INTERNATIONAL STANDARD

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Third edition 2018-07

Reciprocating internal combustion engine driven alternating current generating sets —

Part 2: **Engines**

iTeh ST Groupes électrogènes à courant alternatif entraînés par moteurs alternatifs à combustion interne — (stance au de siteh.ai)

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Contents						
Fore	·eword	iv				
1	Scope	1				
2	Normative references	1				
3	Terms, symbols, and definitions	1				
4	Other regulations and additional requirements	7				
5	General characteristics 5.1 Power characteristics 5.1.1 General 5.1.2 ISO standard power 5.1.3 Service power 5.2 Main characteristics of the RIC engine 5.3 Low-load operation					
6	Speed characteristics 6.1 General 6.2 Types of speed governor used for generating sets 6.2.1 Proportional (P) governor 6.2.2 Proportional Integral (PI) governor 6.2.3 Proportional Integral Differential (PID) governor 6.3 Use of speed governor 6.3.1 General 6.3.2 Single operation dards item.ai 6.3.3 Parallel operation	9 9 9 9 9 10				
7	RIC engine load acceptance 7.1 Generals://standards.itch.ai/catalog/standards/sist/c9b65cac-ce86-459d-8dc6-7.2 Non-turbocharged RIC engines 55/iso-8528-2-2018 7.3 Turbocharged RIC engines Vibration and noise 8.1 Torsional vibration 8.2 Linear vibration 8.3 Noise					
9	Heat balance					
10						
11	Starting ability 1					
12	Fuel, lubricants and coolants					
13	Governing system values					
	lingranhy	13				

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 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. (standards.iteh.ai)

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

This third edition cancels and replaces the second edition (ISO 8528-2:2005)]-of which it constitutes a minor revision.

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The main changes compared to the previous edition are as follows:

- the normative references have been updated;
- editorial changes have been made.

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

Reciprocating internal combustion engine driven alternating current generating sets —

Part 2:

Engines

1 Scope

This document specifies the principal characteristics of Reciprocating Internal Combustion (RIC) engines when used for alternating current (a.c.) generating set applications.

It applies to RIC engines for a.c. generating sets 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 regarded as the basis for establishing any supplementary requirements.

The terms which define the speed governing and speed characteristics of RIC engines are listed and explained where they apply specifically to the use of the engine for driving a.c. generators.

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

ISO 8528-2:2018

Normative references 21-70/7/2025 11-20-7/20

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

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

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

Terms, symbols, and definitions

For the purposes of this document, the following terms and definitions apply.

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/

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

Table 1 — Symbols, terms and definitions

Symbol	Term	Unit	Definition
n	Engine speed	min-1	
n_{r}	Declared speed	min-1	Engine speed at declared power corresponding to the rated frequency of the generating set.
$n_{ m Sf}$	Firing speed	min-1	Engine speed to which an engine must be accelerated from rest by the use of an external supply of energy separate from the fuel feed system before the engine becomes self-sustaining.
$n_{ m max}$	Maximum permissible speed	min ⁻¹	Speed of the engine specified by the RIC engine manufacturer which lies a safe amount below the speed limit (see NOTE 1 and Figure 3).
n_a	Partial-load speed	min-1	Steady-state engine speed of an engine running at a % of the declared power given by:
			$a = 100 \times \frac{P_{a}}{P_{r}}$ EXAMPLE:
	iTeh STANDA	RD I	at 45 % power, $a = 45$ (see Figure 2) For $a = 45$
	(standard	ls.ite	$ \begin{array}{c} \text{not } a = 45 \\ \text{not } a = n_{i,r} - \frac{P_a}{P_r} (n_{i,r} - n_r) \end{array} $
	ISO 852 https://standards.iteh.ai/catalog/standa 3b7967f89765/ii	<u>8-2:2018</u> ards/sist/e9	$=n_{i,r}-0.45(n_{i,r}-n_{r})$ $0.45(n_{i,r}-n_{r})$ Note 1 to entry: Corresponding values of declared speed and partial-load speed are based on an unchanged speed setting.
n _{i,r}	Declared no-load speed	min ⁻¹	Steady-state engine speed without load at the same speed setting as for the declared speed, $n_{\rm r}$.
$n_{\rm i,min}$	Lowest adjustable no-load speed	min ⁻¹	Lowest steady-state engine speed without load obtainable on the governor speed setting device.
$n_{\rm i,max}$	Highest adjustable no-load speed	min ⁻¹	Highest steady-state engine speed without load obtainable on the governor speed setting device.
$n_{ m d,s}$	Setting speed of overspeed limiting device	min ⁻¹	Speed of the engine, the exceeding of which activates the overspeed limiting device (see Figure 3).
$n_{ m d,o}$	Operating speed of overspeed limiting device	min-1	Speed of the engine at which, for a given setting speed, the limiting device starts to operate (see NOTE 2 and Figure 3).

NOTE 1 The speed limit is the maximum calculated speed which the engine can sustain without risk of damage.

NOTE 2 For a given engine, the operating speed depends on the total inertia of the generating set and the design of the overspeed protection system.

NOTE 3 100 kPa = 1 bar.

