INTERNATIONAL STANDARD

ISO 8528-12

First edition
1997-09-15

Reciprocating internal combustion engine driven alternating current generating sets —

Part 12:
Emergency power supply to safety services

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

Partie 12: Alimentation électrique de secours des services de sécurité

Reference number
ISO 8528-12:1997(E)

Contents

International Organization for Standardization
Case postale 56 • CH-1211 Genève 20 • Switzerland
Internet central@iso.ch
X.400 c=ch; a=400net; p=iso; o=isocs; s=central

Printed in Switzerland

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 8528-12 was prepared by Technical Committee ISO/TC 70, *Internal combustion engines*.

International Standard 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*

Annex A of this part of ISO 8528 is for information only.

INTERNATIONAL STANDARD © ISO ISO 8528-12:1997(E)

Reciprocating internal combustion engine driven alternating current generating sets —

Part 12:
Emergency power supply to safety services

1 Scope

This part of ISO 8528 applies to generating sets driven by reciprocating internal-combustion (RIC) engines for emergency power supply to safety services.

It applies, for example, to safety equipments in hospitals, high-rise buildings, public gathering places etc. This part of ISO 8528 establishes the special requirements for the performance, design and maintenance of power generators used in the applications referred to above and taking into account the provisions of ISO 8528-1 to ISO 8528-6 and ISO 8528-10.

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 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 34-1:1996, *Rotating electrical machines — Part 1: Rating and performance.*

IEC 285:1993, *Alkaline secondary cells and batteries — Sealed nickel-cadmium cylindrical rechargeable single cells.*

IEC 364-5-56:1980, *Electrical installations of buildings — Part 5: Selection and erection of electrical equipment — Chapter 56: Safety services.*

IEC 364-7-710:—[1], *Electrical installations of buildings — Part 7: Requirements for special installations or locations — Section 710: Medical locations.*

IEC 601-1:1988, *Medical electrical equipment — Part 1: General requirements for safety.*

IEC 622:1988, *Sealed nickel-cadmium prismatic rechargeable single cells.*

IEC 623:1990, *Vented nickel-cadmium prismatic rechargeable single cells.*

IEC 896-1:1987, *Stationary lead-acid batteries — General requirements and methods of test — Part 1: Vented types.*

IEC 896-2:1995, *Stationary lead-acid batteries — General requirements and methods of test — Part 2: Vale-regulated types.*

3 Definitions

For the purposes of this part of ISO 8528 the following definitions and those in ISO 8528-1 to 6 apply.

3.1 change-over 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.

3.2 bridging time, t_B: Minimum time for which the generating station must supply the consumers with electrical power under pre-determined operating conditions and which corresponds with the rated operating time as defined in IEC 601-1.

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 Symbols

I_2/I_N	Unbalanced load current ratio
k_U	Total voltage harmonic content
t_B	Bridging time
t_{co}	Change-over time
$t_{U,de}$ $t_{U,in}$	Voltage recovery time
β_f	Steady-state frequency band

1) To be published.

δU_{dyn}^{-}, δU_{dyn}^{+} } Transient voltage deviation

δf_{dyn} Transient frequency deviation

δf_{st} Frequency droop

δU_{st} Steady-state voltage deviation

5 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.

6 Classification designation

6.1 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 time, t_{co}, according to IEC 364-5-56 and table 1.

Table 1 — Classification by change-over time

Generating sets	no break	short break	long break	
Change-over time	0	< 0,5 s	< 15 s	> 15 s
Classification	1	2	3	4

6.2 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 change-over 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 change-over 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 change-over time of max. 15 s, power for 100 % of the consumer power demand for safety services shall be available in steps.
4	The mains voltage drops below the rated voltage by more than 10 % for a period longer than 0,5 s. After a change-over time of max. 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.

7 Generating set design

7.1 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 electrical installations). Where applicable, e.g. for reasons of redundancy, the use of several generating sets operating in parallel may 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 8528-5:1993, clause 9 and figures 6 and 7 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 8528-5:1993, figures 6 and 7, 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 in clause 14 is suggested as necessary for designing the power generator.

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

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

NOTE — The application of spark ignition engines is under consideration for special requirements and for national specifications.

7.2 Power determination

ISO 8528-1:1993, 13.1 and 13.3 applies for determining the power requirement.

