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Reciprocating internal combustion engine driven alternating current generating sets —

Part 1: Application, ratings and performance

Groupes électrogènes à courant alternatif entraînés par moteurs alternatifs à combustion interne —

Partie 1: Application, caractéristiques et performances

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Foreword

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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 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 the following URL: www.iso.org/iso/foreword.html.

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This document was prepared by Technical Committee ISO/TC 70, *Internal combustion engines*.

This third edition cancels and replaces the second edition (ISO 8528-1:2005), which has been technically revised. The main changes compared to the previous edition are as follows:

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— the new power ratings: DCP and MAX have been introduced;

— the 10% overload power in the prime power rating has been reintroduced.

A list of all parts in the ISO 8528 series can be found on the ISO website.

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Reciprocating internal combustion engine driven alternating current generating sets —

Part 1: Application, ratings and performance

1 Scope

This document defines various classifications for the application, rating and performance of generating sets consisting of a Reciprocating Internal Combustion (RIC) engine, Alternating Current (a.c.) generator and any associated controlgear, switchgear and auxiliary equipment.

It applies to a.c. generating sets driven by RIC engines for land and marine use, excluding generating sets used on aircraft or to propel land vehicles and locomotives.

For some specific applications (e.g. essential hospital supplies, high-rise buildings), supplementary requirements can be necessary. The provisions of this document can be the basis for establishing any supplementary requirements.

For other reciprocating-type prime movers (e.g. sewage-gas engines, steam engines), the provisions of this document can be used as a basis for establishing these requirements.

Generating sets meeting the requirements of this document are used to generate electrical power for continuous, peak-load and standby applications. The classifications laid down in this document are intended to help understanding between manufacturer and customer.

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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 3046-1, *Reciprocating internal combustion engines — Performance — Part 1: Declarations of power, fuel and lubricating oil consumptions, and test methods — Additional requirements for engines for general use*

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

4 Symbols and abbreviated terms

An explanation of the symbols and abbreviated terms used in this document is shown in Table 1.

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Table 1 — Symbols and abbreviated terms

Symbol or abbreviated term	Term	Unit
a.c.	alternating current	1
COP	continuous power	kW
ESP	emergency standby power	kW
LTP	limited-time running power	kW
DCP	data centre power	kW
MAX	maximum power for low-power generating sets	kW
P	power	kW
P_{pa}	actual average power	kW
P_{pp}	permissible average power	kW
PRP	prime power	kW
p_r	total barometric pressure	kPa
T_{or}	charge air coolant temperature	K
T_r	air temperature	K
t	time	s
$\varnothing_r$	relative humidity	%
φ	power factor	1

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5 Other regulations and additional requirements

For a.c. generating sets used by onboard ships and offshore installations, which need to comply with rules of a classification society, the additional requirements of the classification society shall be observed. The classification society name shall be stated by the customer prior to placing the order.

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For a.c. generating sets operating in non-classified equipment, any additional requirements are subject to agreement between the manufacturer and customer.

If special requirements from any other regulatory authority (e.g. inspecting and/or legislative authorities) need to be met, the authority name shall be stated by the customer prior to placing the order.

Any additional requirements shall be subject to agreement between the manufacturer and customer.

6 General description

6.1 Generating set

6.1.1 General

A generating set consists of one or more RIC engines used to produce mechanical energy and one or more generators to convert the mechanical energy into electrical energy. The generating set includes any components used for coupling the mechanical prime mover(s) and electrical generator(s) (e.g. couplings, gearbox) and, where applicable, any load-bearing and mounting components.

NOTE A generator ready to be installed and only able to function as it stands after being mounted on a means of transport (e.g. an agricultural or forestry tractor) is considered to be a generating set.

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6.1.2 Prime movers

For the purposes of this document, prime movers may be of two types:

a) compression-ignition engines; and

b) spark-ignition engines.

Depending on the generating set application, the following criteria, among others, can be important in selecting the prime mover to be used:

a) quality of fuel and fuel consumption;

b) exhaust gas and noise emission;

c) speed range;

d) mass and dimensions;

e) sudden electrical loading and frequency behaviour;

f) generator short-circuit characteristics;

g) cooling systems;

h) starting systems;

i) maintenance requirements;

j) waste heat utilization.

