INTERNATIONAL STANDARD

ISO 5182

Second edition
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Welding — Materials for resistance welding electrodes and ancillary equipment

Soudage — Matériaux pour électrodes de soudage par résistance et équipements annexes

Reference number
ISO 5182:1991(E)

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 5182 was prepared by Technical Committee ISO/TC 44, *Welding and allied processes*.

This second edition cancels and replaces the first edition (ISO 5182:1978), which has been technically revised.

Annexes A, B, C and D of this International Standard are for information only.

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Welding — Materials for resistance welding electrodes and ancillary equipment

1 Scope

This International Standard specifies the characteristics of materials for resistance welding electrodes and ancillary equipment which are used for carrying current and transmitting force to the work.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard 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 428:1983, *Wrought copper-aluminium alloys — Chemical composition and forms of wrought products.*

ISO 1187:1983, *Special wrought copper alloys — Chemical composition and forms of wrought products.*

ISO 1336:1980, *Wrought coppers (having minimum copper contents of 97,5 %) — Chemical composition and forms of wrought products.*

ISO 1337:1980, *Wrought coppers (having minimum copper contents of 99,85 %) — Chemical composition and forms of wrought products.*

ISO 1634-1:1987, *Wrought copper and copper alloy plate, sheet and strip — Part 1: Technical conditions of delivery for plate, sheet and strip for general purposes.*

ISO 1637:1987, *Wrought copper and copper alloy rod and bar — Technical conditions of delivery.*

ISO 1639:1974, *Wrought copper alloys — Extruded sections — Mechanical properties.*

ISO 1640:1974, *Wrought copper alloys — Forgings — Mechanical properties.*

ISO 3486:1980, *Wrought copper and copper alloys — Cold-rolled flat products delivered in straight lengths (sheet) — Dimensions and tolerances.*

ISO 3487:1980, *Wrought copper and copper alloys — Cold-rolled flat products in coils or on reels (strip) — Dimensions and tolerances.*

ISO 3488:1982, *Wrought copper and copper alloys — Extruded round, square or hexagonal bars — Dimensions and tolerances.*

ISO 3489:1984, *Wrought copper and copper alloys — Drawn round bars — All minus tolerances on diameter and form tolerances.*

ISO 3490:1984, *Wrought copper and copper alloys — Drawn hexagonal bars — All minus tolerances on width across flats and form tolerances.*

ISO 3491:1984, *Wrought copper and copper alloys — Drawn square bars — All minus tolerances on width across flats and form tolerances.*

ISO 3492:1982, *Wrought copper and copper alloys — Drawn round wire — Tolerances on diameter.*

ISO 6506:1981, *Metallic materials — Hardness test — Brinell test.*

ISO 6507-1:1982, *Metallic materials — Hardness test — Vickers test — Part 1: HV 5 to HV 100.*

ISO 6508:1986, *Metallic materials — Hardness test — Rockwell test (scales A - B - C - D - E - F - G - H - K).*

IEC 468:1974, *Method of measurement of resistivity of metallic materials.*

3 Definition

For the purposes of this International Standard, the following definition applies.

softening temperature: The maximum temperature that, if maintained for 2 h, will result in a reduction in ambient temperature hardness of a maximum of 15 % of the "as received" value.

4 Classification

4.1 Group A — Copper and copper alloys

This group defines four types of material:

Type 1: Non-heat-treatable alloys of high conductivity and medium hardness, the wrought forms of which are given their strengths by cold working during manufacture.

Type 2: Alloys which are harder than type 1 and in which the mechanical properties have been developed by heat treatment during manufacture or by a combination of heat treatment and cold working.

Type 3: Heat-treated alloys which have superior mechanical properties to type 2 but a lower electrical conductivity than either type 1 or type 2.

Type 4: Alloys having certain specialized properties which may, in some cases, be obtained either by cold working or by heat treatment. Alloys of this type are not necessarily interchangeable with each other.

4.2 Group B — Sintered materials

This group comprises six types of material based upon the constituents used:

Types 10 and 11: Sintered products of copper and tungsten.

