

Specification for

Rating of resistance welding equipment

UDC 621.791.76.03

NO COPYING WITHOUT BSI PERMISSION EXCEPT AS PERMITTED BY COPYRIGHT LAW

BSI
Documents

AVA

Document Sharing Hub

Cooperating organizations

The Welding Standards Committee under whose direction this British Standard was prepared, consists of representatives from the following:

- Aluminium Federation
- Associated Metal Workers' Union
- Associated Offices Technical Committee
- British Compressed Gases Association
- British Constructional Steelwork Association
- British Railways Board
- British Shipbuilders
- British Steel Industry*
- Crown Agents for Oversea Governments and Administrations
- Health and Safety Executive*
- Institution of Civil Engineers
- Institution of Electrical Engineers*
- Institution of Production Engineers*
- Institution of Structural Engineers
- Lloyd's Register of Shipping
- Ministry of Defence*
- Process Plant Association
- Society of British Aerospace Companies Limited*
- Society of Motor Manufacturers and Traders Limited*
- Water-tube Boilermakers' Association
- Welding Institute*
- Welding Manufacturers' Association*

The organizations marked with an asterisk in the above list, together with the following, were directly represented on the Technical Committee entrusted with the preparation of this British Standard:

- Association of Supervisory and Executive Engineers
- British Non-ferrous Metals Federation
- Copper Development Association
- Electricity Supply Industry in England and Wales
- Coopted members

This British Standard, having been prepared under the direction of the Welding Standards Committee, was published under the authority of the Board of BSI and comes into effect on 31 December 1982

© BSI 12-1999

First published January 1959
First revision December 1965
Second revision December 1982

The following BSI references relate to the work on this standard:
Committee reference WEE/26
Draft for comment 79/72793 DC

ISBN 0 580 13107 6

Amendments issued since publication

Amd. No.	Date of issue	Comments

Contents

	Page
Cooperating organizations	Inside front cover
National foreword	ii
1 Scope and field of application	1
2 Definitions and symbols	1
3 Conditions for temperature measurement	5
4 Limits of temperature rise	5
5 Test methods and requirements	6
6 Insulation test	13
7 Nameplates	13
Annex A Notes on thermal time constants	15
Annex B Example of a nameplate for resistance welding equipment	18
Annex C Example of a nameplate for a butt welding machine	19
Figure 1 — Geometrical characteristics of resistance welding equipment	3
Figure 2 — Contact fault in spot or seam welding as a result of deformation of machine	4
Figure 3 — Contact fault in projection welding as a result of deformation of machine	4
Figure 4 — Contact fault in butt welding as a result of deformation of machine	5
Figure 5 — Short-circuiting bar for butt welding machines	7
Figure 6 — Spot welding machine	10
Figure 7 — Projection welding machine	11
Figure 8 — Measurement of eccentricity	11
Figure 9 — Measuring arrangement with no load	12
Figure 10 — Measuring arrangement with load	12
Figure 11 — Flash and butt welding machine	13
Figure 12 — Characteristics of a transformer at periodic duty cycle	17
Table 1 — Limits of temperature rise	5
Table 2 — Maximum values of no-load power (S_0) and no-load current (I_{10})	8
Publications referred to	Inside back cover

National foreword

This British Standard, the second revision of BS 3065, has been prepared under the direction of the Welding Standards Committee and is identical with ISO 669:1981 “*Rating of resistance welding equipment*”, published by the International Organization for Standardization (ISO).

The first revision of BS 3065, published in 1965, was aligned with the draft recommendations on the rating of resistance welding machines, prepared by ISO. At that time, it was not possible to publish an identical standard. However, during the intervening time, greater international agreement has been reached and it is now possible to publish a dual-numbered standard. References to resistance heating machines in the previous revision of the standard have been removed. These have not had a wide application.

This revision supersedes the 1965 edition which is therefore withdrawn.

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
IEC 85:1957	BS 2757:1956 <i>Classification of insulating materials for electrical machinery and apparatus on the basis of thermal stability in service</i> (Technically equivalent)

The Technical Committee has reviewed the provisions of IEC Publication 28, to which 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 20, 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 defines and specifies the characteristics of single-phase resistance welding equipment. It includes the information to appear on the equipment nameplate and specifies the test methods to be used to verify the compliance of the equipment with the requirements of this International Standard.

It is applicable to single-phase resistance welding machines, including all types of complete portable equipment¹⁾, for use under the following conditions:

- a) altitude: in the absence of any information concerning the height above sea level at which the machine is intended for use in ordinary service, the altitude shall be assumed not to exceed 1 000 m;
- b) temperature of the cooling medium: in the absence of any information to the contrary, it shall be assumed that, for water-cooled machines, the temperature of the cooling water does not exceed 30 °C at the inlet of the machine and, in the case of air-cooled machines, that none of the following limits are exceeded:

- | | |
|---|--------|
| 1) maximum ambient air temperature | 40 °C, |
| 2) daily average ambient air temperature | 30 °C, |
| 3) yearly average ambient air temperature | 20 °C, |

- c) pressure of cooling water: in the absence of any information to the contrary, it shall be assumed that the pressure of the cooling water is not less than that which is necessary to supply the rated quantity of cooling water (see 2.3.5).

