SLOVENSKI STANDARD
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Agregati za proizvodnjo izmeničnega toka, gnani z batnim motorjem z notranjim zgorevanjem - 13. del: Varnost (ISO/DIS 8528-13:2014)

Reciprocating internal combustion engine driven alternating current generating sets - Part 13: Safety (ISO/DIS 8528-13:2014)

Groupes électrogènes à courant alternatif entraînés par moteurs alternatifs à combustion interne - Partie 13: Sécurité (ISO/DIS 8528-13:2014)

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Reciprocating internal combustion engine driven alternating current generating sets —

Part 13: Safety

Groupes électrogènes à courant alternatif entraînés par moteurs alternatifs à combustion interne — Partie 13: Sécurité

[Revision of first edition (ISO 8528-8:1995)]

ICS: 27.020;29.160.40

ISO/CEN PARALLEL PROCESSING

This draft has been developed within the International Organization for Standardization (ISO), and processed under the **ISO lead** mode of collaboration as defined in the Vienna Agreement.

This draft is hereby submitted to the ISO member bodies and to the CEN member bodies for a parallel five month enquiry.

Should this draft be accepted, a final draft, established on the basis of comments received, will be submitted to a parallel two-month approval vote in ISO and formal vote in CEN.

To expedite distribution, this document is circulated as received from the committee secretariat. ISO Central Secretariat work of editing and text composition will be undertaken at publication stage.

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

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.

ISO 8528-13 was prepared by Technical Committee ISO/TC 70, *Internal combustion engines*.

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;*

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

— *Part 11: Dynamic uninterruptible power supply systems;*

— *Part 12: Emergency power supply to safety services;*

— *Part 13: Safety.*

Reciprocating internal combustion engine driven alternating current generating sets — Part 13: Safety

1 Scope

This part of ISO 8528 specifies the safety requirements for reciprocating internal combustion (RIC) engine driven generating sets up to 1000 V consisting of a RIC engine, an alternating current (a.c.) generator including the additional equipment required for operating, e.g. controlgear, switchgear, auxiliary equipment.

It applies to generating sets for land and marine use (domestic, recreational and industrial application), excluding generating sets used on board of seagoing vessels and mobile offshore units as well as on aircraft or to propel road vehicles and locomotives.

NOTE This standard does not apply to arc welding equipment (IEC 60974 Series).

The special requirements needed to cover operation in potentially explosive atmospheres are not covered in this standard.

The hazards relevant to RIC engine driven generating sets are identified in Annex A.

This part of ISO 8528 deals with the special requirements of test and safety design which should be observed in addition to the definitions and requirements laid down in ISO 8528 parts 1 to 6, where applicable. It lays down safety requirements in order to protect the user from danger.

2 Normative references

The following referenced documents are indispensable for the application 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 3046-1:2002, 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 8528-1:2005, *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 60034-1:2010, *Rotating electrical machines — Part 1: Rating and performance*

IEC 60034-5:2006, *Rotating electrical machines — Part 5: Degrees of protection provided by the integral design of rotating electrical machines (IP code) - Classification*

IEC 60245-4:2011, *Rubber insulated cables of rated voltages up to and including 450/750 V — Part 4: Cords and flexible cables*

IEC 60335-1:2010, *Household and similar electrical appliances — Safety — Part 1: General requirements*

IEC 60364-4-41:2005, *Low voltage electrical installations — Part 4-41: Protection for safety: Protection against electric shock*

IEC 60529:1989 60529-1:2001, *Degrees of protection provided by enclosures (IP Code)*

ISO 4871:1996, *Acoustics — Declaration and verification of noise emission values of machinery and equipment*

ISO 11102-1:1997, *Reciprocating internal combustion engines - Handle starting equipment - Part 1: Safety requirements and tests*

ISO 11102-2:1997, *Reciprocating internal combustion engines - Handle starting equipment - Part 2: Method of testing the angle of disengagement*

ISO 12100:2010: *Safety of machinery — general principles for design — risk assessment and risk reduction*

ISO 13732-1:2006, *Ergonomics of the thermal environment — Methods for the assessment of human responses to contact with surfaces — Part 1: Hot surfaces*

ISO 13850:2006, *Safety of machinery — Emergency stop — Principles for design*

ISO 13857:2008, *Safety of machinery — Safety distances to prevent hazard zones being reached by upper and lower limbs*

ISO 14122-2:2001, *Safety of machinery — Permanent means of access to machinery — Part 2: Working platforms and walkways*

ISO 14314:2004, *Reciprocal internal combustion engines - Recoil starting equipment - General safety requirements*

ISO 15534-2:2000, *Ergonomic design for the safety of machinery - Part 2: Principles for determining the dimensions required for access openings*

ISO 8528:8:yyyy, *Reciprocating internal combustion engine driven alternating current generating sets — Part 8: Requirements and tests for low-generating sets*

ISO 2710-1:2000, *Reciprocating internal combustion engines — Vocabulary — Part 1: Terms for engine design and operation*

ISO 2710-2:1999, *Reciprocating internal combustion engines — Vocabulary — Part 2: Terms for engine maintenance*

