BRITISH STANDARD

BS 7698-3: 1993
ISO 8528-3: 1993

Reciprocating internal combustion engine driven alternating current generating sets —

Part 3: Specification for alternating current generators for generating sets

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Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Machinery and Components Standards Policy Committee (MCE/-) to Technical Committee MCE/14, upon which the following bodies were represented:

Association of Consulting Engineers
British Railways Board
Ministry of Defence
Society of Motor Manufacturers and Traders Ltd.

The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

Agricultural Engineers Association
Association of Manufacturers of Power Generating Systems and Association of British Generating Set Manufacturers
British Industrial Truck Association
Department of Transport
Health and Safety Executive
Marine Engine and Equipment Manufacturers' Association

This British Standard, having been prepared under the direction of the Machinery and Components Standards Policy Committee, was published under the authority of the Standards Board and comes into effect on
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The following BSI references relate to the work on this standard:
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National foreword

This Part of BS 7698 has been prepared under the direction of the Machinery and Components Standards Policy Committee. It is identical with ISO 8528-3:1993 *Reciprocating internal combustion engine driven alternating current generating sets — Part 3: Alternating current generators for generating sets,* published by the International Organization for Standardization (ISO).

BS 7698 consists of the following Parts, which are identical with the corresponding Parts of ISO 8528:

— *Part 1: Specification for application, ratings and performance;*

— *Part 2: Specification for engines;*

— *Part 3: Specification for alternating current generators for generating sets;*

— *Part 4: Specification for controlgear and switchgear;*

— *Part 5: Specification for generating sets;*

— *Part 6: Test methods;*

— *Part 7: Technical declarations for specification and design.*[1)]

Further Parts of ISO 8528 are in preparation. It is envisaged that when these Parts of ISO 8528 are published they will be implemented as dual-numbered Parts of BS 7698.

Cross-reference

International standard	Corresponding British Standard
ISO 8528-1:1993	BS 7698 *Reciprocating internal combustion engine driven alternating current generating sets* Part 1:1993 *Specification for application, ratings and performance* (Identical)

The Technical Committee has reviewed the provisions of IEC 34-1:1983, CISPR 14:1985 and CISPR 15:1985, to which normative reference is made in the text, and has decided that they are acceptable for use in conjunction with this standard.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 12, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

[1)] In preparation.

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1 Scope

This part of ISO 8528 specifies the principal characteristics of alternating current (a.c.) generators under the control of their voltage regulators when used for generating set applications. It supplements the requirements of IEC 34-1.

NOTE 1 At present no International Standard is available for asynchronous generators. When such an International Standard is published, this part of ISO 8528 will be revised accordingly. See subclause **12.2**.

This part of ISO 8528 applies to a.c. generators for a.c. generating sets driven by reciprocating internal combustion (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 a.c. generating sets driven by 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 8528-1:1993, *Reciprocating internal combustion engine driven alternating current generating sets — Part 1: Application, ratings and performance.*

IEC 34-1:1983, *Rotating electrical machines — Part 1: Rating and performance.*

CISPR 14:1985, *Limits and methods of measurement of radio interference characteristics of household electrical appliances, portable tools and similar electrical apparatus.*

CISPR 15:1985, *Limits and methods of measurement of radio interference characteristics of fluorescent lamps and luminaires.*

3 Symbols

NOTE 2 For indications of technical data for electrical equipment, IEC uses the term “rated” and the subscript “N”. For indications of technical data for mechanical equipment, ISO uses the term “declared” and the subscript “r”. Therefore, in this part of ISO 8528, the term “rated” is applied only to electrical items. Otherwise, the term “declared” is used throughout.

