

Arc welding power sources equipment and accessories

Part 4. Specification for welding cables

ICS 25.160.30

Committees responsible for this British Standard

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- British Cable Makers' Confederation
- Electricity Association
- Health and Safety Executive
- Institution of Electrical Engineers
- National Association of Arc Welding Equipment Repairers
- Power Generation Contractors' Association PGCA (BEAMA Ltd.)
- Railway Industry Association
- Welding Institute
- Welding Manufacturers' Association (BEAMA Ltd.)

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Foreword

This Part of BS 638 has been prepared by Technical Committee WEE/6. It supersedes BS 638 : Part 4 : 1979, which is withdrawn.

This Part is divided into three sections:

- a general section;
- a section implementing the European Harmonization Document HD 22.6 S2;
- a section on cables of national interest in the United Kingdom and not included in HD 22.6 S2.

NOTE. Annex A is a guide to use (and implements Amendment No. 3 of HD 516.S1).

The other Parts of BS 638 are as follows.

Part 5: *Specification for accessories*

Part 7: *Specification for safety requirements for installation and use*

Part 8: *Specification for electrode holders and hand held torches and guns for MIG, MAG and TIG welding*

Part 9: *Specification for power sources for manual arc welding with limited duty*

Part 10: *Specification for safety requirements for arc welding equipment: welding power sources*

The preliminary drafting of this Part of BS 638 was undertaken by the BCMC to whom due acknowledgement is made.

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

Section 1. General

1.1 Scope

This Part of BS 638 specifies requirements for single core flexible cables carrying the welding current in arc welding circuits.

Section 2 specifies requirements for arc welding cables rated for connection between the industrial arc welding power source and the electrode holder and the workpiece in manual metal-arc welding. These cables are rated at 100 V a.c. r.m.s. and 150 V d.c. This section implements HD 22.6 S2 : 1995 and also includes CENELEC recognized national types.

Section 3 specifies requirements for additional arc welding cables widely used in the United Kingdom. These cables are rated at 100 V a.c. r.m.s. and 150 V d.c. but undergo a higher voltage test and are therefore capable of being used at voltages up to but not exceeding 450 V a.c. r.m.s. or 675 V d.c., provided they are suitably enclosed to protect the covering from damage.

Annex A gives guidance on the selection of the size and type of cables covered by this standard. This annex implements Amendment No. 3 : 1993 to HD 516.S1.

NOTE 1. Recommendations for the protection of personnel from welding hazards and safety precautions concerning arc welding power sources are given in BS 638 : Part 7 and BS 638 : Part 10, to which reference should be made.

NOTE 2. In section 2 and annex A the wording of the harmonized documents has been amended in order to clarify the meaning.

1.2 References

1.2.1 Normative references

This Part of BS 638 incorporates, by dated or undated reference, provisions from other publications. These normative references are made at the appropriate places in the text and the cited publications are listed on the inside back cover. For dated references, only the edition cited applies; any subsequent amendments to or revisions of the cited publication apply to this Part of BS 638 only when incorporated in the reference by amendment or revision. For undated references, the latest edition of the cited publication applies, together with any amendments.

1.2.2 Informative references

This Part of BS 638 refers to other publications that provide information or guidance. Editions of these publications current at the time of issue of this standard are listed on the inside back cover, but reference should be made to the latest editions.

1.3 Definitions

For the purposes of this Part of BS 638, the definitions given in BS 499 : Part 1 and BS 4727 : Part 2 : Group 08 apply, together with the following.

1.3.1 cable

A length of single-stranded covered insulated conductor.

1.3.2 conductor

The conducting portion of a cable consisting of a group of wires assembled together and in contact with each other.

1.3.3 arc welding power source

Equipment for supplying current and voltage with the characteristics required for arc welding and allied processes.

NOTE 1. An arc welding power source may also supply services to other equipment and auxiliaries e.g. auxiliary power, cooling liquid, consumable arc welding electrode and gas to shield the arc and the welding area.

1.3.4 manual metal-arc welding (MMA welding)

Metal-arc welding with straight, covered electrodes of a suitable length and applied by the operator without automatic or semi-automatic means of replacement. No protection in the form of a gas or mixture of gases from a separate source is applied to the arc or molten pool during welding.

1.3.5 automatic welding

Welding in which all the welding parameters are automatically controlled. Manual adjustments may be made between welding operations but not during welding.

1.3.6 semi-automatic welding

Welding in which some of the welding parameters are automatically controlled, but manual guidance is necessary.

1.3.7 duty cycle

The ratio, for a given time interval, of the on-load duration to the total time.

