entry: AIT is also referred to as ignition temperature, minimum ignition temperature or self-ignition temperature in other standards and in the literature (see 5.16.4.4).

3.2
drain valve
valve that is intended to remove liquids from a pipework system, and that normally drains to atmospheric pressure

3.3
extinction safety time
maximum allowable period of time between the direct or indirect detection of loss of combustion and cessation of the fuel supply

3.4
foreseeable lifetime
includes all phases of life of a part or a system, for example, but not limited to, construction, transportation, commissioning, use, operation, cleaning, trouble-shooting, maintenance, decommissioning, dismantling, final disposal, etc

3.5
ignition safety time
maximum allowable period of time between the opening of the fuel supply valve, which permits fuel to flow, and cessation of the fuel supply, in the absence of confirmation that combustion has commenced (e.g. unsuccessful ignition)

3.6
interlock
interlocking device
mechanical, electrical or other type of device, the purpose of which is to prevent the operation of machine elements under specified conditions by an inhibit command from the interlocking device that

a) directly interrupts the energy supply or directly disconnects parts from the equipment, or

b) is introduced into the control system so that interruption of the energy or disconnection of parts from the equipment is triggered by the control system

3.7
lower explosive limit
LEL
volume concentration of flammable gas or vapour in air, below which the mixture is not explosive

Note 1 to entry: The terms “explosive limit” and “flammable limit” are equivalent.

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