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Reciprocating internal combustion engine driven alternating current generating sets —

Part 7: Technical declarations for specification and design

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

Partie 7: Déclarations techniques pour la spécification et la conception

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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).

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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.

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

This second edition cancels and replaces the first edition (ISO 8528-7:1994), which has been technically revised.

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

Reciprocating internal combustion engine driven alternating current generating sets —

Part 7:
Technical declarations for specification and design

1 Scope

This document specifies the requirements and parameters for the specification and design of a reciprocating internal combustion (RIC) engine driven generating set, with reference to the definitions given in ISO 8528-1 to ISO 8528-6.

It applies to alternating current (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 (for example, essential hospital supplies, high-rise buildings, etc.) supplementary requirements may be necessary. The provisions of this document are intended to be regarded as a basis.

For other reciprocating-type prime movers (e.g. sewage gas engines, steam engines), the provisions of this document are intended to be used as a basis.

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 8178-3, *Reciprocating internal combustion engines — Exhaust emission measurement — Part 3: Definitions and methods of measurement of exhaust gas smoke under steady-state conditions*

ISO 8528-1:2005, *Reciprocating internal combustion engine driven alternating current generating sets — Part 1: Application, ratings and performance*

ISO 8528-2:2005, *Reciprocating internal combustion engine driven alternating current generating sets — Part 2: Engines*

ISO 8528-3:2005, *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: Controlgear and switchgear*

ISO 8528-5:2013, *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*

IEC 60034-2-1, *Rotating electrical machines — Part 2-1: Standard methods for determining losses and efficiency from tests (excluding machines for traction vehicles)*

IEC 60034-5, *Rotating electrical machines — Part 5: Degrees of protection provided by the integral design of rotating electrical machines (IP code) — Classification*

IEC 60034-6, *Rotating electrical machines — Part 6: Methods of cooling (IC code)*

IEC 60034-7, *Rotating electrical machines — Part 7: Classification of types of construction, mounting arrangements and terminal box position (IM code)*

IEC 60364-4-41, *Low-voltage electrical installations — Part 4-41: Protection for safety — Protection against electric shock*

3 Terms and definitions

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

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

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

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

4 Technical declarations

In order to achieve the appropriate layout of a power generation station, the customer/user shall give requirements and parameters to the generating set manufacturer. Special items for the most important requirements and parameters are listed in Table 1, 4.1 to 4.19.

If there are no specific declarations stated by the customer, then the declarations stated by the manufacturer should be taken as the basis for the requirements and parameters.

The following distinction shall be made between the manufacturer and customer/user:

— Declarations which the customer or the user of the generating set are required to provide;

— Declarations which the manufacturer of the generating set are required to provide;

— Declarations to be agreed between the manufacturer and customer/user.

These are indicated by symbol “X” in Table 1, columns “M” (manufacturer) and “C” (customer) of 4.1 to 4.19.

