

Specification for

Transformers for resistance welding machines

[ISO title: Transformers for resistance welding machines —
general specifications applicable to all welding transformers]

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Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Welding Standards Policy Committee (WEE/-), to Technical Committee WEE/26, upon which the following bodies were represented:

- Association of Supervisory and Executive Engineers
- British Non-Ferrous Metals Federation
- British Steel Industry
- British Telecommunications plc
- Copper Development Association
- Electricity Supply Industry in England and Wales
- Health and Safety Executive
- Society of British Aerospace Companies Limited
- Society of Motor Manufacturers and Traders Limited
- Welding Institute
- Welding Manufacturers Association
- Coopted members

This British Standard, having been prepared under the direction of the Welding Standards Policy Committee, was published under the authority of the Board of BSI and comes into effect on 31 August 1989

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National foreword

This British Standard, which has been prepared under the direction of the Welding Standards Policy Committee, is one of a series of standards covering resistance welding equipment and associated accessories. It is identical with ISO 5826:1983 *“Transformers for resistance welding machines — general specifications applicable to all welding transformers”* published by the International Organization for Standardization (ISO).

Duty factor

Although no duty cycle (duty factor) is stated in this standard, one of 100 % is inferred. In the United Kingdom the duty cycle normally used is 50 % and the standard should be applied with this in mind.

Terminology and conventions. The text of the International Standard has been approved as suitable for publication as a British Standard without deviation. Some terminology and certain conventions are not identical with those used in British Standards; attention is drawn especially to the following.

The comma has been used as a decimal marker. In British Standards it is current practice to use a full point on the baseline as the decimal marker.

Wherever the words “International Standard” appear, referring to this standard, they should be read as “British Standard”.

Cross-references

International Standard	Corresponding British Standard
ISO 669:1981	BS 3065:1982 <i>Specification for rating of resistance welding equipment</i> (Identical)
IEC 417:1973 (including Supplements A to E)	BS 6217:1981 <i>Guide to graphical symbols for use on electrical equipment</i> (Identical)
Euronorm 106:1984	BS 6404 <i>Magnetic materials</i> Section 8.4:1986 <i>Specification for cold-rolled non-oriented magnetic steel sheet and strip delivered in the finally annealed state</i> (Technically equivalent)
Euronorm 107:1986	BS 601 <i>Specification for steel sheet and strip for magnetic circuits of electrical apparatus</i> Part 2:1973 <i>Oriented steel, 0.25 mm thick and above</i> (Technically equivalent)

CENELEC HD 389 has been implemented as BS 5924:1980 *“Specification for safety requirements for electrical equipment of machines for resistance welding and allied processes”*.

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 Scope and field of application

This International Standard lays down specifications for transformers supplied with single phase current and used in resistance welding installations. It also specifies the tests these transformers shall undergo when they are not an integral part of a machine.

This International Standard applies to single phase transformers used in resistance welding and sold separately from the machine.¹⁾ These transformers may be cooled either by water circulation in the secondary winding and possibly the magnetic core, or by air.

2 References

ISO 669, *Rating of resistance welding equipment*.

IEC Publication 417, *Graphical symbols for use on equipment*.

3 Operating conditions

Unless otherwise stated, the transformer is assumed to be operating under the following conditions²⁾:

a) altitude:

It is assumed to be not more than 1 000 m above sea-level;

b) temperature of the cooling medium:

It is assumed that the maximum temperature of the cooling water does not exceed 30 °C at the transformer entry point and that, in the case of air cooled transformers, none of the following maximum temperatures are exceeded:

- maximum ambient temperature: 40 °C
- average daily temperature: 30 °C
- average annual air temperature: 20 °C

4 Definitions

Annex A gives further information to assist comprehension of some of these definitions. See also the definitions given in ISO 669³⁾.

