

Industrial electroheat equipment — Test methods for electroslag remelting furnaces

ICS 25.180.10

National foreword

This British Standard is the UK implementation of EN 60779:2005. It is identical with IEC 60779:2005, incorporating corrigendum December 2008. It supersedes BS 7688:1993 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PEL/27, Electroheating.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 22 February 2006

© BSI 2009

ISBN 978 0 580 65844 0

Amendments/corrigenda issued since publication

Date	Comments
30 June 2009	Implementation of IEC corrigendum December 2008. Replacement of Figures 1, 2, and 3. Deletion of subclause 5.10

EUROPEAN STANDARD

EN 60779

NORME EUROPÉENNE

EUROPÄISCHE NORM

November 2005

ICS 25.180.10

Supersedes HD 470 S1:1987

English version

**Industrial electroheat equipment –
Test methods for electroslag remelting furnaces
(IEC 60779:2005)**

Equipements électrothermiques
industriels –
Méthodes d'essai des fours de refusion
sous laitier électroconducteur
(CEI 60779:2005)

Industrielle Elektrowärmeanlagen -
Prüfverfahren für Elektroschlacke-
Umschmelzöfen
(IEC 60779:2005)

This European Standard was approved by CENELEC on 2005-11-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

© 2005 CENELEC - All rights of exploitation in any form and by any means reserved worldwide for CENELEC members.

Foreword

The text of document 27/474/FDIS, future edition 2 of IEC 60779, prepared by IEC TC 27, Industrial electroheating equipment, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60779 on 2005-11-01.

This European Standard supersedes HD 470 S1:1987.

The significant technical changes with respect to HD 470 S1:1987 are the additional technical tests described in 5.1, 5.2, 5.3, 5.9, 5.10, 5.11, 5.13, 5.14 and 5.15.

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) | 2006-08-01 |
| – latest date by which the national standards conflicting with the EN have to be withdrawn | (dow) | 2008-11-01 |

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60779:2005 was approved by CENELEC as a European Standard without any modification.

CONTENTS

1	Scope and object.....	4
2	Normative references	4
3	Terms and definitions	4
4	Type of tests and general conditions of their performance	7
4.1	Type of tests	7
4.2	General conditions of test performance	8
5	Recommendations for technical tests	8
5.1	Measurement of the effective stroke of the electrode ram motion	8
5.2	Measurement of the speed of the electrode motion	8
5.3	Measurement of the time interval for exchanging electrodes	8
5.4	Measurement of the open-circuit secondary voltage of the electroheat installation.....	8
5.5	Measurement of the electrical parameters of the secondary circuit of the electroheat installation.....	8
5.6	Measurement of the active power, reactive power and power factor of the electroheat installation.....	13
5.7	Measurement of the temperature of components which are subjected to strong magnetic field and/or radiated or converted heat.....	14
5.8	Measurement of the temperature rise of the cooling-water	15
5.9	Measurement of the cooling-water flow rate and heat losses.....	15
5.10	Measurement of the intensity of the magnetic field at or near an electrosag remelting furnace.....	15
5.11	Measurement of the melting rate of consumable electrode(s).....	15
5.12	Determination of the specific energy consumption	16
5.13	Measurement of vacuum parameters for a vacuum electrosag remelting furnace.....	16
5.14	Measurement of the pressure in the chamber of a pressurized electrosag remelting furnace.....	17
5.15	Measurement of the gas composition of an electrosag remelting furnace working under an inert gas atmosphere	17
	Figure 1 – Example of a single-phase electrosag remelting furnace circuit	9
	Figure 2 – Example of a three-phase electrosag remelting furnace circuit.....	12
	Figure 3 – Example of a coaxial electrosag remelting furnace circuit	14
	Annex ZA (normative) Normative references to international publications with their corresponding European publications.....	18

INDUSTRIAL ELECTROHEAT EQUIPMENT – TEST METHODS FOR ELECTROSLAG REMELTING FURNACES

1 Scope and object

This International Standard applies to industrial electroslag remelting furnaces, the rated capacity of which is equal to, or greater than, 50 kg.

This standard is applicable to industrial electroslag remelting furnaces having one or more electrodes and having different melting power supplies, such as alternating current, direct current, or low-frequency current.

The object of this standard is the standardization of electroslag remelting furnace test conditions and methods to determine the main parameters and technical characteristics.

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

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition applies. For undated references, the latest edition of the referenced documents (including any amendments) applies.

IEC 60050-841:2004, *International Electrotechnical Vocabulary – Part 841: Industrial electroheat*

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

IEC 60676:2002, *Industrial electroheating equipment – Test methods for direct arc furnaces*

3 Terms and definitions

For the purposes of this document, the following terms and definitions, as well as those given in IEC 60050-841 and IEC 60676, apply.

3.1

electroslag remelting furnace

remelting furnace in which the charge, usually a consumable electrode, is remelted by direct resistance heating of an electrical conductive molten slag

NOTE The slag is contained in a mould (crucible).

3.2

electroheat installation with an electroslag remelting furnace

complete assembly of electroheat equipment and electrical and mechanical accessories necessary for operation and utilization of an electroslag remelting furnace

NOTE The electrical equipment comprises, in particular, the conductors and switchgear in the power, control and regulating circuits, and the melting power supply(ies), when the device has its own melting power supply(ies).

3.3

power of an electroheat installation

apparent power S (in kVA) or active power P (in kW) measured at the input of the supply line

3.4

power factor of an electroheat installation ($\cos \varphi$)

ratio of the active power to the apparent power measured at the input of the supply line

3.5

mould (crucible) of an electros slag remelting furnace

water-cooled non-consumable container which shapes the ingot to be produced by the electros slag remelting process and which contains the molten slag

3.6

secondary electrical circuit of an electros slag remelting furnace

electrical circuit which is closed by the melting power supply and may include

- a) output terminals of melting power supply;
- b) high-current feeder (busbars and/or cables);
- c) bus switches, if required;
- d) electrode clamp;
- e) electrode stub;
- f) consumable electrode or electrodes (depending on the connection system);
- g) conductive molten slag (not included in the short-circuit test);
- h) remelted ingot (not included in the case of the furnace with more than two electrodes);
- i) base plate (depending on the connection system)

3.7

consumable electrode

solid part(s) in contact with the molten slag which carries the electrical current necessary for the melting operation and is constituted of the material necessary for the formation of the ingot

3.8

on-load voltage of an electros slag remelting furnace

- a) voltage which can be measured between the following two points (not applicable for a furnace with two electrodes corresponding to single-phase a.c. power supply):
 - the base plate;
 - the electrode clamping device(s) bringing the melting electrical current to the consumable electrode(s) or stub(s)

NOTE See U_F in Figures 1 and 2.

- b) for a furnace with two electrodes corresponding to single-phase a.c. power supply, voltage measured between the two electrode clamping devices
- c) in the case of an electros slag remelting furnace of a coaxial design for a single-phase a.c. power supply, the voltage measured between the electrode clamping device and the point of common connection of the multiple return conductors

NOTE See U_F in Figure 3.