INTERNATIONAL STANDARD

ISO 8528-7

First edition
1994-09-01

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

Reference number
ISO 8528-7:1994(E)

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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 8528-7 was prepared by Technical Committee ISO/TC 70, *Internal combustion engines*, Subcommittee SC 2, *Performance and tests*.

ISO 8528 consists of the following parts, under the general title *Reciprocating internal combustion engine driven alternating current generating sets*:

— *Part 1: Application, ratings and performance*

— *Part 2: Engines*

— *Part 3: Alternating current generators for generating sets*

— *Part 4: Controlgear and switchgear*

— *Part 5: Generating sets*

— *Part 6: Test methods*

— *Part 7: Technical declarations for specification and design*

— *Part 8: Requirements and tests for low-power generating sets*

— *Part 9: Measurement and evaluation of mechanical vibrations*

International Organization for Standardization
Case Postale 56 • CH-1211 Genève 20 • Switzerland

Printed in Switzerland

— *Part 10: Measurement of airborne noise by the enveloping surface method*

— *Part 11: Dynamic uninterruptible power supply systems*

Part 12, concerning emergency power supply systems, is at an early stage of preparation.

Annexes A, B and C form an integral part of this part of ISO 8528. Annex D is for information only.

Reciprocating internal combustion engine driven alternating current generating sets —

Part 7:
Technical declarations for specification and design

1 Scope

This part of ISO 8528 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 part of ISO 8528 should be regarded as a basis.

For other reciprocating-type prime movers (e.g. sewage gas engines, steam engines), the provisions of this part of ISO 8528 should be used as a basis.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 8528. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 8528 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 8178-3:1994, *Reciprocating internal combustion engines — Exhaust emission measurement — Part 3: Definitions and methods of measurement of exhaust gas smoke under steady-state conditions.*

ISO 8528-1:1993, *Reciprocating internal combustion engine driven alternating current generating sets — Part 1: Application, ratings and performance.*

ISO 8528-2:1993, *Reciprocating internal combustion engine driven alternating current generating sets — Part 2: Engines.*

ISO 8528-3:1993, *Reciprocating internal combustion engine driven alternating current generating sets — Part 3: Alternating current generators for generating sets.*

ISO 8528-4:1993, *Reciprocating internal combustion engine driven alternating current generating sets — Part 4: Controlgear and switchgear.*

ISO 8528-5:1993, *Reciprocating internal combustion engine driven alternating current generating sets — Part 5: Generating sets.*

ISO 8528-6:1993, *Reciprocating internal combustion engine driven alternating current generating sets — Part 6: Test methods.*

IEC 34-2:1972, *Rotating electrical machines — Part 2: Methods for determining losses and efficiency of rotating electrical machinery from tests (excluding machines for traction vehicles).*

IEC 34-5:1991, *Rotating electrical machines — Part 5: Classification of degrees of protection provided by enclosures of rotating electrical machines (IP code).*

IEC 34-6:1991, *Rotating electrical machines — Part 6: Methods of cooling (IC code).*

IEC 34-7:1992, *Rotating electrical machines — Part 7: Classification of types of constructions and mounting arrangements.*

IEC 364-4-41:1992, *Electrical installations of buildings — Part 4: Protection for safety — Chapter 41: Protection against electric shock.*

IEC 721-2-5:1991, *Classification of environmental conditions — Part 2: Environmental conditions appearing in nature — Section Five: Dust, sand, salt mist.*

3 Other regulations and additional requirements

3.1 For a.c. generating sets used on board ships and offshore installations which have to comply 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 of 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.

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

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

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 4.1 to 4.19.

NOTE 1 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.

Distinction has to be made between

— declarations which the customer or the user of the generating set has to give (symbol "x" in column "C" of 4.1 to 4.19).

— declarations which the manufacturer of the generating set has to give (symbol "x" in column "M" of 4.1 to 4.19);

— declarations to be agreed between the manufacturer and customer/user (symbol "x" in columns "M" and "C" of 4.1 to 4.19).