Type 12: A sintered product of copper and tungsten carbide.

Type 13: A sintered and worked product of molybdenum.

Type 14: A sintered and worked product of tungsten.

Type 15: A sintered product of silver and tungsten.

5 Specifications

5.1 Requirements

The materials shall comply with the required characteristics specified in table 2.

5.2 Chemical composition

The compositions and maximum impurities for some of the materials are standardized in the ISO International Standards shown in table 1.

Table 1 — ISO publications relating to chemical composition

Designation	ISO publication
Cu-ETP	ISO 1337
Cu Cd1	ISO 1336
Cu Cr1	ISO 1336
Cu Co2 Be	ISO 1187
Cu Ni2 Si	ISO 1187
Cu Be2 Co Ni	ISO 1187
Cu Al10 Fe5 Ni5	ISO 428

5.3 Mechanical properties

The hardness of the materials shall be not less than given in table 2.

NOTE 1 These materials are used in particular for resistance welding, and their properties are, therefore, different from those of materials used for general purposes. For certain of these alloys, information on tensile strength, 0,2 % proof stress and elongations may be obtained if required from the following ISO standards for mechanical properties of coppers and copper alloys: ISO 1634, ISO 1637, ISO 1639, and ISO 1640.

5.4 Electrical properties

Electrical conductivities, in Siemens per metre (S/m), of materials shall be not less than those given in table 2.

6 Methods of test

6.1 Vickers hardness test

The Vickers hardness test with a 300 N load shall be carried out in accordance with ISO 6507-1.

6.2 Electrical properties

The electrical properties shall be measured in accordance with IEC Publication 468, where the size of the sample permits. When it is not possible to use

this method, the test shall be carried out as agreed between the supplier, the purchaser and a mutually acceptable arbitrator.

6.3 Softening temperature test

Hardness and conductivity tests normally guarantee the quality of the material and allow verification of the softening temperature. The softening temperature test is not normally carried out on each batch of material.

Pending the finalization of a standard method for carrying out the softening temperature test, the test can only be made as agreed between supplier and purchaser.

7 Designation

Materials shall be designated by the group, type and number (see table 2).

EXAMPLES

Cu Cr1 shall be coded as **A 2/1 — ISO 5182**

W75 Cu shall be coded as **B 10 — ISO 5182**

8 Application

For typical applications, see annex A.

9 Hardness conversions

See annex B.

10 Chemical and mechanical properties

See annex C.

Table 2 — Composition and properties of materials

Material								Softening temperature
Group	Type	Number	Designation	Nominal composition[1)] %	Forms available (values in mm)	Hardness HV (30 kg) min.	Electrical conductivity S/m min.	°C min.
A	1	1	Cu-ETP	Cu (+Ag) min. 99,90	drawn ≥ 25 drawn < 25 forged cast	85 90 50 40	56 56 56 50	150
		2	Cu Cd1	Cd 0,7 to 1,3	drawn ≥ 25 drawn < 25 forged	90 95 90	45 43 45	250
	2	1	Cu Cr1	Cr 0,3 to 1,2	drawn ≥ 25 drawn < 25 forged cast	125 140 100 85	43 43 43 43	475
		2	Cu Cr1 Zr	Cr 0,5 to 1,4 Zr 0,02 to 0,2	drawn ≥ 25 drawn < 25 forged	130 140 100	43 43 43	500
		3	Cu Cr Zr	Cr 0,4 to 1 Zr 0,02 to 0,15	hardened ground < 45	160 160	43 43	500
		4	Cu Zr	Zr 0,11 to 0,25	hardened ground < 30	130 130	47 47	500
	3	1	Cu Co2 Be	Co 2,0 to 2,8 Be 0,4 to 0,7	drawn ≥ 25 drawn < 25 forged cast	180 190 180 180	23 23 23 23	475
		2	Cu Ni2 Si	Ni 1,6 to 2,5 Si 0,5 to 0,8	drawn ≥ 25 drawn < 25 forged cast	200 200 168 158	18 17 19 17	500
	4	1	Cu Ni1 P	Ni 0,8 to 1,2 P 0,16 to 0,25	drawn ≥ 25 drawn < 25 forged cast	130 140 130 110	29 29 29 29	475
		2	Cu Be2 Co Ni	Be 1,8 to 2,1 Co-Ni-Fe 0,20 to 0,60	drawn ≥ 25 drawn < 25 forged cast	350 350 350 350	12 12 12 12	300
		3	Cu Ag6	Ag 6 to 7	forged ≤ 25 forged 25 to 50	140 120	40 40	400
		4	Cu Al10 Fe5 Ni5	Al 8,5 to 11,5 Fe 2,0 to 6,0 Ni 4,0 to 6,0 Mn 0 to 2,0	forged cast	170 170	4 4	650
B	10		W75 Cu	Cu 25		220	17	1 000
	11		W78 Cu	Cu 23		240	16	1 000
	12		WC70 Cu	Cu 30		300	12	1 000
	13		Mo	Mo 99,5		150	17	1 000
	14		W	W 99,5		420	17	1 000
	15		W65 Ag	35 Ag		140	29	900