7.3 Operating limit values

The operating limits shall at least meet the requirements of performance class G2 as in ISO 8528-5:1993.

Special requirements for the limit values are given in ISO 8528-5.

The transient operating limits generally apply as in ISO 8528-5:1993, table 3.

Classifications given in table 2 are listed in table 3.

Table 3 — Special requirements for examples given in table 2

Parameter	Symbol	Dimension	Reference	Classification			
				1	2	3	4
Frequency droop	δf_{st}	%	ISO 8528-5:1993, 5.1.1	AMC[1)]	AMC	5	4
Steady-state frequency band	β_f	%	ISO 8528-5:1993, 5.1.4	AMC	AMC	1,5	0,5
Transient frequency deviation	δf_{dyn}	%	ISO 8528-5:1993, 5.3.4	AMC	AMC	−10	−10
Steady state voltage deviation	δU_{st}	%	ISO 8528-5:1993, 7.1.4	AMC	AMC	± 2,5	± 1
Transient voltage deviation	δU^{-}_{dyn} δU^{+}_{dyn}	% %	ISO 8528-5:1993, 7.3.3	AMC	AMC	+20 −15	+10 −10
Voltage recovery time	$t_{U,de}$ $t_{U,in}$	s s	ISO 8528-5:1993, 7.3.5	AMC	AMC	4	4
Unbalanced load current ratio	I_2/I_N [2)]	1	ISO 8528-3:1993, 10.1	33 [3)] 15 [4)]	33 [3)] 15 [4)]	33 [3)] 15 [4)]	33 [3)] 15 [4)]
Total voltage harmonic content	k_U	%	—	AMC	AMC	—	5 [5)]

NOTE — All other values are given in ISO 8528-5.

1) AMC Agreement between manufacturer and customer.

2) See also definition in IEC 34-1:1983, section 22.

3) For generating sets with ratings above 300 kV·A.

4) For generating sets with ratings above 300 kV·A.

5) This applies also to the voltage between conductors and the neutral conductor under linear and symmetrical loading.

8 Additional requirements

8.1 A continuous power supply for monitoring and controlling voltages shall be backed up by batteries. Batteries for this application shall comply with the requirements of either IEC 896-1, IEC 896-2, IEC 285, IEC 622 or IEC 623.

Such batteries, if suitable, may also be used for starting the engine. Partial voltages shall not be tapped. The battery shall not be used for any other purpose than starting the engine and as a power supply for the monitoring/controlling voltages.

The battery is to be of such a capacity that it provides enough current to start, monitor and control the generating set at an ambient temperature of 10 °C under float charged conditions, enabling three starts of ten seconds duration each with five seconds break between starts. The voltage drop each time the starter is operated shall not negatively influence the control system.

For each battery, charging equipment of a controlled type with limited constant current and limited constant voltage characteristics (*IU* curve), changing to a float charge characteristic at the end of the charging period, shall be provided. The battery charger shall be capable of automatically recharging a discharged battery to 80 % of its rated capacity (in Ah) as follows:

— for classification 4 generating sets in within six hours,

— for classification 3 generating sets in within ten hours.

In addition to charging the battery, the charging equipment shall supply adequate energy for continuous operation of the monitoring and control equipment.

Equipment shall be provided, which continuously monitors the battery voltage and provides a malfunction alarm. The circuit for this alarm shall fail in the alarm mode. This alarm shall sound at or be repeated to a permanently manned monitoring station. Voltage drops of short duration, e.g. during the start event or while charging, must not initiate an alarm.

Malfunctions of the battery charger (e.g. loss of AC supply voltage for more than 3 minutes or tripping of AC or DC miniature circuit breaker) shall also initiate an alarm.

The design of the battery charger and its associated system shall be such that the voltage appearing at the output terminals shall not exceed the maximum rated voltage of permanently connected control and actuating equipment.

Starter motor cables shall be dimensioned for a total cable voltage drop while cranking the engine, not exceeding 8 % of the nominal battery voltage.

If separate batteries are used for controlling the power generator and for starting the generator set, each battery shall be provided with an individual battery charger in accordance with the requirements of this subclause.

