

ISO/~~DIS~~**FDIS** 8528-12:~~2023~~**2022**(E)

ISO TC 70/WG 10

Date: 2022-~~03-24~~**05-11**

Reciprocating internal combustion engine driven alternating current generating sets —

Part 12: Emergency power supply to safety services

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Published in Switzerland

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ISO/FDIS 8528-12  
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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](http://www.iso.org/directives)).

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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](http://www.iso.org/iso/foreword.html).

This document was ~~revised~~<sup>prepared</sup> by Technical Committee ISO/TC 70, *Internal combustion engines*.  
The [https://standards.iteh.ai/catalog/standards/sist/ad3a8d88-2801-44bb-b79e-a6e9f31d2ebb/iso-](https://standards.iteh.ai/catalog/standards/sist/ad3a8d88-2801-44bb-b79e-a6e9f31d2ebb/iso-8528-12)

This second edition ~~is a minor revision~~<sup>is a minor revision</sup> and ~~contains only editorial changes~~<sup>contains only editorial changes</sup>. It replaces the first edition (ISO 8528-12:1997).

The main changes are as follows:

- ~~adoption into~~<sup>structure updated according to</sup> the current ISO template;
- ~~update of~~<sup>update of</sup> normative references ~~updated~~<sup>updated</sup>;
- ~~delete previous~~<sup>delete previous</sup> Clause 4 and refer to ~~deleted – the~~<sup>deleted – the</sup> symbols ~~based on terms and definitions used~~<sup>based on terms and definitions used</sup> in ISO 8528-5 ~~now apply~~<sup>now apply</sup>;
- ~~division of~~<sup>division of</sup> Clause 7 ~~in sub-clauses~~<sup>split into subclauses</sup>;
- ~~removal of~~<sup>removal of</sup> hanging paragraphs ~~in~~<sup>removed from</sup> Clauses 8 and 9;
- ~~modification of~~<sup>modification of</sup> values in Table 3 ~~modified~~<sup>modified</sup> based on ~~the~~<sup>the</sup> values in ISO 8528-5:2022, Table 4;
- ~~minor editorial changes~~<sup>minor editorial changes</sup>.

## ISO/FDIS 8528-12:2022(E)

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

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](http://www.iso.org/members.html).

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## Reciprocating internal combustion engine driven alternating current generating sets — Part 12: Emergency power supply to safety services

### 1 Scope

This document applies to generating sets driven by reciprocating internal combustion (RIC) engines for emergency power supply to safety services.

~~This document~~ applies, for example, to safety equipment in hospitals, high-rise buildings, ~~and~~ public gathering places ~~etc.~~ ~~This document~~ ~~It~~ establishes the special requirements for the performance, design and maintenance of generating sets used in ~~the~~ ~~these~~ applications referred to ~~above~~ ~~previously~~ and ~~taking~~ ~~takes~~ into account the provisions of ISO 8528-1 to ISO 8528-6 and ISO 8528-10.

### 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 8528-1:2018, *Reciprocating internal combustion engine driven alternating current generating sets — Part 1: ~~Applications~~ Application, ratings and performance*

ISO 8528-2:2018, *Reciprocating internal combustion engine driven alternating current generating sets — Part 2: Engines*

ISO 8528-3, *Reciprocating internal combustion engine driven alternating current generating sets — Part 3: Alternating current generators for generating sets*

ISO 8528-4:2005, *Reciprocating internal combustion engine driven alternating current generating sets — Part 4: Control gear and switchgear*

ISO 8528-5:2022, *Reciprocating internal combustion engine driven alternating current generating sets — Part 5: Generating sets*

ISO 8528-6:2005, *Reciprocating internal combustion engine driven alternating current generating sets — Part 6: Test methods*

~~ISO 8528-10, Reciprocating internal combustion engine driven alternating current generating sets — Part 10: Measurement of airborne noise by the enveloping surface method~~

~~IEC 60034-1:2017, Rotating electrical machines — Part 1: Rating and performance~~

~~IEC 60364-5-56, Low-voltage electrical installations — Part 5-56: Selection and erection of electrical equipment — Safety services~~

~~IEC 60364-7-710, Low-voltage electrical installations — Part 7-710: Requirements for special installations and locations — Medical locations~~