Table 1 — Important technical requirements and parameters

No.	Term	Item	Reference	C	M
4.1	Basic data	Power demand		X	
		Power factor		X	
		Rated frequency		X	
		Rated voltage		X	
		Type of system earthing	IEC 60364-4-41	X	
		Profile of the connected electrical load	ISO 8528-5:2013, 9.1 ISO 8528-1:2005, 6.1 to 6.3	X	
		Required steady-state frequency and voltage behaviour	ISO 8528-5:2013, 5.1 and Clause 7	X	X
		Required transient frequency and voltage behaviour	ISO 8528-5:2013, 5.1 and Clause 7	X	X
		Type of fuel available	ISO 8528-2:2005, Clause 12	X	
		Fuel system safety construction	ISO 8528-13, 6.13	X	X
		Starting	ISO 8528-5:2013, 15.1 and ISO 8528-7, C.3.11	X	X
		Cooling and room ventilation	ISO 8528-5:2013, 15.6	X	X
4.2	Engine	Speed	ISO 8528-2:2005, 6.1	X	X
		Fuel specification	ISO 8528-2:2005, Clause 12	X	X
		Nature and type of speed governor	ISO 8528-2:2005, 6.2 and 6.3		X
		Nature of engine cooling	ISO 8528-2:2005, Clause 12	X	X
		Required operating time without refuelling	ISO 8528-5:2013, 15.3	X	
		Required engine instrumentation	ISO 8528-4:2005, 7.5	X	X
		Required protection system	ISO 8528-4:2005, 7.3 and 7.4	X	X
		Fuel consumption	ISO 8528-1:2005, 14.5		X
		Starting system and ability	ISO 8528-2:2005, Clause 11 and ISO 8528-7, C.1.10	X	X
		Heat balance	ISO 8528-2:2005, Clause 9		X
		Air consumption			X
4.3	Generator	Nature and type of excitation and voltage regulation	ISO 8528-1:2005, 14.7.2 and ISO 8528-3:2005, Clauses 8 and 12	X	X
		Required mechanical protection	IEC 60034-5	X	X
		Required electrical protection	ISO 8528-4:2005, 7.3	X	X
		Nature of generator cooling	IEC 60034-6	X	X
		Heat balance	IEC 60034-2-1		X
		Unsymmetrical load (unbalanced load current)	ISO 8528-3:2005, 10.2	X	
		Construction and mounting arrangement	IEC 60034-7		X
		Grade of radio interference suppression	ISO 8528-3:2005, 10.6	X	X
		Continuous		X	

Table 1 *(continued)*

No.	Term	Item	Reference	C	M
4.4	Mode of operation	Limited-time operation (emergency generating set. peak-load generating set)	ISO 8528-1:2005, 6.1	X	
		Expected operating hours per year		X	
4.5	Power rating classification	Continuous power	ISO 8528-1:2005, 13.3		X
		Prime power			X
		Limited-time running power			X
		MAX power			X
		Emergency Standby Power	ISO 8528-1:2005, 13.3		×
4.6	Site criteria	Land use	ISO 8528-1:2005, 6.2.1	X	
		Marine use	ISO 8528-1:2005, 6.2.2 and 11.6	X	
4.7	Performance class		ISO 8528-1:2005, Clause 7	X	
4.8	Single and parallel operation	Parallel operation with other generating sets	ISO 8528-1:2005, 6.3	X	
		Parallel operation with mains		X	
		Type and execution of synchronizing		X	X
4.9	Mode of start-up and control	Manual	ISO 8528-1:2005, 6.4 and ISO 8528-4:2005, Clause 6	X	
		Automatic		X	
		Semi-automatic		X	
		Additional control device proposed by the generating set manufacturer			X
4.10	Start-up time	Generating set with no specified start-up time	ISO 8528-1:2005, 6.5	X	
		Long-break set		X	
		Short-break set		X	
		No-break set		X	
4.11	Generating set configuration	Installation configuration - fixed - transportable - mobile	ISO 8528-1:2005, 8.2	X	
		Set configuration - base frame - enclosure - trailer	ISO 8528-1:2005, 8.3	X	
		Type of mounting	ISO 8528-1:2005, 8.4	X	X
		Weather effects - inside - outside - open air	ISO 8528-1:2005, 8.6	X	X