8.2 For RIC engines which are started using compressed air, the size and number of air bottles shall be such that the RIC engine can be run at five times the firing speed in both the hot and cold condition. An automatic compressor system shall be provided to re-charge the air bottles. The charging system shall be able to fill the bottles test to the operating pressure within 45 min of starting. The pressure in the air bottles shall be indicated at all times.

If the required air pressure is not maintained, an alarm shall be initiated.

An automatic and manual water drain shall be provided on each air bottle.

8.3 The bridging time during which a generating set driven by an RIC engine can supply consumers with electrical power depends primarily on the amount of fuel supplied.

The amount of fuel available for classification 3 generating sets shall be adequate for at least eight hours of operation; for classification 4 generating sets, this shall be for at least 24 h of operation at the rated power, including the fuel required for test operation.

The amount of fuel available could be increased based on the agreement between customer and manufacturer for special services when the generating set has to be operated for longer time periods in case of disasters such as earthquakes.

The fuel service tank capacity shall be large enough for at least two hours of operation at rated power. It shall be placed close to the engine. To ensure reliable starting the bottom edge of the service tank shall be at least 0,5 m above the injection pump of the RIC engine, unless otherwise specified by the engine manufacturer. The service tank shall have bleed and venting equipment. To avoid overfilling and to detect leakages, appropriate protection measures shall be provided.

Other requirements for duration of operation and fuel storage shall be by agreement between customer and manufacturer.

The tanks shall be provided with level indicators or dipsticks as well as an indication of their capacity.

8.4 Movable ventilation louvers, where fitted, shall be opened automatically by the emergency power supply.

These ventilation louvers shall also be manually operable.

8.5 Malfunctions of the normal electrical power supply systems of less than 0,5 s shall not initiate engine start, except for no-break and short-break generating sets.

8.6 If necessary, effective measures shall additionally be provided against vibrations etc., due to earthquakes.

NOTES

1 Damage, due to earthquake, to any single component of the emergency generating set, including piping and cabling could stop it from supplying power to safety services.

2 If safety services and/or cables to them are damaged due to an earthquake, supplying power from emergency generating sets might cause a secondary disaster.

3 If the disaster happens over a wide area, emergency generating sets could be expected to supply power to safety services for a long time until the normal electrical power supply system is repaired. It took 153 hours to repair — in some cases temporarily — the normal electric power supply system to all consumers after the disaster which happened in the Kobe area of Japan in January 1995.

A few emergency generating sets could not start after the disaster due to poor daily maintenance. Therefore, emergency generating sets should be maintained daily, by checking e.g. fuel oil level, filter clogging condition and battery charging level.

9 Controlgear and switchgear

The generating set's automatic equipment may be combined into a single unit with the mains switchgear.

9.1 Protection, measurement, monitoring and control equipment for the generator

9.1.1 Generator protection equipment

ISO 8528-4:1993, 5.4 specifies the criteria for the protection equipment for the generator.

9.1.2 Generator measurement and monitoring equipment

ISO 8528-4:1993, 6.11 specifies the criteria for the measurement and monitoring equipment for the generator.

The maximum currents shall be indicated/recorded.

The following shall also be monitored:

— excessive generator current;

— "Mains ON" and "Generator ON" modes.

Refer also to ISO 8528-4:1993, clause 6.

9.2 Engine measurement and monitoring equipment

ISO 8528-4:1993, 7.3 and 7.4 specify the criteria for the measurement and monitoring equipment for the engine.

9.3 Generating set measurement and monitoring equipment

ISO 8528-4:1993, 7 specifies the criteria for the measurement and monitoring equipment for the generating set.

9.4 Remote signals

The following operating messages and malfunction alarms shall be provided for remote-controlled long-break generating sets:

— generating set "READY" (selector at "AUTOMATIC" mode);

— generating set "OPERATING" - consumers are provided with electric power by the long-break generating set;

— generating set "OPERATING" - consumers are provided with electric power by the mains;

— generating set "MALFUNCTION".

10 Test mode

10.1 Test operation with synchronization to the mains supply

To test classification 3 and 4 generating sets which are usually supplied with electric power from the mains, pickup of the installation power with synchronization to the mains and without interruption can be accomplished as follows.

10.1.1 Gradual power application without switching

The generating set shall be brought to the frequency and voltage of the mains either manually or automatically.