No.	Term	Item	Reference[1)]	C	M
4.1	Basic data	Power demand		x	
		Power factor		x	
		Rated frequency		x	
		Rated voltage		x	
		Type of system earthing	IEC 364-4-41	x	
		Profile of the connected electrical load	9.1 of ISO 8528-5	x	
		Required steady-state frequency and voltage behaviour	5.1 and 7.1 of ISO 8528-5	x	x
		Required transient frequency and voltage behaviour	5.3 and 7.3 of ISO 8528-5	x	x
		Type of fuel available	12 of ISO 8528-2	x	
		Starting	15.1 of ISO 8528-5 and C.3.11 of ISO 8528-7	x	x
		Cooling and room ventilation	15.6 of ISO 8528-5	x	x
4.2	Engine	Speed	6.2 of ISO 8528-2	x	x
		Fuel specification	12 of ISO 8528-2	x	x
		Nature and type of speed governor	6.6 of ISO 8528-2		x
		Nature of engine cooling	12 of ISO 8528-2	x	x
		Required operating time without refueling	15.3 of ISO 8528-5	x	
		Required engine instrumentation	7.4 of ISO 8528-4	x	x
		Required protection system	7.3 of ISO 8528-4	x	x
		Fuel consumption	14.5 of ISO 8528-1		x
		Starting system and ability	11 of ISO 8528-2 and C.1.10 of ISO 8528-7	x	x
		Heat balance	9 of ISO 8528-2		x
		Air consumption			x
4.3	Generator	Nature and type of excitation and voltage regulation	14.7.2 of ISO 8528-1 and 8 and 12 of ISO 8528-3	x	x
		Required mechanical protection	IEC 34-5	x	x
		Required electrical protection	7.2 of ISO 8528-4	x	x
		Nature of generator cooling	IEC 34-6	x	x
		Heat balance	IEC 34-2		x
		Unsymmetrical load (unbalanced load current)	10.1 of ISO 8528-3	x	
		Construction and mounting arrangement	IEC 34-7		x
		Grade of radio interference suppression	10.5 of ISO 8528-3	x	x

No.	Term	Item	Reference[1)]	C	M
4.4	Mode of operation	Continuous	6.1 of ISO 8528-1	x	
		Limited-time operation (emergency generating set, peak-load generating set)		x	
		Expected operating hours per year		x	
4.5	Power rating classification	Continuous power	13.3 of ISO 8528-1		x
		Prime power			x
		Limited-time running power			x
4.6	Site criteria	Land use	6.2.1 of ISO 8528-1	x	
		Marine use	6.2.2 and 11.5 of ISO 8528-1	x	
4.7	Performance class		7 of ISO 8528-1	x	
4.8	Single and parallel operation	Parallel operation with other generating sets	6.3 of ISO 8528-1	x	
		Parallel operation with mains		x	
		Type and execution of synchronizing		x	x
4.9	Mode of start-up and control	Manual	6.4 of ISO 8528-1 and 6 of ISO 8528-4	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	6.5 of ISO 8528-1	x	
		Long-break set		x	
		Short-break set		x	
		No-break set		x	
4.11	Installation features	Installation configuration — fixed — transportable — mobile	8.1 of ISO 8528-1	x	
		Set configuration — base frame — enclosure — trailer	8.2 of ISO 8528-1	x	
		Type of mounting	8.3 of ISO 8528-1	x	x
		Weather effects — inside — outside — open air	8.5 of ISO 8528-1	x	x