This International Standard does not apply to multi-spot welding machines, to transformers sold separately or to capacitor discharge or rectifier machines.

2 Definitions and symbols

2.1 Electrical and thermal characteristics

For a given voltage and frequency the characteristics of the equipment are calculated, constructed and tested, as a function of the following characteristic operations:

- a) intermittent operation at a duty cycle (see 2.1.5) of 50 %, the values of current and power being termed nominal and rated;
- b) continuous operation, the values of current and power being termed permanent (continuous).

2.1.1

operating conditions

all quantities defining the performance of a machine

2.1.2

rated

a qualifying term applied to a value used in the designation of resistance welding equipment

2.1.3

duty

a schedule of the loads on an apparatus or machine, taking into account their respective duration and sequence

2.1.4

periodic duty

a duty which is repeated periodically, the sum of one load time and no-load time being termed the weld cycle time

NOTE The periodic duty referred to in this International Standard comprises, for each cycle, a given working time under load, followed by a given no-load time. The load is constant, i.e. without any preheating and/or postheating period.

2.1.5

duty cycle (symbol X)

the ratio of the duration of work under load to the duration of the welding cycle time, this ratio lying between 0 and 1, and possibly expressed as a percentage

2.1.6

nominal welding cycle time

a cycle having a duration of 60 s and a duty cycle of 50 %

2.1.7

rated supply voltage (symbol U_{1n})

the supply voltage for which the machine is constructed

2.1.8

secondary open-circuit voltage (symbol U_{20})

the voltage between the electrodes when the rated supply voltage is applied to the terminals of the machine at its various settings with the secondary circuit open

¹⁾ A complete portable machine is one containing all elements required for operation.

2.1.9**maximum short-circuit current**

(primary, symbol I_{1cc} and secondary, symbol I_{2cc})

the root mean square current at the rated supply voltage and at the highest regulator (tap) setting, the electrodes being short-circuited according to conditions laid down in the test method (see 5.2.1) and the machine being arranged so as to have successively:

- minimum impedance (minimum throat depth and gap);
- maximum impedance (maximum throat depth and gap).

2.1.10**maximum short-circuit power** (symbol S_{cc})

the maximum apparent power at the terminals of the machine, expressed in kilovoltamperes, measured at the highest regulator (tap) setting, the electrodes being short-circuited according to conditions laid down in the test method (see 5.2.1), and the machine being arranged in such a manner as to have the minimum secondary impedance compatible with this method of short-circuit

$$S_{cc} = U_{1n} \times I_{1cc}$$

2.1.11**maximum welding power** (symbol $S_{max.}$)

the power equal to 80 % of the maximum short-circuit power

2.1.12**nominal power at 50 % duty cycle** (symbol S_n)

the maximum electrical input (apparent power), expressed in kilovoltamperes, at the nominal welding cycle time without exceeding the specified temperature rise, when measured by the appropriate test method (see clause 5)

2.1.13**permanent (continuous) power** (symbol S_p)

the power corresponding to a 100 % duty cycle, the relationship with the nominal power at 50 % duty cycle being given by the formula

$$S_p = \frac{S_n}{\sqrt{2}}$$

2.1.14**nominal current at 50 % duty cycle** (symbol I_{2n})

the highest current that can be drawn from the transformer, on all settings of the regulator, during actual or assumed operation at the nominal welding cycle, without exceeding the specified temperature rises (see clause 4).

2.1.15**permanent (continuous) current** (symbol I_{2p})

the current supplied for continuous operation, its value being given by the formula

$$I_{2p} = \frac{I_{2n}}{\sqrt{2}}$$

2.2 Geometrical characteristics (see Figure 1)**2.2.1****throat gap of the machine** (symbol e)

(see Figure 1)

- for spot and seam welding machines: the usable distance between the arms or the external current-carrying parts of the secondary, when the electrodes are in contact.

NOTE The space requirements of the electrode-holders are not included for the purposes of this definition.

- for projection welding machines: the usable distance between the platens.

- for butt welding machines: the free accessible distance between both pairs of clamping jaws.

2.2.2**throat depth** (symbol l) (see Figure 1)

- for spot, projection and seam welding machines: the usable distance between the axis of the electrodes, the platens or the centre of the contact line of the wheels and the nearest element of the machine.

NOTE This definition does not take into account any offset of the electrode tips.