~~IEC 60601-1, Medical electrical equipment — Part 1: General requirements for basic safety and essential performance~~

IEC 60622, Secondary cells and batteries containing alkaline or other non-acid electrolytes — Sealed nickel-cadmium prismatic rechargeable single cells

IEC 60623, Secondary cells and batteries containing alkaline or other non-acid electrolytes — Vented nickel-cadmium prismatic rechargeable single cells

~~IEC 60896-11, Stationary lead-acid batteries — Part 11: Vented types — General requirements and methods of tests~~

~~IEC 60896-21, Stationary lead-acid batteries — Part 21: Valve regulated types — Methods of test~~

IEC 61951-1, Secondary cells and batteries containing alkaline or other non-acid electrolytes — Secondary sealed cells and batteries for portable applications — Part 1: Nickel-Cadmium

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 8528-1 to ISO 8528-6 and the following apply.

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

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

— IEC Electropedia: available at <https://www.electropedia.org/>

3.1 ~~change-over~~  
**changeover time**

$t_{co}$   
time interval from the appearance of a malfunction of the normal electrical power supply system until the safety services are again connected to the emergency power supply; ~~this connection to the safety services may be applied in several load steps~~

Note 1 to entry: This connection to the safety services may be applied in several load steps.

3.2 **bridging time**

$t_B$   
minimum time for which the generating station supplies the consumers with electrical power under ~~pre-determined~~predetermined operating conditions ~~and which corresponds with the rated operating time as defined in IEC 60601-1~~

Note 1 to entry: The bridging time corresponds with the rated operating time as defined in IEC 60601-1.

3.3 **safety services**

equipment for the safety of persons which is installed and kept prepared in case of failure of the usual electrical power supply system



**3.4****consumer power demand**

total of all intended demands of the connected consumers, taking into consideration the actual load steps

**3.5****power demand for safety services**

required power demand to fulfil the safety service requirements

**4 Additional regulations and requirements**

If special requirements or additional regulations are to be observed, they shall be stated by the customer and agreed upon between manufacturer and customer.

**5 Classification designation****5.1 General**

Classification of generating sets for safety services is based on performance class G2 as defined in ISO 8528-1 and the required ~~change-over~~changeover time,  $t_{co}$   ~~$t_{co}$~~ , according to IEC 60364-5-56 and Table 1.

**Table 1 — Classification by ~~change-over~~changeover time**

Generating sets	<del>no</del> No break	<del>short</del> Short break	<del>long</del> Long break
<del>Change-over</del> Changeover time	0	< 0,5 s	< 15 s > 15 s
Classification	1	2	3 4

**5.2 Typical examples of classification**

Typical examples of classification as defined in Table 1 are given in Table 2.

**Table 2 — Examples**

Classification	Typical examples
1	The mains voltage drops below the rated voltage by more than 10 %. After a <del>change-over</del> changeover time of 0 s the power for the consumer power demand for safety services shall be available. The design of the no-break generating sets depends on the required frequency and voltage deviations.
2	The mains voltage drops below the rated voltage by more than 10 %. After a <del>change-over</del> changeover time of 0,5 s the power for the consumer power demand for safety services shall be available. The design of the short-break generation set depends on the required frequency and voltage deviations.
3	The mains voltage drops below the rated voltage by more than 10 % for a period longer than 0,5 s.

	After a <del>change-over</del> <del>changeover</del> time of <del>max-maximum</del> 15 s, power for 100 % of the consumer power demand for safety services shall be available in steps.
4	<p>The mains voltage drops below the rated voltage by more than 10 % for a period longer than 0,5 s.</p> <p>After a <del>change-over</del><del>changeover</del> time of <del>max-maximum</del> 15 s, power for 80 % of the consumer power demand for safety services shall be available in two steps, and the power for 100 % of the consumer demand shall be available after an additional 5 s has passed.</p>

6 Generating set design

6.1 Criteria for determining the required power

To ensure a reliable supply of electrical power by the generating set, the generating set manufacturer shall be informed of the power requirements of the installations to be supplied.