No.	Term	Item	Reference[1]	C	M
4.12	Site conditions	Ambient temperature	11 of ISO 8528-1	x	
		Altitude		x	
		Humidity		x	
		Sand and dust[2]		x	
		Marine		x	
		Shock and vibration		x	
		Chemical pollution		x	
		Type of radiation		x	
		Cooling water/liquid		x	
4.13	Emissions	Noise limitation	9 of ISO 8528-1	x	
		Exhaust gas emission limitation		x	
		Vibrations		x	x
		National legislation		x	
4.14	Test methods	Standard	4 of ISO 8528-6	x	x
		Special requirements		x	
4.15	Maintenance intervals	Routine (e.g. oil change)	13.3 of ISO 8528-1	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	Controlgear and switchgear	Rated current capacity	4.5 of ISO 8528-4	x	x
		Neutral earth scheme	7.2.7 of ISO 8528-4	x	
		Fault-current rating	5.2 of ISO 8528-4	x	x
		Nature of protection device	7.2 of ISO 8528-4	x	x
		Nominal operating voltage and control-circuit voltage	4.6 of ISO 8528-4	x	x
		Required electrical instrumentation	7.1 of ISO 8528-4	x	x
4.18	Factors affecting generating set's performance	With respect to power	9.1 of ISO 8528-5 and 14.2 of ISO 8528-1	x	
		With respect to frequency and voltage	9.2 of ISO 8528-5 and 14.2 of ISO 8528-1	x	
4.19	Other regulations and requirements		3 of ISO 8528-7	x	

1) The subclause numbers of parts 1 to 7 of ISO 8528 refer to the 1993 edition.

2) Where applicable IEC 721-2-5 shall be used to determine the classification, concentration, particle sizes and permanence of the type of sand or dust.

Annex A
(normative)

Technical questionnaire — General data

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

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 ☐	4.1
A.2.2	Required operating time at rated power without refueling: ..... h	4.2
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 ☐ Peakload set ☐	4.4
A.4.2	Expected operation hours per year: ..... h	
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

No.	Requirement	Reference to subclause of ISO 8528-7
A.7	**Single and parallel operation**	
A.7.1	Single operation ☐	4.8
A.7.2	Parallel operation with other generating sets ☐ Parallel operation with mains ☐ Nature of synchronizing:	
A.8	**Mode of start-up and control**	
A.8.1	Start-up: Manual ☐ Automatic ☐ Semi-automatic ☐	4.9
A.8.2	Control: Manual ☐ Automatic ☐ Semi-automatic ☐	
A.9	**Start-up time**	
A.9.1	Generating set with no specified start-up time ☐ Generating set with specific start-up time ☐	4.10
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
A.11.2	Set configuration: Base frame ☐ Enclosure ☐ Trailer ☐	
A.11.3	Weather effects: Inside ☐ Outside ☐ Open air ☐	

No.	Requirement	Reference to subclause of ISO 8528-7
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:	
A.12.7	Chemical pollution: Yes ☐ No ☐ Nature of pollution: ..... Nature of chemicals:	
A.12.8	Radiation type:	
A.12.9	Cooling liquid: Availability: Yes ☐ No ☐ Sea water ☐ Fresh water ☐ Other ☐ (to be specified) ..... Quality: ..... pH-value: ..... Maximum temperature: ..... °C	
A.13	**Emissions**	
A.13.1	Noise limitation: Yes ☐ No ☐ Maximal level L_{WA} = ... dB	4.13

No.	Requirement	Reference to subclause of ISO 8528-7
A.13.2	Exhaust gas emission limitation: Yes ☐ No ☐	
A.13.2.1	Emissions related to energy consumption: NO_x ..... g/kW·h CO ..... g/kW·h SO_2 ..... g/kW·h HC ..... g/kW·h Smoke number (in accordance with ISO 8178-3):	4.13
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/m^3 CO ..... mg/m^3 SO_2 ..... mg/m^3 HC ..... mg/m^3 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 a customer's requirements is given in 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.

No.	Characteristic	Reference to subclause of ISO 8528-7
B.1	Frequency droop: ..... %	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:	
B.6	Transient voltage deviation from initial voltage/rated voltage (depending on loading steps):	
B.7	Voltage recovery time:	
B.8	Load characteristics:	4.18
B.9	Neutral earth scheme:	4.17

Annex C
(normative)

Generating set data

A check-list of specifications agreed by the customer and manufacturer are given in C.1 to C.3. The customer is asked to mark a cross in the appropriate box.