- for butt welding machines: the distance perpendicular to the direction of the upsetting force between the housing wall of the machine and the part of the clamping area located furthest from the machine.

2.2.3 stroke of the electrode (symbol c)

- where the electrode or the moving jaw is attached to the driving cylinder, the maximum stroke of the electrode, by convention, equals the total stroke of the driving cylinder.

- where the moving electrode is attached to a hinged lever moved by a driving cylinder, the maximum stroke of the electrode, by convention, equals the length of the chord of the arc generated by a point on the axis of the moving electrode for a full stroke of the cylinder. This point is at the intersection of the axis of the moving electrode and the contact face for the tip of this electrode, and the electrode is arranged to give the maximum stroke.

NOTE On certain machines, the stroke of the electrode may be composed of an "approach" with wide amplitude and without any contact, facilitating the introduction of the parts to be welded between the arms, of the machine, and a "working stroke", in general, with less amplitude.

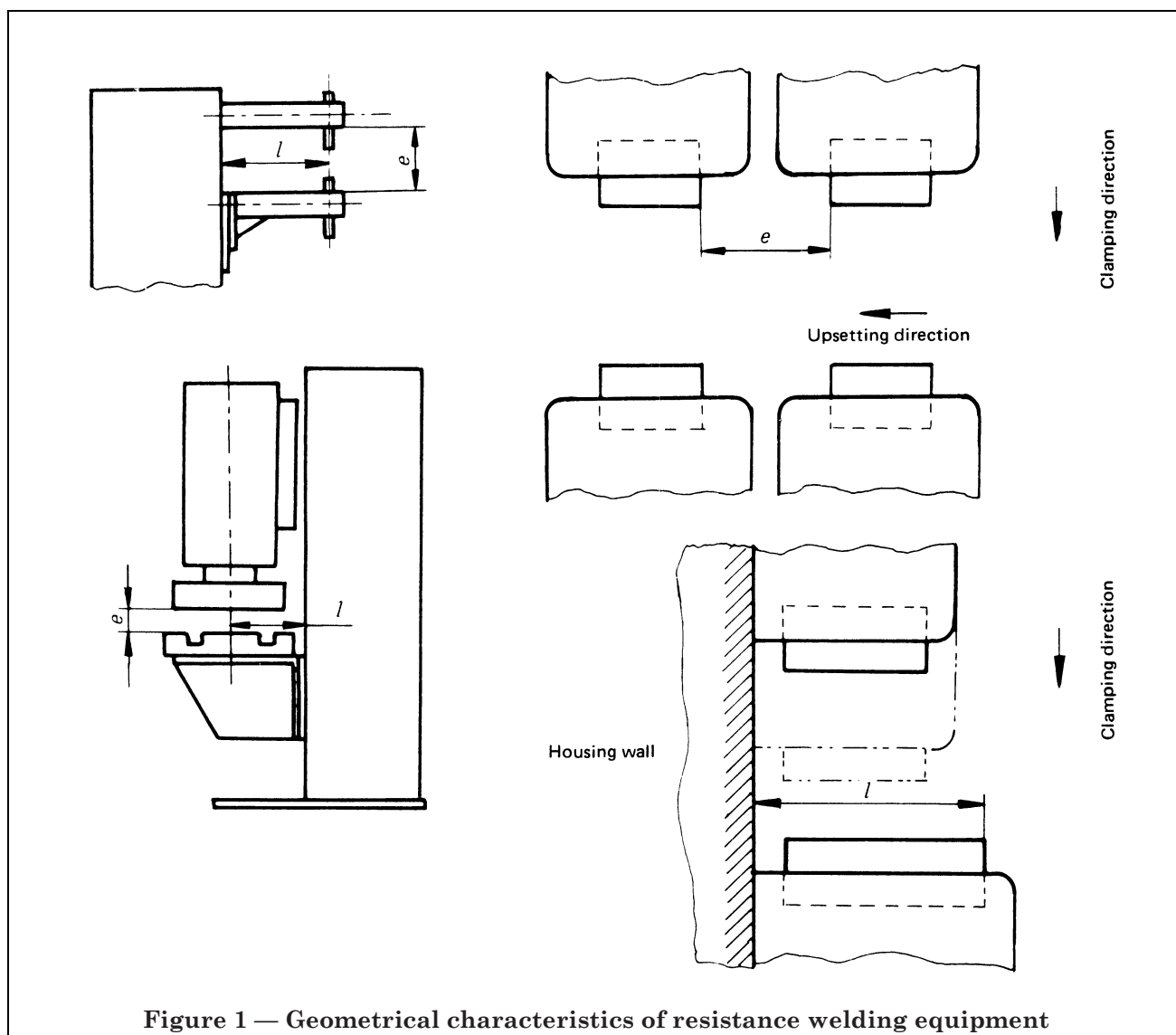


Figure 1 — Geometrical characteristics of resistance welding equipment

2.3 Mechanical characteristics

2.3.1

maximum and minimum electrode force

(symbol F , for spot, projection and seam welding machines)