After operating the generator breaker in the synchronized state, adjustment of the desired speed is taken over by the speed governor of the RIC engine as a function of the amount of power required by the installation. Test operation takes place with the generating set in parallel with the mains.

Upon completion of test, the generating set load is shed by reducing the desired speed setting of the speed governor. When less than 10 % of the rated power is reached, the generator breaker is opened.

For this purpose, suitable generator protection equipment as well as switching and control equipment are necessary and are to be provided (see ISO 8528-4:1993, 5.4 and 7.2).

Coordination with the electric power utility is necessary in order to determine the protection required for the mains and to recognize mains failure.

10.1.2 Gradual power application with switching

The generating set shall be brought to the frequency and voltage of the mains either manually or automatically.

After operation of the generator breaker in the synchronized state, the generating set power output shall be increased by raising the setting of the RIC engine's governor. When approximately 10 % of the generating set's rated power is supplied from the mains, the mains breaker shall be opened.

Upon conclusion of test, the switching sequence described above shall be reversed in order to disconnect the installations from the generating set and reconnect them to the mains without interruption.

For this purpose, suitable generator protection equipment as well as switching and control equipment are necessary and are to be provided (see ISO 8528-4:1993, 5.4 and 7.2).

Coordination with the electric power utility is necessary in order to determine the protection for the mains and to recognize mains failure.

10.1.3 Sudden power application with short time parallel operation

The generating set shall be brought to the frequency and voltage of the mains either manually or automatically.

When it is synchronous with the mains, the generator breaker shall be closed and, with a maximum overlap duration of 100 ms, the mains breaker shall be opened. The power consumption of the installations shall be immediately taken over by the generating set.

To prevent overloading and subsequent failure of the generating set, it must be ensured that, at the moment of load acceptance the installations do not draw more than the power recommended for the first stage as described in ISO 8528-5:1993, 9. The frequency and voltage will not be the same as that of the mains.

Upon conclusion of test, the switching sequence described above shall be reversed in order to disconnect the installations from the generating set and reconnect them to the mains without interruption.

A prerequisite for this change-over is that the electric power utility grant permission to switch the total consumer load back on to the mains at a particular time.

For this purpose, suitable generator protection equipment as well as switching and control equipment are necessary and are to be provided (see ISO 8528-4:1993, 6.10)

Coordination with the electric power utility is necessary in order to determine the protection for the mains and to recognize mains failure.

10.2 Without mains synchronization

For a test operation simulating malfunction of the mains supply, the mains breaker shall be opened. This causes an interruption of electric power to the installations, with the switching time corresponding to that given in clause 6. Starting of the generating set and acceptance of the installation power requirement is to follow the sequence as in clause 6.

Generally, testing follows the description:

— for classification 3 generating sets as described in 10.1.1 or 10.1.2;

— for classification 4 generating sets as described in 10.1.3

11 Testing

11.1 General

Testing is classified according to installation or periodic tests.

The acceptance test is given in ISO 8528-6:1993, clause 6.

11.2 Installation tests

The tests listed under items a) to f) following are to provide information on the correct dimensioning and working order of the generating set. The tests shall be performed before initial operation as well as after any modification or repair before putting the generating set back into operation.

a) Testing the operation of the emergency power supply by interrupting the mains supply at the distribution point to the installations.

b) Examination of the room in which the generating set is located with respect to fire protection, flooding, ventilation, exhaust ducting etc.

c) The size of the generating set under consideration, static floor loading and possible starting currents (e.g. for motors driving fans, pumps and lifts) shall be taken into account.

d) Testing of the generating set protection equipment, particularly the selectivity matching.

e) Operational testing of the emergency power supply with RIC engines, including the testing of start and run-up behaviour, operation of the auxiliary equipment, switchgear and control equipment, performance of a power test with possible rated power and testing of operational behaviour as one generating set. Particular attention should be paid to the dynamic deviations in voltage and speed.

f) Inspection for compliance with local fire protection requirements.

11.3 Periodic tests

11.3.1 Electrical plants shall be tested at periodic intervals in compliance with IEC 364-7-710.

NOTE May be reconsidered after finalizing IEC 364-6-62 (periodic verification), which is currently under consideration.