Table 1 *(continued)*

No.	Term	Item	Reference	C	M
4.12	Air quality	Ambient temperature	ISO 8528-1:2005, Clause 11	X	
		Altitude		X	
		Humidity		X	
		Sand and dust		X	
		Marine		X	
		Shock and vibration		X	
		Chemical pollution		X	
		Type of radiation		X	
		Cooling water/liquid		X	
4.13	Emissions	Noise limitation	ISO 8528-1:2005, Clause 9	X	
		Exhaust gas emission limitation		X	
		Vibrations		X	X
		National legislation		X	
4.14	Test methods	Standard	ISO 8528-6:2005, Clause 4	X	X
		Special requirements		X	
4.15	Maintenance intervals	Routine (e.g. oil change)	ISO 8528-1:2005, 13.3	X	X
		Mechanical (e.g. filters)			X
		Electrical (e.g. controls)			X
		Service life to major overhaul			X
4.16	Auxiliaries	Power consumption of the auxiliary devices (e.g. fan, compressor)			X
		Preheating			X
		Prelubricating			X
		Auxiliary and starting battery			X
4.17	Control gear and switchgear	Rated current capacity	ISO 8528-4:2005, 4.5	X	X
		Neutral earth scheme	ISO 8528-4:2005, 7.3.7	X	
		Fault-current rating	ISO 8528-4:2005, 5.3	X	X
		Nature of protection device	ISO 8528-4:2005, 7.4	X	X
		Nominal operating voltage and control-circuit voltage	ISO 8528-4:2005, 4.3 and 4.6	X	X
		Required electrical instrumentation	ISO 8528-4:2005, 7.2	X	X
4.18	Factors affecting generating set performance	With respect to power	ISO 8528-5:2013, 9.2 and ISO 8528-1:2005, 14.2	X	
		With respect to frequency and voltage	ISO 8528-5:2013, 9.3 and ISO 8528-1:2005, 14.2	X	
4.19	Other regulations and requirements		ISO 8528-7, Clause 3	X	

5 Other regulations and additional requirements

5.1 For a.c. generating sets used on board ships and offshore installations which require complying with rules of a classification society, the additional requirements of the classification society shall be observed. The classification society shall be stated by the customer prior to placing the order.

For a.c. generating sets operating in non-classed equipment, such additional requirements are in each case subject to agreement between the manufacturer and customer.

5.2 If special requirements from regulations of any other authority (e.g. inspecting and/or legislative authorities) are required, the authority shall be stated by the customer prior to placing the order.

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

Annex A
(normative)

Technical questionnaire — General data

A check-list of customer requirements is given in Table A.1, A.1 to A.15. The customer is asked to mark a cross in the appropriate box.

Table A.1

No	Requirement	Reference to subclause of ISO 8528-7
A.1	Basic data	
A.1.1	Power demand of the customer: ..... kW at power factor (cos ϕ): ·····	4.1
A.1.2	Rated voltage: ....,..... v Rated frequency: ..... Hz Number of phases: ..... Type of system earthing: TN ☐ TT ☐ IT ☐	
A.1.3	Profile of connected electrical load:	
A.2	Fuel	
A.2.1	Type available: Diesel ☐ Petrol ☐ Gas ☐ Gas :CNG ☐ LNG ☐ sewage gas ☐ Oil associated gas ☐ biogas ☐ straw gas ☐ Supply gas conditions: intermittent ☐ continuous ☐ Gas volume: .... V/h Gas source composition variation range; Low calorific value gas source: Max.:..... kJ/Nm³; Min.: .....kJ/Nm³ Impurity composition and particle gas source; Gas source temperature: Max.:..... °C Min.: ..... °C Gas source pressure: Max.:..... Pa Min.: ..... Pa	4.1
A.2.2	Required operating time at rated power without refuelling: .....h	4.2
A.2.3	Fuel supply mode :routing of pipe ☐ fuel tanks ☐	4.1
A.3	Nature of engine cooling: Air ☐ Liquid ☐ Type:	4.2
A.4	Mode of operation	
A.4.1	Continuous operation ☐ Limited time operation ☐ Emergency set ☐ Peak load set ☐	4.4
A.4.2	Expected operation hours per year: .... h	