2.3.1.1

maximum electrode force (symbol $F_{\max.}$)

the maximum force, applied to the parts to be assembled during welding, which can be withstood by the welding equipment without deleterious deformations of its mechanical parts

2.3.1.2

minimum electrode force (symbol $F_{\min.}$)

the minimum force which can be used for proper functioning of the machine

2.3.2 maximum and minimum upsetting and maximum clamping force of butt welding machines

2.3.2.1

maximum upsetting force (symbol $F_{\max.}$)

the maximum compressive force, which can be used for proper functioning of the machine, applied to the parts to be assembled during welding, which can be withstood by the welding equipment without deleterious deformations of its mechanical parts

2.3.2.2

minimum upsetting force (symbol $F_{1 \min.}$)

the minimum force which can be used for proper functioning of the machine

2.3.2.3**maximum clamping force** (symbol $F_{2 \max.}$)

the maximum force, acting through the jaws on each part to be assembled, to prevent any sliding and to maintain good electrical contact with the electrodes when the maximum upsetting force is applied

2.3.3**supply pressure of the energizing medium** (symbol p_a)

the required supply pressure of the energizing medium taken at the supply to the machine

2.3.4**pressure of the energizing medium** (symbol p)

the pressure of the medium in the driving cylinder or cylinders, at established conditions, required to obtain the maximum forces

2.3.5**required total rate of flow of cooling agent** (symbol Q)

the total quantity of circulating cooling agent, in cubic decimetres (litres) per minute, which has to be present in the cooling circuit in order to ensure that the permitted maximum temperature rise (see clause 4) is not exceeded when the equipment is operated at nominal power, S_n

NOTE The quantity of the cooling agent required for each circuit may also be indicated on the equipment nameplate.

2.3.6**contact fault between the working electrodes faces**

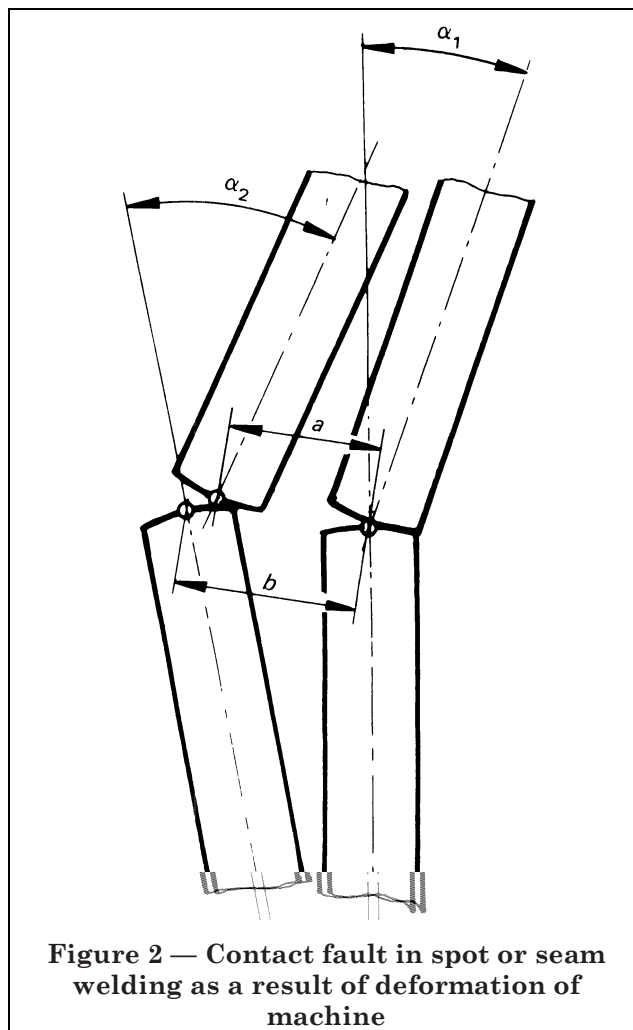
a) *for spot and seam welding machines* (see Figure 2): for any load, the misalignment between the centres of the working faces of the electrodes, expressed in millimetres.

NOTE This definition may be expressed by indication of the angle α in radians.

Figure 2 illustrates the definition and corresponds either to two aspects of the figure or to two successive loads as represented by the formulae

$$1) \alpha = \alpha_2 - \alpha_1$$

$$2) g = b - a$$



b) *for projection welding machines* (see Figure 3): for any electrode force, the difference, h , between the clamping plates obtained by application of the nominal electrode force in relation to the unloaded state, and the eccentricity g , h being given by the formula

$$h = b_1 - b_2$$