U_s	Set voltage
$U_{st,max}$	Maximum steady-state voltage deviation
$U_{st,min}$	Minimum steady-state voltage deviation
U_r	Rated voltage
U_{rec}	Recovery voltage
$U_{s,do}$	Downward adjustable voltage
$U_{s,up}$	Upward adjustable voltage
U_0	No-load voltage
$U_{dyn,max}$	Maximum upward transient voltage on load decrease
$U_{dyn,min}$	Minimum downward transient voltage on load increase
ΔU	Steady-state voltage tolerance band
ΔU_s	Range of voltage setting
$\Delta U_{s,do}$	Downward range of voltage setting
$\Delta U_{s,up}$	Upward range of voltage setting
δU_{dyn}	Transient voltage deviation
δU_{dyn}^{-}	Transient voltage deviation on load increase
δU_{dyn}^{+}	Transient voltage deviation on load decrease
δU_s	Related range of voltage setting
$\delta U_{s,do}$	Related downward range of voltage setting
$\delta U_{s,up}$	Related upward range of voltage setting
δU_{st}	Steady-state voltage deviation
$\hat{U}_{mod,max}$	Maximum peak of voltage modulation
$\hat{U}_{mod,min}$	Minimum peak of voltage modulation
$\hat{U}_{mod}$	Voltage modulation
$\delta U_{2,0}$	Voltage unbalance
δ_{QCC}	Grade of quadrature-current compensation voltage droop
$s_{r,G}$	Rated slip of asynchronous generator
f_r	Rated frequency
p	Number of pole pairs
$n_{r,g}$	Rated speed of rotation of generator
S_r	Rated output (rated apparent power)
P_r	Rated active power
$\cos \varphi_r$	Rated power factor
Q_r	Rated reactive power

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t_U	Voltage recovery time
$t_{U,\text{in}}$	Voltage recovery time after load increase
$t_{U,\text{de}}$	Voltage recovery time after load decrease
I_L	Real current drawn by the load
T_L	Relative thermal life expectancy factor

4 Other regulations and additional requirements

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

4.2 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.

5 Rating

The generator rating class shall be specified in accordance with IEC 34-1. In the case of generators for RIC engine driven generating sets, continuous rating (duty type S1) or rating with discrete constant loads (duty type S10) shall be specified.

For the purposes of this part of ISO 8528, the maximum continuous rating based on duty type S1 is called the basic continuous rating (BR). Additionally for duty type S10, there is a peak continuous rating (PR), where the permissible generator temperature rises are increased by a specific amount according to the thermal classification.

In the case of duty type S10, operation at the PR thermally ages the generator insulation systems at an increased rate. Factor T_L for the relative thermal life expectancy of the insulation system is therefore an important integral part of the rating class.

6 Limits of temperature and temperature rise

6.1 Basic continuous rating

The generator shall be capable of delivering its basic continuous rating (BR) over the whole range of operating conditions (e.g. minimum to maximum coolant temperatures) with total temperatures not exceeding 40 °C plus the temperature rises specified in IEC 34-1:1983, Table I (see note 3).

6.2 Peak continuous rating

At the generator peak continuous rating (PR), the total temperatures may be increased by the following allowances (see notes 3 and 4):

Thermal classification	Rating < 5 MV·A	Rating ⩾ 5 MV·A
A or E	15 °C	10 °C
B or F	20 °C	15 °C
H	25 °C	20 °C

For ambient temperatures below 10 °C, the limit of the total temperature shall be reduced by 1 °C for each degree Celsius by which the ambient temperature is below 10 °C.

NOTE 3 The RIC engine output may vary with changes of ambient air temperature; the generator total temperature in operation will depend upon its primary coolant temperature, which is not necessarily related to the RIC engine inlet air temperature.

NOTE 4 When the generator operates at these higher temperatures, the generator insulation systems will age thermally from two to six times faster (depending on the temperature increase and specific insulation system) than at the generator BR temperature rise values; i.e. operating 1 h at PR temperature rise values is approximately equal to operating 2 h to 6 h at BR temperature rise values. The exact value for the factor T_L is to be given by the manufacturer and marked on the rating plate (see also clause **14**).

7 Rated power and speed characteristics

Terms, symbols and definitions for rated power and speed are given in **7.1** to **7.5**.

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