

Industrial electroheating equipment — Test methods for direct arc furnaces

The European Standard EN 60676:2002 has the status of a
British Standard

ICS 25.180.10

National foreword

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The UK participation in its preparation was entrusted to Technical Committee PEL/27, Electroheating, which has the responsibility to:

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**Industrial electroheating equipment -
Test methods for direct arc furnaces
(IEC 60676:2002)**

Chauffage électrique industriel -
Méthodes d'essai des fours à arc direct
(CEI 60676:2002)

Industrielle Elektrowärmeanlagen -
Prüfverfahren für Lichtbogen-Schmelzöfen
(IEC 60676:2002)

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European Committee for Electrotechnical Standardization
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Foreword

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This European Standard supersedes HD 598 S1:1992.

The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical
national standard or by endorsement (dop) 2003-05-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2005-05-01

Annexes designated "normative" are part of the body of the standard.
In this standard, annex ZA is normative.
Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60676:2002 was approved by CENELEC as a European Standard without any modification.

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INDUSTRIAL ELECTROHEATING EQUIPMENT – TEST METHODS FOR DIRECT ARC FURNACES

1 Scope and object

This International Standard applies to industrial three-phase direct arc furnaces, the rated capacity of which is equal to, or greater than, 500 kg. The furnaces are suitable both for solid and liquid charges at or near internal atmospheric pressure.

This standard is also applicable to furnaces having one or more electrodes, other than three-phase furnaces, in so far as it applies.

These furnaces are intended for the melting of ferrous metals (for example, steel, cast iron) and non-ferrous metals (for example, copper); they may also be used as holding furnaces for a liquid charge to superheat and maintain the temperature before tapping.

The object of this publication is the standardization of arc furnace test conditions and of methods to determine the main parameters and technical operating characteristics.

NOTE 1 These tests are to be executed independently of the status of compensating equipment.

The scope of this standard does not cover all possible test methods which may be carried out for the technical and economic assessment of arc furnaces.

NOTE 2 Complementary test conditions may be agreed between manufacturer and user.

Tests for some special equipment for d.c. direct arc furnaces such as controlled rectifiers are covered by IEC 60146-1-1.

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.

IEC 60050(841):1983, *International Electrotechnical Vocabulary (IEV) – Chapter 841: Industrial electroheating*

IEC 60146-1-1:1991, *Semiconductor convertors – General requirements and line commutated convertors – Part 1-1: Specifications of basic requirements*

IEC 60398:1999, *Industrial electroheating installations – General test methods*

3 Definitions

For the purposes of this International Standard, the definitions of IEC 60050-841, some of which are reproduced below, as well as the following definitions, apply.

3.1

arc furnace

furnace in which the electric arc is the main source of heat

[IEV 841-04-27]

3.2

direct arc furnace

arc furnace in which the arc is maintained between the charge and one or more electrodes

[IEV 841-04-28]

3.3

arc furnace installation

furnace assembly with a complete set of electrical equipment comprising

- a) main electrical circuit consisting of
 - high-voltage equipment;
 - a.c. reactor (if applicable);
 - furnace transformer;
 - high-current line (secondary side);
 - controlled rectifier and d.c. reactor (only applicable for d.c. direct arc furnaces);
 - electrodes, arc and charge not being parts of the arc furnace installation;
- b) equipment for control of the electrical parameters, such as boards, panels, desks with protection, control, measuring and signalling devices

3.4

arc furnace shell

steel constructed vessel usually with refractory lined bottom and side walls into which the charge is placed

[IEV 841-04-43]

3.5

rated volume of the furnace

total internal volume of the furnace body as defined by the inner surface of the specified shell lining

NOTE The volume between the upper level of the shell and the underside of the roof is not included in the rated volume.

3.6

rated capacity of the furnace

calculated capacity in tonnes of liquid metal for which the furnace has been designed, built and marked

NOTE 1 This capacity is defined with the specified shell lining, manufactured in accordance with the design, with allowance for the maximum expected slag volume over the liquid metal surface without exceeding the normal sill level.

NOTE 2 The specific density of the liquid metal used by the manufacturer for the calculations should be clearly defined.

3.7

minimum bulk density of scrap for the single complete maximum charge of the furnace (t/m^3)
ratio of the furnace rated capacity to its rated volume

3.8**furnace high-voltage switch**

high-voltage switch for switching on and off, under load, the furnace transformer, in accordance with operating requirements

3.9**arc furnace transformer**

transformer feeding the arc furnace from the high-voltage network and providing a voltage range suitable for the furnace operation

[IEV 841-04-34]

3.10**power rating of an arc furnace transformer**

maximum admissible continuous power of the arc furnace transformer primary

[IEV 841-04-12, modified]

3.11**melt-down power of an arc furnace transformer**

maximum admissible power of the arc furnace transformer with limited on-time during melting (taking into account repetition of the load cycle during subsequent melts)

NOTE The limited on-time of melt-down power is at least equal to the net power-on time (see 3.22).

3.12**arc furnace reactor**

inductive winding, sometimes connected in series with the primary circuit of the arc furnace transformer in order to limit the short-circuit current and ensure arc stability for each stage of the melting and refining process

[IEV 841-04-35, modified]

3.13**saturable reactor**

set of inductive a.c. windings with saturable magnetic cores and d.c. control windings with the a.c. winding being connected in series with the primary circuit of the arc furnace transformer in order to control the arc current

NOTE For example, see figure 3.

3.14**d.c. reactor** (only applicable for d.c. direct arc furnaces)

reactor in the d.c. current line of the d.c. direct arc furnaces for smoothing and stabilizing the d.c. current

3.15**controlled rectifier** (only applicable for d.c. direct arc furnaces)

rectifier using controlled semiconductor devices and diodes connected to the secondary side of the transformer(s)