ISO 3046-6:1990, *Reciprocating internal combustion engines — performance — Part 6: Overspeed protection*

ISO 6826:1997, *Reciprocating internal combustion engines — Fire protection*

ISO 7967-1:2005, *Reciprocating internal combustion engines — Vocabulary of components and systems — Part 1: Structure and external covers*

ISO 7967-2:2010, *Reciprocating internal combustion engines — Vocabulary of components and systems — Part 2: Main running gear*

ISO 7967-3:2010, *Reciprocating internal combustion engines — Vocabulary of components and systems — Part 3: Valves, camshaft drive and actuating mechanisms*

ISO 7967-4:2005, Reciprocating internal combustion engines — Vocabulary of components and systems — Part 4: Pressure charging and air/exhaust gas ducting systems

ISO 7967-8:2005, *Reciprocating internal combustion engines — Vocabulary of components and systems — Part 8: Starting systems*

ISO 7967-9:2010, *Reciprocating internal combustion engines — Vocabulary of components and systems — Part 9: Control and monitoring systems*

ISO 8999:2001, *Reciprocating internal combustion engines —Graphical symbols*

ISO 11684:1995 Tractors, machinery for agriculture and forestry, powered lawn and garden equipment — *Safety signs and hazard pictorials — General principles*

IEC 60417-DB-12M: 2002, *Graphic symbols for use on equipment — 12-month subscription to online database comprising all graphical symbols published in IEC 60417*

IEC 60073:2002, *Basic and safety principles for man-machine interface, marking and identification — Coding principles for indicators and actuators*

IEC 60204-1:2005, *Safety of machinery — electrical equipment of machines — Part 1: general requirements*

IEC 61310-1:2007, *Safety of machinery — Indication, marking and actuation — Part 1: Requirements for visual, acoustic and tactile signals*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 8528-1:2005, ISO 8528-2:2005, ISO 8528-3:2005, ISO 8528-4:2005, ISO 8528-5:2013, ISO 8528-6:2005, ISO 8528-7:1994, ISO 8528-8:yyyy, ISO 8528-9:1995, ISO 8528-10:1998, ISO 2710-1:2000, ISO 2710-2:1999, ISO 3046-1:2002, ISO 3046-6:1990, ISO 7967-1:2005, ISO 7967-2:2010, ISO 7967-3:2010, ISO 7967-4:2005, ISO 7967-8:2005, ISO 7967-9:2010, ISO 12100:2010, IEC 60364-1:2005 and the following apply.

3.1
layman
a person who does not necessarily recognize potential danger resulting from electricity, moving parts or hot parts. The layman has a lack of training, knowledge and experience, and has insufficient knowledge of the relevant regulations

3.2
close proximity
the 30 mm space immediately around the operating and adjusting controls and carrying handles, including their whole movement range

3.3
rated power
electric power assigned by the manufacturer according to ISO 8528-1:2005, clause 13 (COP, PRP, LTP, ESP), except for low power generating sets to ISO 8528-8:20xx clause 3.3 (COP)

3.4
low power generating sets
power generating sets for the purpose of this standard which are determined by the following special features :

— low power is taken to mean rated power of a magnitude up to approximately 10 kW/50Hz, 12kW/60Hz;

— users normally are laymen;

— complete generating set is usually transportable, or mobile;

— electrical output is connected by means of plugs, sockets and screwed terminal except for extra low voltages;

— generating set is ready for use without any additional installation work by the user.

4 General

If the installation of a generating set can create hazards in addition to those covered by this Standard, the safety requirements and/or protective measures related to these additional hazards are the responsibilities of the installer, if necessary with the agreement of the manufacturer of the generating set. The installer will be responsible for ensuring compliance for the additional hazards arising because of the installation.

5 Hazards

The hazards relevant to RIC engine driven generating sets that have to be considered in order to prevent personal injury are listed in Annex A.

6 Safety requirements and tests

6.1 General

Machinery shall comply with the safety requirements and/or protective measures of this clause. In addition, the machine shall be designed according to the principles of ISO 12100 for relevant but not significant hazards, which are not dealt with by this document.

6.2 Starting system

6.2.1 Requirements

Starting systems can be triggered manually or automatically.

Electrical starting systems normally operate at voltages of 24 V or below and therefore do not present a hazard. Electrical starting systems above 24 V are not dealt with in this standard and the installer of the engine has to ensure safe operation after connecting the engine to the driven machinery.

For engines with compressed air starting, the starting pneumatic system shall comply with the installation requirements and with the operation and safety information specified in the manuals provided by the starting system components suppliers.

Crank handle starting systems shall meet the requirements specified in ISO 11102-1:1997 and ISO 11102-2:1997. Additionally the following requirements apply:

— Starting handles shall have sufficient clearance from the mounting surface to ensure safe turning;

— Diesel engines with a manual starter shall have a decompression facility which does not require to be hand-held during cranking.

The only permissible hand starting systems are crank handle (as defined above) and recoil starting devices as described in ISO 14314:2004. The marking required in Clause 7.3, ISO 14314:2004 shall not apply.