1) The nominal composition of materials is for information only. The material shall be manufactured to the properties shown in the table.

Annex A
(informative)

Typical applications

See table A.1.

Table A.1

Material	Spot welding	Seam welding	Projection welding	Flash or butt welding	Auxiliary application
A 1/1	Electrodes for welding aluminium	Electrode wheels for welding aluminium	—	—	Unstressed current-carrying parts; laminated shunts
A 1/2	Electrodes for welding aluminium Electrodes for welding coated steel (zinc, tin, aluminium, lead)	Electrodes for welding aluminium Electrode wheels for welding coated steel (zinc, tin, lead, etc.)	—	Dies or insert for welding mild steel	Electrodes for high-frequency resistance welding of non-ferrous metals
A 2/1	Electrodes for welding mild steel Holders and shafts and back-ups	Electrodes for welding mild steel	Large dies	Dies or inserts for welding mild and carbon steels, stainless steels and heat-resistant steels	Stressed current-carrying parts Backing for sintered electrode materials of Group B
A 2/2	Electrodes for welding mild steel and coated steel	Electrode wheels for welding mild steel and coated steel	Dies and inserts	—	Stressed current-carrying parts Parts for guns, e.g. holders, shafts
A 2/3	Electrodes for welding mild steel, coated steel and high strength low alloy steel	Electrode wheels for welding mild steel and coated steel	Dies and inserts	—	Stressed current-carrying parts Parts for guns, e.g. holders, shafts
A 2/4	Electrodes for welding mild steel, coated steel, and high strength low alloy steel	Electrode wheels for welding mild steel and coated steel	Dies and inserts	—	Stressed current-carrying parts
A 3/1	Electrodes for welding stainless and heat-resistant steels Stressed electrode holders, shafts and arms	Electrode wheels for welding stainless and heat-resistant steels Shafts and bushings	Dies or inserts	Dies or inserts under high clamping force	Stressed current-carrying parts
A 3/2	Stressed electrode holders, shafts and arms	Shafts and bushings	—	—	Stressed current-carrying parts
A 4/1	Electrode holders and bent arms	Shafts and bushings	—	—	Stressed current-carrying parts

Material	Spot welding	Seam welding	Projection welding	Flash or butt welding	Auxiliary application
A 4/2	Electrode holders and shafts under extreme mechanical stress	Machine arms under extreme mechanical stress	Dies or inserts under high electrode forces	Long dies for flash welding	—
A 4/3	—	Electrode wheels for welding mild steel under high thermal stress	—	—	—
A 4/4	Electrode holders	Shafts and bushings under light electrical loading	Plattens and dies	—	—
B 10	—	—	Inserts for welding mild steel	Inserts for welding mild steel under high stress	Inserts for hot riveting and hot upsetting
B 11	—	—	—	—	Inserts for hot riveting and hot upsetting
B 12	—	—	Inserts for welding stainless steel	Small dies or inserts for welding steel	Inserts for hot riveting and hot upsetting
B 13	Inserts for welding copper-based high conductivity materials	—	—	—	Inserts for hot riveting and hot upsetting Inserts for resistance brazing
B 14	Inserts for welding copper-based high conductivity materials	—	—	—	Inserts for hot riveting and hot upsetting Inserts for resistance brazing
B 15	—	—	—	—	Electrodes for high-frequency resistance welding of ferrous materials