Table A.1 *(continued)*

No	Requirement	Reference to subclause of ISO 8528-7
A.5	Site criteria Land use ☐ Marine use ☐	4. 6
A.6	Performance class G1 ☐ G2 ☐ G3 ☐ G4 ☐ NOTE If performance class G4 is applied, see Annex B.	4.7
A.7	Single and parallel operation	4.8
	Single operation ☐	
A.7.2	Parallel operation with other generating sets ☐ Parallel operation with mains ☐ Nature of synchronizing: ...., ...	
A.8	Mode of start-up and control	4.9
A.8.1	Start-up: Manual ☐ Automatic ☐ Semi-automatic ☐	
A.8.2	Control: Manual ☐ Automatic ☐ Semi-automatic ☐	
A.9	Start-up time	4.10
A.9.1	Generating set with no specified start-up time ☐ Generating set with specific start-up time ☐	
A.9.2	Long-break set ☐ Short-break set ☐ No-break set ☐	
A.10	load acceptance Loading, 1st step: ..... % of rated power..... s after starting Loading, 2nd step: ..... % of rated power..... s after starting Loading, 3rd step: ..... % of rated power..... s after starting	4.18
A.11	Installation features	
A.11.1	Installation configuration: Fixed ☐ Transportable ☐ Mobile ☐	4.11
A11.2	Set configuration: Base frame ☐ Enclosure ☐ Trailer ☐	
A.11.3	Weather effects: Inside ☐ Outside ☐ Open air ☐	
A.12	Site conditions	
A.12.1	Ambient air temperature: max..... .... °C min..... °C	4.12
A.12.2	Altitude above sea level:..... m	
A.12.3	Maximum humidity: ..... %	
A.12.4	Sand and dust: Yes ☐ No ☐ Nature of sand and dust:	
A.12.5	Marine climate operation: Yes ☐ No ☐	
A.12.6	Shock and vibration:	

Table A.1 *(continued)*

No	Requirement	Reference to subclause of ISO 8528-7
A.12.7	Chemical pollution: Yes ☐ No ☐ Nature of pollution: ..... Nature of chemicals:	
A.12.8	Radiation type:	
	Cooling liquid: Availability: Yes ☐ No ☐ Seawater ☐ Fresh water ☐ Other ☐ (to be specified) .... Quality: ..... pH-value: ..... Maximum temperature: .... °C	
A.13	Emissions	
A.13.1	Noise limitation: Yes ☐ No ☐ Maximal level LwA = ... dB	4.13
A.13.2	Exhaust gas emission limitation: Yes ☐ No ☐	4.13
A.13.2.1	Emissions related to energy consumption: NO_X .... g/(kWh) CO ..... g/(kWh) SO_2..... ..... g/(kWh) HC ..... g/(kWh) Smoke number (in accordance with ISO 8178-3):	
A.13.2.2	Emissions given in concentration values: NO_X. .... ppm CO..... ppm SO_2 ... . ppm HC ..... ppm Smoke number (in accordance with ISO 8178-3): ..... The O_2 content in the exhaust gas on which the emission values are based: .... % (V/V)	
A.13.2.3	Emissions given in concentration values: NO_X ..... mg/m³ CO ..... mg/m³ SO_2 ..... mg/m³ HC ..... mg/m³ measured under standard reference conditions (0 °C, 101.3 kPa.). Smoke number (in accordance with ISO 8178-3): ..... The O_2 content in the exhaust gas on which the emission values are based: .....% (V/V)	
A.14	Test methods	
A.14.1	Test programme according to ISO 8528-6: ISO standard type test ☐ ISO standard acceptance test ☐	4.14
A.14.2	Special requirements for carrying out the test:	
A.15	Other regulations and requirements	
A.15.1	Laws to be taken into account (details to be attached): Yes ☐ No ☐	4.19
A.15.2	Special requirements of any authorities to be taken into account (details to be attached): Yes ☐ No ☐	

Annex B
(normative)

Technical questionnaire — Specific data

A check-list of customer requirements is given in Table B.1, B.1 to B.9.

This document may constitute either an addition to the general requirements of Annex A or an amendment to the requirements given in the selected performance class.

Table B.1

No.	Characteristic	Reference to subclause of ISO 8528-7
B.1	Frequency droops: ..... %	4.1
B.2	Steady state frequency band: ..... %	
B.3	Steady state voltage deviation: .... %	
B.4	Transient frequency deviation from initial frequency/rated frequency (depending on loading steps): ..... %	
B.5	Frequency recovery time: .....s	
B.6	Transient voltage deviation from initial voltage/rated voltage (depending on loading steps): .....%	
B.7	Voltage recovery time: .....s	
B.8	Load characteristics:	4.18
B.9	Neutral earth scheme:	4.17