The power requirements shall include short load peaks when switching in electrical installations (e.g. lifts, pumps, fans, lighting equipment and ~~non-linear~~~~nonlinear~~ electrical installations). Where applicable, ~~e.g. for example~~ for reasons of redundancy, the use of several generating sets operating in parallel ~~may will~~ ~~possibly~~ be required.

Since many modern RIC engines are turbocharged, it will be necessary to arrange load acceptance in several steps.

For load acceptance, the definitions and values laid down in ISO 8528-5:2022, ~~Clause~~ 8.4, Figure 5 and Figure 6 apply, where the load acceptance capability of the generating set is shown to be dependent on the brake mean effective pressure of the RIC engine.

If larger steps are used than those recommended in ISO 8528-5:2022, Figure 5 and Figure 6, either suitable additional measures shall be taken, or the generating set power rating, and, where applicable, the rotating mass of the flywheel, shall be increased.

The information provided by the ~~check list~~~~checklist~~ in Clause 13 ~~of this document~~ is ~~suggested as necessary~~~~recommended~~ for designing the generating set.

Essential equipment of emergency generating sets, such as ~~a~~ cooling system, ~~a~~ fuel system including storage tank, ~~and a~~ lubrication system ~~etc.~~, shall be provided to ensure the operation of the generating set for the required period.

The cooling system of the RIC engine shall be self-contained.

6.2 Power determination

ISO 8528-1:2018, Clauses 13 and 14 ~~applies~~~~apply~~ for determining the power requirement.

6.3 Operating limit values

The operating limits shall at least meet the requirements of performance class G2 ~~as~~ in ISO 8528-5:2022.

Special requirements for the limit values are given in ISO 8528-5:2022, Table 4.

The transient operating limits ~~generally apply as given~~ in ISO 8528-5:2022, Table 4 ~~generally apply~~.

Classifications given in Table 2 are listed in Table 3.

Table 3 — Special requirements for examples given in Table 2

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Parameter	Symbol	Unit	Reference	Classification			
				1	2	3	4
Frequency droop	$\delta f_{st}$	%	ISO 8528-5:2022, Clause 3.1.26	AMC <sup>a</sup>	AMC	≤ 5	≤ 4
Steady-state frequency band	$\beta_f$	%	ISO 8528-5:2022, Clause 3.1.23	AMC	AMC	≤ 1,5	≤ 0,5
Transient frequency deviation from rated frequency	$\delta f_{dyn}^-$	%	ISO 8528-5:2022, Clause 3.2	AMC	AMC	≤ 10	≤ 10
Steady-state voltage deviation	$\Delta U_{st}$	%	ISO 8528-5:2022, Clause 3.1.28	AMC	AMC	≤ ± 2,5	≤ ± 1
Transient voltage deviation	$\Delta U_{dyn}^+$ $\Delta U_{dyn}^-$	%	ISO 8528-5:2022, Clause 3.2	AMC	AMC	+20 ≤ 15	+10 ≤ 10
Voltage recovery time	$t_{u,de}$	s	ISO 8528-5:2022, Clause 3.2	AMC	AMC	4	4
	$t_{u,in}$	s	ISO 8528-5:2022, Clause 3.2				
Unbalanced load current ratio	$I_2 / I_N^b$	1	IEC 60034-1:2017, 7.2.3	33 <sup>c</sup> 15 <sup>d</sup>	33 <sup>c</sup> 15 <sup>d</sup>	33 <sup>c</sup> 15 <sup>b,d</sup>	33 <sup>c</sup> 15 <sup>d</sup>
Total voltage harmonic distortion	$k_u$	%	IEC 60034-1:2017, 9.11	AMC	AMC	=	5 <sup>e</sup>
<p>NOTE All other values are given in ISO 8528-5.</p> <p><sup>a</sup> AMC Agreement between a generating set manufacturer and customer.</p> <p><sup>b</sup> See also definition in IEC 60034-1:2017, 7.2.3.</p> <p><sup>c</sup> For generating sets with ratings above 300 kVA.</p> <p><sup>d</sup> For generating sets with ratings below 300 kVA.</p> <p><sup>e</sup> This applies also to the voltage between conductors and the neutral conductor under linear and symmetrical loading.</p>							

Table 3 (continued)

Parameter	Symbol	Unit	Reference	Classification			
				1	2	3	4