NOTE. This ratio, lying between 0 and 1, may be expressed as a percentage.

1.3.8 single cycle operation

A single on-load period, not exceeding a specified time, followed by a period in which the cable temperature returns to ambient.

NOTE. In this Part of BS 638, the maximum, single on-load period is 5 min and the equipment usage is expressed as a percentage of 5 min.

1.3.9 repeat cycle operation

A periodically switched constant load with an on-load period followed by an off-load period. This cycle is repeated.

1.3.10 type tests

Tests made before supplying cable conforming to this Part of BS 638 on a commercial basis in order to demonstrate satisfactory performance characteristics to meet the intended application.

NOTE. These tests need not be repeated unless changes are made in the cable materials or design which might affect the performance characteristics.

1.3.11 sample tests

Tests made on samples of completed cable, or components taken from a completed cable to verify that the finished products meet the design specifications.

Section 2. Arc welding cables rated at 100 V a.c. r.m.s.

2.1 Code designations

2.1.1 Harmonized types

Designations for harmonized arc welding cables rated at 100 V a.c. r.m.s. are as follows:

- for cables with normal flexibility, HO1N2-D;
- for cables with extra high flexibility, HO1N2-E.

2.1.2 CENELEC recognized national types

Designations for national arc welding cables rated at 100 V a.c. r.m.s. are as follows:

- for cables with RS5 covering and normal flexibility, AO1B-D.
- for cables with RS5 covering and extra high flexibility, AO1B-E.
- for cables with EM5 covering and aluminium conductors, AO1N2-A.
- for cables with RS5 covering and aluminium conductors, AO1B-A.

2.2 Rated voltage

The rated voltage shall not exceed 100 V a.c. r.m.s. between conductors or between conductor and earth.

NOTE. The corresponding d.c. voltage rating for these cables is 150 V.

2.3 Conductors

2.3.1 General

Conductors shall conform to either of the following.

- a) For cables HO1N2-D, HO1N2-E, AO1B-D and AO1B-E. The conductors shall be circular, plain or tinned, annealed copper. They shall conform to BS 6360, and shall be of multiple strand formation as given in table 1 or table 2.
- b) For cables AO1N2-A and AO1B-A. The conductors shall be composed of hard drawn aluminium, or aluminium alloy, wire of multiple strand formation, the wire being plain or metal coated, as given in table 3.

NOTE. The attention of purchasers and users is drawn to the following limitations of aluminium conductors and of most aluminium alloy conductors compared with copper conductors:

- 1) terminations should be suitable for use with the conductors;
- 2) the service life is reduced if the cable is subjected to repeated flexing;
- 3) the conductors are more liable to atmospheric corrosion;
- 4) the cable size is larger for similar electrical properties, which may cause difficulties in mating with other items of equipment manufactured in accordance with this Part of BS 638.

The maximum conductor resistance shall be as given in tables 1 to 3, as applicable.

2.3.2 Diameter of wires

The diameter of the wires in the conductor shall be not greater than that given in tables 1 to 3, as applicable.

NOTE. The conceptual construction number and the nominal diameter of the wires in the conductor given in table 3 are for information only. These formations were assumed in calculating the maximum specified conductor resistances.

2.3.3 Separator

A separator consisting of a suitable material shall be applied around the conductor.

NOTE. Embrittlement or discoloration of this separator after vulcanization of the covering may be disregarded.

2.4 Covering

The covering shall be applied by extrusion around the conductor and consist of two layers.

For coverings in one layer, the covering shall be of rubber compound type EM5 or RS5¹⁾ conforming to BS 7655 : Section 2.4.

NOTE 1. The RS5¹⁾ covering should be grey.

For coverings in two layers, the covering shall comprise an outer layer of rubber compound type EM5 and an inner layer which shall be either of rubber compound type EM5 or rubber compound type EI7 conforming to HD 22.1.S2.

NOTE 2. The ratio of thicknesses of the two layers is not specified.

Full testing shall be carried out on both layers, except where the resulting sample from the inner layer is less than 0.8 mm thick. In this case full testing shall be carried out on the outer layer and only the hot set test shall be carried out on the inner layer.

The thickness of covering shall be as given in tables 1 to 3, as applicable.

2.5 Overall diameter

The overall diameter of the cable shall be as given in tables 1 to 3, as applicable.

2.6 Marking

2.6.1 General

The outer covering shall be marked, by printing, indenting or embossing, with the following:

- a) the appropriate code designation (in accordance with 2.1); and
- b) the cross-sectional area (in mm²) of the conductor.

¹⁾ CENELEC recognized national type.