 Table 1 (continued)

$ \delta n_{\rm S} \qquad \text{Speed setting related range} \qquad \qquad \% \qquad \text{Range of speed setting, expression} \\ \delta n_{\rm S} = \frac{n_{\rm i,max} - n_{\rm i,min}}{n_{\rm r}} \times 100 \\ \Delta n_{\rm S} \qquad \text{Speed setting range} \qquad \qquad \min^{-1} \qquad \text{Range between the highest a adjustable no-load speeds gions} \\ \delta n_{\rm S,do} \qquad \text{Speed setting related downward range} \qquad \qquad 0 \\ \delta n_{\rm S,do} \qquad \text{Speed setting related downward range} \qquad 0 \\ \delta n_{\rm S,do} \qquad 0 \\ \delta n_$	peed given by: and lowest iven by:
$\Delta n_{\rm S}$ Speed setting range ${ m min^{-1}}$ Range between the highest a adjustable no-load speeds gi $\Delta n_{\rm S} = n_{\rm i,max} - n_{\rm i,min}$ $\delta n_{\rm S,do}$ Speed setting related downward range ${ m \%}$ Downward range of speed so pressed as a percentage of the	iven by:
$\Delta n_{\rm s} = n_{\rm i,max} - n_{\rm i,min}$ adjustable no-load speeds gi $\Delta n_{\rm s} = n_{\rm i,max} - n_{\rm i,min}$ $\delta n_{\rm s,do}$ Speed setting related downward range % Downward range of speed so pressed as a percentage of the	iven by:
$\delta n_{ m s,do}$ Speed setting related downward range $\%$ Downward range of speed so pressed as a percentage of the	etting ex-
pressed as a percentage of the	otting ex-
$\delta n_{\rm s,do} = \frac{n_{\rm i,r} - n_{\rm i,min}}{n_{\rm r}} \times 100$	
$\Delta n_{ m s,do}$ Speed setting downward range min $^{-1}$ Range between the declared speed and the lowest adjustation speed given by:	
$\Delta n_{\rm s,do} = n_{\rm i,r} - n_{\rm i,min}$	
$\delta n_{ m s,up}$ Speed setting related upward range % Upward range of speed setti as a percentage of the declar given by:	
(standards.iteh.ai) $\delta n_{s,up} = \frac{n_{i,max} - n_{i,r}}{n_r} \times 100$	
Δn _{s,up} Speed setting upward range ISO 8528-2:2018 min-1 Range between the highest a https://standards.iteh.ai/catalog/standards/sist/e9b65cae-enfo-load/speed and the declar 3b7967f89765/iso-8528-2-2018 speed given by:	
$\Delta n_{\rm s,up} = n_{\rm i,max} - n_{\rm i,r}$	
ν_n Speed setting rate of change %·s ⁻¹ Rate of change of speed setting remote control, expressed as of the related range of speed second given by:	s a percentage
$v_{\rm n} = \frac{(n_{\rm i,max} - n_{\rm i,min})/n_{\rm r}}{t} \times 1$.00
Adjustment range min ⁻¹ Speed range over which the limiting device can be adjust	
$\delta n_{\rm st}$ Speed droop % Difference between the declar speed and the declared speed power, for fixed speed settin ure 1). It is expressed as perdeclared speed given by:	ed at declared ng (see Fig-
$\delta n_{\rm st} = \frac{n_{\rm i,r} - n_{\rm r}}{n_{\rm r}} \times 100$	

NOTE 1 The speed limit is the maximum calculated speed which the engine can sustain without risk of damage.

NOTE 2 For a given engine, the operating speed depends on the total inertia of the generating set and the design of the overspeed protection system.

NOTE 3 100 kPa = 1 bar.

Table 1 (continued)

Symbol	Term	Unit	Definition
$\Delta\delta n_{ m st}$	Speed/power characteristic deviation	%	Maximum deviation from a linear speed power characteristic curve in the power range between no-load and declared power, expressed as percentage of the declared speed (see Figure 2).
	Speed/power characteristic curve		Curve of steady-state speeds in the power range between no-load and declared power plotted against RIC engine power (see Figures 1 and 2).
P	Engine power	kW	
Pa	Actual engine power	kW	
p_{me}	Brake mean effective pressure	kPa	
$P_{\rm r}$	Declared engine power	kW	
$t_{ m r}$	Response time	S	Time between activation of the overspeed limiting device and commencement of its operation.
$V_{ m st}$	Engine swept volume	1	

NOTE 1 The speed limit is the maximum calculated speed which the engine can sustain without risk of damage.

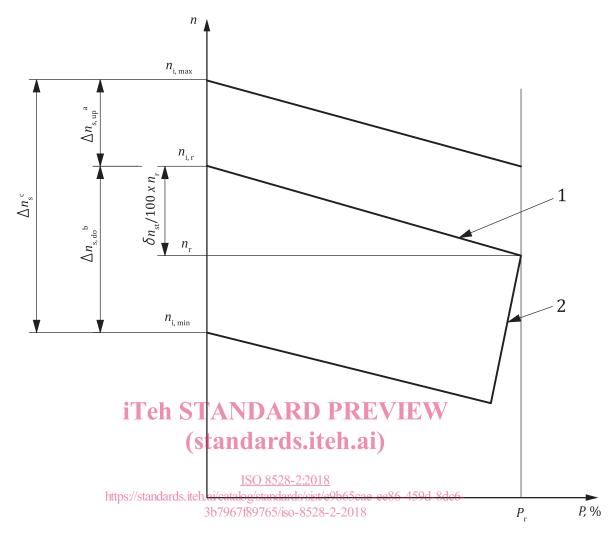
NOTE 2 For a given engine, the operating speed depends on the total inertia of the generating set and the design of the overspeed protection system. iTeh STANDARD PREVIEW

NOTE 3 100 kPa = 1 bar.

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Key

- P engine power
- *n* engine speed
- 1 speed/power characteristic curve
- 2 power limit
- a Upward speed setting.
- b Downward speed setting range.
- c Range of speed setting.

Figure 1 — Speed/power characteristic, range of speed setting