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6.1.3 Electrical generators

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For the purposes of this document, electrical generators may be of two types:

a) synchronous; and

b) asynchronous.

Depending on the generating set application, the following criteria, among others, can be important in selecting the generator to be used:

a) voltage characteristics during starting and normal operation as well as after load changes, taking into account the electrical power factor;

b) short-circuit behaviour (electrical and mechanical);

c) efficiency;

d) generator design and enclosure type;

e) parallel-operation behaviour;

f) maintenance requirements.

6.1.4 Control and switchgear

Equipment for the control, switching, operation and monitoring of the generating set shall be part of the associated controlgear and switchgear systems.

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6.1.5 Auxiliaries

Auxiliaries are items of equipment additional to those already fitted/installed on the generating set as supplied but essential to its proper and safe operation, such as:

a) starting system;

b) air intake and exhaust gas systems;

c) cooling systems;

d) lubricating oil system;

e) fuel system (including fuel treatment where applicable);

f) auxiliary electrical power supply.

6.2 Power station

A power station comprises an installation of one or more generating sets and their auxiliary equipment, the associated controlgear and switchgear and, where applicable, the place of installation (e.g. a building, an enclosure or special equipment for protection from the weather).

7 Application criteria

7.1 Modes of operation

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7.1.1 General

The generating set mode of operation can affect certain important performance characteristics (e.g. its economical and reliable operation, the intervals between maintenance and repair) and shall be taken into account by the customer when agreeing the requirements with the manufacturer (see Clause 12).

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7.1.2 Continuous operation at constant load

Continuous operation at constant load is defined as operation of a generating set without time limit taking into account the maintenance period, where the applied electrical load is constant.

EXAMPLE Providing a base load for a combined heat and power plant.

7.1.3 Continuous operation at varying load

Continuous operation at varying load is defined as operation of a generating set without time limit, taking into account the maintenance period, where the applied electrical load is variable.

EXAMPLE Providing electrical power where there is no utility electrical power available or the utility electrical supply is uncertain.

7.1.4 Limited time operation at constant load

Limited time operation at constant load is defined as operation of a generating set within set time limits where the applied electrical load is constant.

EXAMPLE Peak shaving load management where a generating set operating in parallel with a utility supply takes a constant load during periods of peak power consumption.

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7.1.5 Limited time operation at varying load

Limited time operation at varying load is defined as operation of a generating set within set time limits where the applied electrical load is variable.

EXAMPLE To provide a basic support function to a building electrical supply in the event of normal utility supply failure.

7.2 Site criteria

7.2.1 Land use

Land use applies to generating sets either fixed, transportable or mobile which are used on land.

7.2.2 Marine use

Marine use applies to generating sets used on board ships and offshore installations.

7.3 Single and parallel operation

7.3.1 General

Generating sets can have two types of operation as follows:

a) Single operation: This applies to generating sets, irrespective of their configuration or mode of start-up and control, which operate as the sole source of electrical power.

b) Parallel operation: This refers to the electrical connection of a generating set to another source of electrical supply with the same voltage, frequency and phase to share the power supply demand for the connected network. The characteristics of the normal utility electrical power supply, including voltage range and variation, frequency range and variation, impedance of the network, etc., shall be stated by the customer.

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7.3.2 Generating set parallel operation

In this type of operation, two or more generating sets are electrically connected (not mechanically connected) after having been brought into synchronism. Generating sets with different outputs and speeds can be used.

7.3.3 Generating set operation in parallel with a utility supply

In this type of operation, one or more generating sets operating in parallel (as described in 7.3.1) are electrically connected to a utility supply.

In the case of public utility electrical power supply, permission for parallel operation shall be obtained. Protective equipment shall be provided.

NOTE This also applies to generating sets which, in order to periodically check their start-up function, need to operate by supplying power into the normal electrical power supply system for a time period laid down by the generating set manufacturer.

7.4 Modes of start-up and control

7.4.1 General

The modes of start-up and control involved in the operation of a generating set are normally:

a) starting;

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