No.	Requirement	Reference
C.1	**RIC engine**	
C.1.1	Manufacturer:	4.2 of ISO 8528-7
C.1.2	Engine speed: ..... min^{-1} (r/min)	
C.1.3	Engine intake air temperature: Max.: ..... °C Min.: ..... °C	
C.1.4	Fuel specification	
C.1.5	Nature and type of engine governor: .... Manufacturer:	
C.1.6	Nature of engine cooling	
C.1.7	Required engine instrumentation	
C.1.8	Required protection equipment	
C.1.9	Type of RIC engine: Compression ignition engine ☐ Spark ignition engine ☐ Turbocharged engine: Yes ☐ No ☐ 2-stroke ☐ 4-stroke ☐	
C.1.10	Starting system: Pneumatic starter motor ☐ Electrical starter motor ☐ Air starting system ☐ Other ☐ (to be specified): .... (see also C.3)	

No.	Requirement	Reference
C.2	**Alternating current generator**	
C.2.1	Manufacturer:	4.3 of ISO 8528-7
C.2.2	Type of a.c. generator: Synchronous ☐ Asynchronous ☐	
C.2.3	Excitation system: Static ☐ Brushless ☐	
C.2.4	Required mechanical protection:	4.4 of ISO 8528-7 and IEC 34-5
C.2.5	Required electrical protection:	7.2 of ISO 8528-4 and 4.3 of ISO 8528-7
C.2.6	Construction and mounting arrangement:	4.3 of ISO 8528-7 and IEC 34-7
C.2.7	Nature of generator cooling:	4.3 of ISO 8528-7 and IEC 34-6
C.3	**Generating set**	
C.3.1	Power rating classification: Continuous power ☐ Prime power ☐ Limiting-time running power ☐	
C.3.2	Type of synchronizing:	
C.3.3	Type of mounting: Rigid mounting ☐ Resilient mounting: Fully resilient ☐ Semi-resilient ☐ Compound resilient ☐ Mounting on resilient foundation ☐	
C.3.4	Vibration emission limitations: Yes ☐ No ☐	
C.3.5	Fuel consumption, taking into account the efficiency of the generator:	14.5 of ISO 8528-1
C.3.6	Control-circuit voltage: V	
C.3.7	Additional control devices offered by the generating set manufacturer:	
C.3.8	Weather effects	4.11 of ISO 8528-7
C.3.9	Maintenance intervals: Routine: ..... Special	4.15 of ISO 8528-7

No.	Requirement	Reference
C.3.10	Auxiliaries: Auxiliary devices: Included ☐ Not included ☐ Preheating required: Yes ☐ No ☐ Prelubricating required: Yes ☐ No ☐ Auxiliaries and starting battery required: Yes ☐ No ☐	4.16 of ISO 8528-7
C.3.11	Starting capability: Number of consecutive starting attempts required: ..... Elapsed time between starting attempts: ..... s	4.1 of ISO 8528-7
C.3.9	Type of cooling and room ventilation Natural ☐ Forced ☐	4.1 of ISO 8528-7

Annex D
(informative)

Bibliography

[1] ISO 3046-1:1986, *Reciprocating internal combustion engines — Performance — Part 1: Standard reference conditions and declarations of power, fuel consumption and lubricating oil consumption.*

[2] ISO 3046-4:1978, *Reciprocating internal combustion engines — Performance — Part 4: Speed governing.*

[3] ISO 8178-1:—[1], *Reciprocating internal combustion engines — Exhaust emission measurement — Part 1: Test bed measurement of gaseous and particulate emissions.*

[4] ISO 8178-2:—[1], *Reciprocating internal combustion engines — Exhaust emission measurement — Part 2: At-site measurement of gaseous and particulate exhaust emissions.*

[5] ISO 8178-4:—[1], *Reciprocating internal combustion engines — Exhaust emission measurement — Part 4: Test cycles for different engine applications.*

[6] IEC 721-3-3:1987, *Classification of environmental conditions — Part 3: Classification of groups of environmental parameters and their severities. Stationary use at weatherprotected localities.*

1) To be published.

ICS 29.160.40

Descriptors: motor generator sets, specifications, design, technical data sheets.

Price based on 14 pages