11.3.2 The tests as listed under 11.2, a) to f) are in addition to those indicated below.

a) Monthly operating test of supply to security equipment, documenting:

— mains voltage monitoring;

— start and run-up behaviour;

— specified load acceptance;

— behaviour of switchgear, controlgear and auxiliary equipment.

b) Load behaviour operating test of the emergency generating set shall be carried out monthly with at least 50 % of the rated power for 60 minutes for emergency power sources driven by RIC engines, unless agreed otherwise between customer and manufacturer.

This operating test may be deleted for emergency power supplies operating continuously.

c) Monthly test of switchgear operation.

d) Annual verification of whether the power of the emergency power supply still meets the necessary power requirement of the installations.

11.3.3 Log books shall be maintained for those tests to be performed at recurring intervals to enable monitoring over a period of at least two years.

12 Rating plate

In addition to the marking specified in ISO 8528-5:1993, clause 14, the generating set rating plate shall indicate the classification according to table 1.

13 Required documentation

Instruction manuals providing sufficient information for operation, maintenance and safety shall be provided for the system components and auxiliaries.

14 Check list

Table 4 provides information for the correct design of power generator.

Table 4 — Design considerations for power generators

Designation	Reference	Remarks	Information		
			1)	2)	3)
Start-up time	ISO 8528-1:1993, 6.5 ISO 8528-5:1993, 11	Information on the required switching time; this determines whether to install a long-break, a short-break or a no-break generating set.	×		
Performance classes	ISO 8528-1:1993, 7 ISO 8528-5:1993, 9	Information on the installations, concerning load application and type of load; which installations are to be connected in the respective steps; the greatest load change to be expected during operation.	×		
Single and parallel operation	ISO 8528-1:1993, 6.3	Due to the variety of synchronization and operation possibilities, purpose and conditions for parallel operation are to be agreed upon.	×	×	
Modes of start-up and control	ISO 8528-1:1993, 6.4	Starting, monitoring, switching, etc.	×	×	×
Prime movers	ISO 8528-1:1993, 5.1.1	Diesel, gas engine	×	×	×
Generator	ISO 8528-1:1993, 5.1.2	Synchronous/asynchronous	×	×	×
Generating set configuration	ISO 8528-1:1993, 8.2	Determination of shape	×	×	×
Site conditions	ISO 8528-1:1993, 11	Location and ambient conditions affecting generating set.	×		
Emissions	ISO 8528-1:1993, 9	Influences affecting the environment.	×	×	
Power characteristics	ISO 8528-2:1993, 5.1	Determine rated power, load peaks, short-circuit behaviour.	×	×	
Switchgear and controlgear	ISO 8528-4:1993	Short-circuit stability, tolerances, rated and control voltages, neutral-line loadability, type of protection.	×	×	×
Types of mounting	ISO 8528-1:1993, 8.3	Selection of rigid or resilient mounting depending on specification of structure-borne-noise attenuation and permissible foundation vibration loading.	×	×	×
Central supply to several buildings	IEC 601-1 IEC 364-7-710	Details and number of main distributors.	×	×	

1) Items to be supplied by the customer to the manufacturer.

2) Items which are to be agreed upon between the customer and manufacturer.

3) Items to be supplied by the manufacturer to the customer.

Annex A
(informative)

Bibliography

[1] IEC 146-1-1:1991, *General requirements and line commuted converters — Part 1-1: Specifications of basic requirements.*

[2] IEC 146-1-2,1991 *General requirements and line commuted converters — Part 1-2: Application guide.*

[3] IEC 146-1-3,1991, *General requirements and line commuted converters — Part 1-3: Transformers and reactors.*

[4] IEC 146-2,1974, *Semiconductor converters — Part 2: Semiconductor self-commuted converters.*

[5] IEC 146-4,1986, *Semiconductor converters — Part 4: Method of specifying the performance and test requirements of uninterruptable power systems.*

[6] IEC 364-3:1993, *Electrical installations of buildings — Part 3: Assessment of general characteristics.*

[7] IEC 364-6-61:1986, *Electrical installations of buildings — Part 6: Verification — Chapter 61: Initial verification.*

[8] IEC 364-6-62:—[2], *Electrical installations of buildings — Part 6: Verification — Chapter 62: Periodic verification.*

2) To be published.

ICS 29.160.40

Descriptors: motor generator sets, emergency electrical installations, electric power supply, specifications, performance.

Price based on 12 pages