6.2.2 Verification

Compliance with the requirements shall be verified by inspection and testing of the starting systems.

6.3 Stopping

6.3.1 Requirements

6.3.1.1 Normal stopping

All generating sets shall have a normal stopping device which can be manually or automatically actuated. Stopping controls shall remain in the stop position when operated. This shall operate by a device ensuring the cutting off of the fuel or the ignition (for spark ignition engines) supply. This device may include an air supply cut-off.

6.3.1.2 Stopping in case of failure

Generating sets except low power generating sets shall be provided with an automatically actuated stopping device in case of failure.

This device shall monitor one or more signals of the generating set and if these signals are out of the allowable range it triggers the automatic stop.

The main signals that might be used to actuate automatic stopping are e.g.

a) for the RIC engine:

   1) overspeed

   2) low lubricating oil pressure;

   3) high coolant temperature;

   4) low coolant level;

b) for the generator:

   1) excessive overvoltage;

   2) overload.

Which of these or other measures should be specified depends on the application.

6.3.2 Verification

Normal stopping shall be verified by inspection and testing of the stopping device in manual and in automatic modes (if provided in the application).

Automatic stopping in case of failure shall be verified by testing the action of typical failure modes in operating conditions (an appropriate method shall be used to create typical failure conditions, e.g. manual triggering, short-circuiting of contacts).

6.4 Emergency stopping

6.4.1 Requirements

Emergency stopping devices are required for remote controlled generating sets and generating sets with an enclosure or container accessible by persons. In accordance with the risk assessment in ISO 12100, 6.3.5.2, an emergency stopping device is not required for low power generating sets, as it would not lessen the risk by reducing the stopping time.

Emergency stopping devices shall be actuated manually. As for normal stopping, emergency stopping shall operate by a device ensuring the cutting off of the fuel supply or ignition (for spark ignition engines). This device may include an air supply cut-off.

Emergency stopping devices shall also meet the requirements of ISO 13850:2006, category 0, and the reset shall not initiate a restart or any hazardous conditions.

Manually actuated emergency stopping devices shall be located inside and outside the enclosure or container in which a generating set is located and which is accessible for personnel to carry out maintenance or control operations when generating sets are in operation.

6.4.2 Verification

Emergency stopping devices shall be verified by inspection and testing in operating conditions.

6.5 Control devices

6.5.1 Design, safety and mechanical strength

6.5.1.1 Requirements

Control devices for the RIC engine of the generating set shall meet the following requirements:

hand controls shall be designed to withstand 1,2 times the maximum actuating forces given in Table 1.

Table 1 — Clearance between controls

Operation by	Spacing (mm)	Maximum actuating
Finger tip	10	10
Finger grasp - toggles -knobs	 20 20	 50 50
Hand - upward -fore-aft	 50 50	 400 300

— For handles, knobs, grips, levers and similar devices, requirements and tests shall be in accordance with IEC 60335-1:2010, 22.12.

— controls shall act positively and smoothly and without delay or unexpected action and be in accordance with ISO 2261:1994;

— the surface temperature of the controls that have to be manually actuated while the engine is running shall be within the following limits in accordance with ISO 13732-1 for a contact time of 10 s;

— 55 °C for metallic surfaces;

— 70 °C for non metallic surfaces.

— sharp edges or corners on, or adjacent to manual controls shall be removed. Edges shall have a chamfer of at least 0,5 mm.

Control devices on electrical equipment of the generating set shall comply with IEC 60204-1, subclauses 10.1 and 10.2 with the exception as given in Annex B.10 of this part of ISO 8528.

6.5.1.2 Verification

Control devices of the RIC engine shall be verified by inspection and testing.

Control devices of the generating sets shall be verified in accordance with IEC 60204-1 subclauses 10.1 and 10.2.

For surface temperature measurement of the control devices (RIC engines and generating sets), the following method shall be conducted:

a) the generating set shall be operated at its rated power until the surface temperatures stabilize;

b) the test shall be conducted in well-ventilated place not directly exposed to sunshine;

c) if the test is conducted at an ambient temperature outside of the nominal (20 ±3) °C temperatures shall be corrected by the following formula:

Corrected temperature (°C) = observed temperature (°C) – ambient temperature (°C) + 20°C

6.5.2 Identification

6.5.2.1 Requirements

The controls devices of the RIC engines shall be identified according to the function they perform or their function shall be explained in the operating manual. They shall be identified according to IEC 61310-2: 2007. Colour coding shall be according IEC 60073:2002.

The marking on the engine controls shall be legible throughout the engine life.

Identification should preferably be by symbols according to ISO 8999:2001 or, if there are no suitable symbols, by words placed on the control or adjacent to it. Design, location and marking principles of IEC61310-1:2007 shall be followed.

Emergency shut-off control handles or buttons shall be prominently located and shaped as well as being colored red, in order to be identified among the other controls.

The control devices on electrical equipment shall comply with the requirements of IEC 60204-1, subclauses 10.1 and 10.2 with the exception as given in Annex B.10 of this part of ISO 8528.

6.5.2.2 Verification

Compliance with the requirements shall be verified by inspection