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Resistance welding — Materials for electrodes and ancillary equipment

Soudage par résistance — Matériaux pour électrodes et équipements annexes

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 5182 was prepared by Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 6, *Resistance welding*.

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This third edition cancels and replaces the second edition (ISO 5182:1991), which has been technically revised.

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Resistance welding — Materials for 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 referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 6507-1, *Metallic materials — Vickers hardness test — Part 1: Test method*

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ASTM E1004, *Standard practice for determining electrical conductivity using the electromagnetic (eddy-current) method*

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3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
softening temperature
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 specialised 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.

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4.2 Group B — Sintered materials

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

Type 10 and **type 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 tungsten and silver.

4.3 Group C — Dispersion-strengthened copper (DSC) alloys

This group comprises two types of materials, manufactured by internal oxidation or ball milling (mechanical alloying).

5 Specifications

5.1 Requirements

The materials shall comply with the required characteristics specified in Table 1.

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5.2 Chemical composition

The compositions for the materials are given in Table 1.

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5.3 Mechanical properties

The hardness of the materials shall not be less than those given in Table 1.

NOTE These materials are used in particular for resistance welding, and their properties are, therefore, different from those of materials used for general purposes.

5.4 Electrical properties

The electrical conductivity, given in megasiemens per metre (MS/m) or as a percentage of the conductivity of the International Annealed Copper Standard (IACS), of materials shall be not less than those given in Table 1.

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 should be measured in accordance with ASTM E1004 (eddy-current test). When it is not possible to use this method, the test shall be carried out as agreed between the suppliers, the purchaser, and a mutually acceptable arbitrator.

NOTE Electrical conductivity, when evaluated with eddy-current instruments, is usually expressed as a percentage of the conductivity of the International Annealed Copper Standard (IACS).

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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 suppliers and purchaser.

7 Designation

Materials shall be designated by the group, type and number (see Table 1).

EXAMPLE 1 CuCr1 shall be coded as

A 2/1 (ISO 5182:2007)

where

A is the CuCr1 material group (see Clause 4);

2 is the material type (see Clause 4);

1 is the CuCr1 material number (see Table 1).

EXAMPLE 2 W75Cu shall be coded as

B 10 (ISO 5182:2007)

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8 Application

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For typical applications, see Annex A.

WARNING — For alloys containing beryllium, precautions shall be taken in case of dry grinding, dry polishing or welding to avoid inhalation of dust or fumes over a certain period of time.

9 Hardness conversions

See Annex B.

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Table 1 — Composition and properties of materials

Group	Type	Number	Designation	Nominal alloying elements	Forms available	Hardness HV 30	Electrical conductivity		Softening temperature
				%	mm	min.	MS/m min.	% IACS	°C min.
A	1	1	Cu-ETP	Cu (+Ag) min. 99,90	drawn ⩾ 25	85	56	96	150
					drawn < 25	90	56	96	
					forged	50	56	96	
					cast	40	50	86	
		3	CuAg0,1P	Ag 0,08 to 0,15	drawn < 25	90	55	95	150
		4	Cu-PHC	P 0,003	drawn	40	56	96	150
	2	1	CuCr1	Cr 0,3 to 1,2	drawn ⩾ 25	125	44	76	475
					drawn < 25	140	44	76	
					forged	100	44	76	
					cast	85	44	76	
		2	CuCr1Zr	Cr 0,5 to 1,4 Zr 0,02 to 0,2	drawn ⩾ 25	130	43	74	500
					drawn < 25	140	43	74	
					forged	100	43	74	
		3	CuCrZr	Cr 0,4 to 1 Zr 0,02 to 0,15	hardened	150	43	74	500
					ground < 45	150	43	74	
		4	CuZr	Zr 0,11 to 0,25	drawn	140	47	81	500
					ground < 30	130	47	81	
	3	1	CuCo2Be	Co 2,0 to 2,8 Be 0,4 to 0,7	drawn ⩾ 25	260	23	40	500
					drawn < 25	270	23	40	
					forged	260	23	40	
					cast	250	23	40	
		2	CuNi2Si	Ni 1,6 to 2,5 Si 0,4 to 0,8	drawn ⩾ 25	180	17	29	450
					drawn < 25	190	18	31	
					forged	170	19	33	
					cast	160	17	29	
		3	CuNi2Be	Ni 1,4 to 2,4 Be 0,2 to 0,6	drawn < 40	240	24	42	450
		4	CuCo1Ni1Be	Co 0,8 to 1,3 Ni 0,8 to 1,3 Be 0,4 to 0,7	drawn < 40	250	23	40	475
	4	1	CuNi1P	Ni 0,8 to 1,2 P 0,16 to 0,25	drawn ⩾ 25	130	29	50	450
					drawn < 25	140	29	50	
					forged	130	29	50	
					cast	110	29	50	
		2	CuBe2CoNi	Be 1,8 to 2,1 Co-Ni-Fe 0,20 to 0,60	drawn ⩾ 25	330	14	25	300
					drawn < 25	340	14	25	
					forged	350	14	25	
					cast	350	14	25	

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Table 1 (*continued*)

Group	Type	Number	Designation	Nominal alloying elements %	Forms available mm	Hardness HV 30 min.	Electrical conductivity MS/m min.	 % IACS	Softening temperature °C min.
A	4	4	CuAl10Fe5Ni5	Al 8,5 to 11,5 Fe 2,0 to 6,0 Ni 4,0 to 6,0 Mn 0 to 2,0	forged	170	4	7	650
					cast	170	4	7	
		5	CuZn40Pb2	Cu 57 to 59, Pb 1,6 to 2,5	bars and tubes, max. diameter 60 mm	120	10	17	
B	10		W75Cu	Cu 25		220	17	29	1 000
	11		W78Cu	Cu 23		240	16	27	1 000
	12		WC70Cu	Cu 30		300	12	20	1 000
	13		Mo	Mo 99,5		150	17	29	1 000
	14		W	W 99,5		420	17	29	1 000
	15		W65Ag	35 Ag		140	29	50	900
C	20	1	CuAl2O3	Al2O3 1,1	extruded	150	44	76	980
					work hardened	160	44	76	980
		2	CuAl2O3	Al2O3 0,5	extruded	140	50	86	980
					work hardened	150	50	86	980
		3	CuAl2O3	Al2O3 0,3	extruded	120	54	92	950
					work hardened	140	54	92	980
		4	CuAl2O3	Al2O3 1,5 B max. 0,2	extruded	155	43	74	980
		5	CuAl2O3	Al2O3 1,0 B max. 0,2	extruded	140	45	77	980
		6	CuAl2O3	Al2O3 0,6 B max. 0,2	extruded	130	50	86	950

NOTE The nominal alloying elements of the listed grades are for information only. The materials are manufactured to the properties shown in the table. Group A and C alloys are copper based; refractory materials are listed in group B.

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