Annex B
(informative)

Hardness conversions

For resistance welding materials it is common to measure hardness by Vickers, Brinell or Rockwell methods in accordance with ISO 6507-1, ISO 6506 or ISO 6508. In this International Standard, the Vickers method has been adopted since it is generally accepted as being the most accurate referee method used in laboratories on carefully prepared samples. Experience has shown that whatever test method or load is used, a surface layer must be removed before typical hardness values can be measured. This is especially true where oxidation may have occurred during hot working or heat treatment, for example on forgings.

It has been found when comparing Vickers, Brinell and Rockwell results on Group A2 alloys that the values do not correspond to the standard comparisons normally used for coppers and brasses [1][2]. Figure B.1 and figure B.2 are, therefore, appended to give approximate conversions for Cu Cr and Cu Cr Zr alloys; they are also valid for Cu Co2 Be and Cu Ni1 P. The bands include 80 % of results and indicate the scatter which may be expected. The Brinell hardness values were obtained with a variety of ball sizes and loads and the scatter is therefore greater.

For other alloys these comparisons may be valid, but equivalents should be agreed between the supplier and the purchaser.

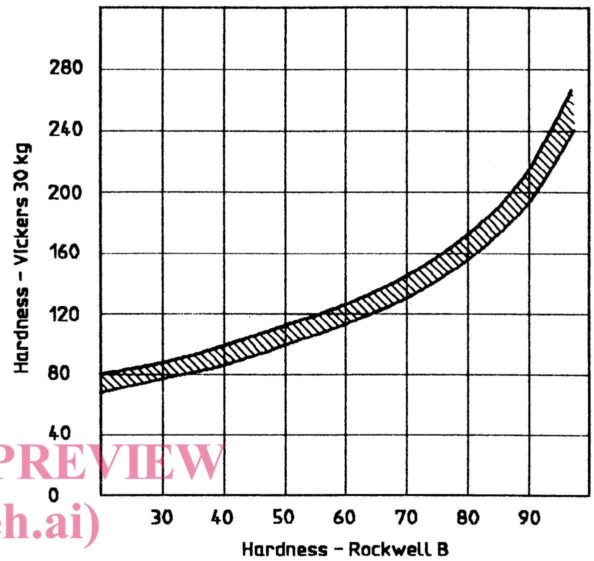

Figure B.1 — Conversion of Vickers 30 kg hardness to Rockwell B hardness

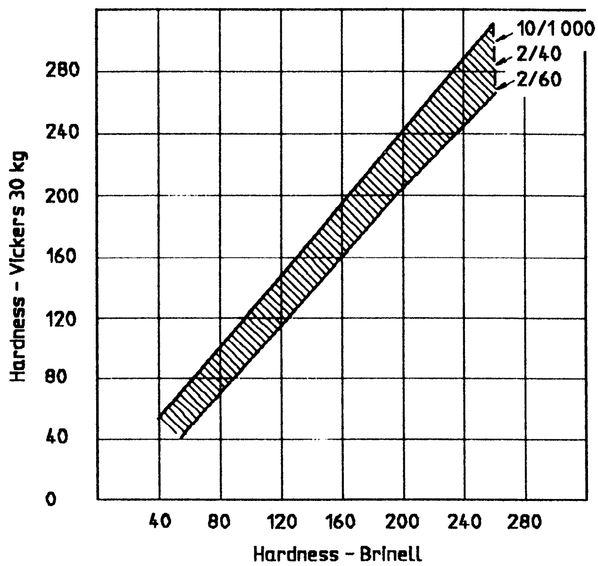

Figure B.2 — Conversion of Vickers 30 kg hardness to Brinell hardness