4.1

continuous duty

periodic service when the duty factor is 100 %

4.2

no-load secondary voltage

voltage between the secondary terminals when the welding circuit is open

4.3

continuous output (S_p) (see Annex A)

the highest electrical output, expressed in kilovoltamperes, for a 100 % duty factor, without exceeding the specified heat rise limits:

$$S_p = U_{20} \times I_{2p}$$

4.4

output at a given duty factor (S_X) (see Annex A)

the output at a duty factor X , without exceeding the specified heat rise limits. This output is related to the continuous output (S_p) and the output at the duty factor 50 % (S_{50}) by the formulae:

$$S_X = S_p \sqrt{\frac{1 - e^{-T/\tau}}{1 - e^{-\frac{XT}{100\tau}}}} \text{ and,}$$

$$S_X = S_{50} \sqrt{\frac{1 - e^{-T/2\tau}}{1 - e^{-\frac{XT}{100\tau}}}}$$

where

T is the duration of the cycle;

X is the duty factor;

τ is the thermal time constant of the primary winding.

in practice, where the ratio $\frac{T}{\tau}$ is higher than five, it is possible to use the simplified formulae:

$$S_X = S_p \sqrt{\frac{100}{X}} \text{ and,}$$

$$S_X = S_{50} \sqrt{\frac{100}{2X}}$$

¹⁾ When the transformer is supplied with a machine of which it forms an integral part, ISO 669 applies to the whole assembly. The parties may agree that the transformer fitted in a machine can be of a type that has undergone the type tests in accordance with this International Standard.

²⁾ For transformers designed to operate in different service conditions the correction tables in Annex B are to be used.

³⁾ In accordance with a recent agreement, the determining values for classification of transformers have been adopted for the continuous secondary current (I_{2p}) and secondary no-load voltage (U_{20}).

In ISO 669 the rated values still relate to 50 % duty factor.

In this International Standard, contrary to ISO 669, terms relating to 50 % duty factor are not taken as nominal (rated) values.

4.5

output at the duty factor 50 % (S_{50})

the output at the duty factor $X = 50\%$ without exceeding the specified heat rise limit, with a cycle time duration conventionally taken equal to 1 min. This output is related to the continuous output (S_p) by the formula:

$$S_{50} = S_p \sqrt{1 + e^{-30/\tau}}$$

where τ is the thermal time constant of the secondary winding *in seconds*

in practice, where the ratio $\frac{\tau}{T}$ is higher than five, it is possible to use the simplified formula:

$$S_{50} = S_p \sqrt{2}$$

4.6

continuous secondary current (I_{2p})

(see Annex A)

the highest current that can be passed by the transformer at a 100 % duty factor without exceeding the specified maximum heat rises

4.7

secondary current at a given duty factor (I_{2X})

(see Annex A)

the highest current that can be passed by the transformer for a given duty factor X without exceeding the specified maximum heat rises

this current is related to the continuous secondary current and the secondary current at the duty factor 50 % by the formulae:

$$I_{2X} = I_{2p} \sqrt{\frac{1 - e^{-T/\tau}}{1 - e^{-\frac{XT}{100\tau}}}} \text{ and,}$$

$$I_{2X} = I_{50} \sqrt{\frac{1 - e^{-T/2\tau}}{1 - e^{-\frac{XT}{100\tau}}}}$$

where

T is the duration of the cycle;

X is the duty factor;

τ is the thermal time constant of the primary winding.

in practice, where the ratio $\frac{\tau}{T}$ is higher than five, it is possible to use the simplified formulae:

$$I_{2X} = I_{2p} \sqrt{\frac{100}{X}} \text{ and,}$$

$$I_{2X} = I_{50} \sqrt{\frac{100}{2X}}$$

4.8

secondary current at the duty factor 50 % (I_{50})

the highest current that can be passed by the transformer, for a duty factor 50 % and a cycle time duration of 1 min without exceeding the specified maximum heat rises. This current is related to the continuous current by the formula:

$$I_{50} = I_{2p} \sqrt{1 + e^{-30/\tau}}$$

formula in which τ is the thermal time constant of the primary winding *in seconds*

in practice, where the ratio $\frac{\tau}{T}$ is higher than five, it is possible to use the simplified formulae:

$$I_{50} = I_{2p} \sqrt{2}$$

4.9

magnetic circuit — maximum duty factor (X_m)

(see Annex A)

the maximum admissible duty factor that ensures that the heat rise in the magnetic circuit of the transformer does not exceed the values laid down

4.10

short circuit voltage (U_{cc})

the voltage at the rated frequency that has to be applied to the primary winding to cause the continuous current to flow therein when the terminals of the secondary winding(s) are short circuited

4.11

no-load losses (P_o)

active input power taken when the rated voltage at the rated frequency is applied to the terminals of the primary winding(s), with the secondary winding(s) on open circuit

4.12

no-load current (I_o)

the current circulating in the primary winding when the rated voltage at rated frequency is applied to the winding, with the secondary winding(s) on open circuit

the no-load current is expressed in amperes