

PD IEC/TS 62796:2013



BSI Standards Publication

Energy efficiency in electroheating installations

bsi.

...making excellence a habit.™

National foreword

This Published Document is the UK implementation of IEC/TS 62796:2013.

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.

© The British Standards Institution 2013.

Published by BSI Standards Limited 2013

ISBN 978 0 580 78971 7

ICS 25.180.10

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

This Published Document was published under the authority of the Standards Policy and Strategy Committee on 31 July 2013.

Amendments/corrigenda issued since publication

Date	Text affected
-------------	----------------------



TECHNICAL SPECIFICATION

Energy efficiency in electroheating installations

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

PRICE CODE

Q

ICS 25.180.10

ISBN 978-2-83220-855-7

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD.....	3
INTRODUCTION.....	5
1 Scope and object.....	6
2 Normative references	6
3 Terms and definitions	6
3.1 General concepts	7
3.2 Equipment, operations and workloads	7
4 General aspects of energy efficiency measurements in electroheating.....	9
4.1 General.....	9
4.2 Instrumentation	9
4.3 Ambient conditions and initial temperature of the workload.....	9
4.4 Non-ambient pressures	10
4.5 Chemical reactions.....	10
4.6 Cooling and heat leakage to ambient.....	10
5 Workload categories and requirements.....	10
5.1 General.....	10
5.2 Use of workloads for comparative tests	11
5.3 Use of normal workloads for enthalpy determination.....	11
5.4 Use of dummy workloads for enthalpy determinations	11
5.5 Use of performance test workloads.....	11
6 Measurement of electric power and ancillary energy factors	12
6.1 Measurement of cold start-up energy consumption and time.....	12
6.2 Measurement of hot standby power	12
6.3 Measurement of pressurising and depressurising energy consumption	12
6.4 Measurement of holding power.....	12
7 Measurement of efficiencies	13
7.1 General.....	13
7.2 Measurement of electric-only conversion efficiency	13
7.3 Measurement of electroheating energy consumption and efficiency.....	13
8 Energy recovery	13
8.1 General.....	13
8.2 Temperature and pressure of the fluid	14
8.3 Hot fluid heat capacity performance factor.....	14
8.4 Calculations of thermal recovery in the process.....	14
8.5 Determination of external energy recoverability	14
8.6 Calculation of the endoreversible thermal efficiency for a heat engine (exergy).....	15
9 Aspects of management of operation flexibility (smart grid connectivity)	15
9.1 Load management and smart grid	15
9.2 Applicability to electroheating installations	15
9.3 Tune down times	15
9.4 Shut-down and start-up capability evaluations.....	16
Bibliography.....	17

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ENERGY EFFICIENCY IN ELECTROHEATING INSTALLATIONS

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

The main task of IEC technical committees is to prepare International Standards. In exceptional circumstances, a technical committee may propose the publication of a technical specification when

- the required support cannot be obtained for the publication of an International Standard, despite repeated efforts, or
- the subject is still under technical development or where, for any other reason, there is the future but no immediate possibility of an agreement on an International Standard.

Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC 62796, which is a technical specification, has been prepared by IEC technical committee 27: Industrial electroheating and electromagnetic processing.

The text of this technical specification is based on the following documents:

Enquiry draft	Report on voting
27/882/DTS	27/903/RVC

Full information on the voting for the approval of this technical specification can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- transformed into an International Standard,
- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

This Technical Specification (TS) was prepared by a working group of IEC TC 27, whose overall intent was to develop guidelines for the classification of industrial electroheating systems, which allow for the determination of the performance/efficiency of a given system and a comparison with other systems of that class.

The initial technical considerations suggested that TC 27 should at first limit its focus on determination of energy consumption for a defined output of processed workload. The next step should then be consideration of performance characteristics influencing the energy efficiency, such as metallurgical or thermal processing particulars. However, during the course of the work, it turned out that comparisons of performance can best be made by specifying different workloads for different kinds of comparisons.

Measurements of efficiencies are split into two main categories: electrical-only and of the electroheating in normal operation. The latter has a relationship to other performance aspects which are also dealt with.

Testing requires specification limits on workload and three kinds are defined:

- normal workloads – i.e. such within the specifications provided by the manufacturer;
- dummy workloads – artificial items specially designed to very efficiently absorb the available output power without being processed or modified as the normal workload, and by that promoting the accuracy of enthalpy increase measurements;
- performance test workloads – artificial or partially artificial workloads specially designed for discrimination of processing results.

The TS provides general methods for determination of the efficiency of electroheating systems and is intended to assist in creating a consistent terminology and structure in various TC 27 test standards dealing with specific equipment types. The TS material is to be covered by the future third edition of IEC 60398 [3]¹.

¹ Numbers in square brackets refer to the Bibliography.

ENERGY EFFICIENCY IN ELECTROHEATING INSTALLATIONS

1 Scope and object

This Technical Specification is applicable to industrial electroheating installations using electric energy as input, alone or in combination with other kinds of energy. However, external combustible fuel energy input is not dealt with, and all considerations begin at the electric only mains frequency source to which the installation is connected. Any external voltage transformation from the supply network to the plant into a special voltage which is fed into the installation is not dealt with in this Technical Specification, since it is not considered a responsibility of the manufacturer of the installation.

The object of this Technical Specification is to provide methods for determination of the efficiency of a given system as well as enabling comparisons with other equipment using the same principle for processing of the workload.

For satisfactory comparisons to be possible, differences in end product quality and influences of environmental factors on heat recovery are included.

Heat recovery aspects are dealt with but limited to the temperature changes, the specific heat capacity characteristics, and the physical properties of the usually fluidic substance obtained from the installation and employed for energy recovery use. Conversion into mechanical energy is dealt with.

Adaptation to the needs of operation and performance management as might be necessary for the implementation or application of smart grid technologies, is addressed but no test methods are given.

A guideline is provided for the development of the detailed electroheating efficiency tests for the particular test method standards. The different principles of electroheating for processing a workload, and types of equipment, are given in Clause 1 of IEC 60519-1:2010.

If energy from combustible gases or liquids is used in addition to electric energy, the measurement and calculation of the energy efficiency contribution of combustion in the installation are made according to the relevant ISO standards. These may deal with the electric energy input in other ways than in this Technical Specification.

NOTE The relevant standards in the ISO 13579 series are listed in the Bibliography [4 – 7].

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60519-1:2010, *Safety in electroheating installations – Part 1: General requirements*

3 Terms and definitions

For the purposes of this document, terms and definitions given in IEC 60519-1:2010 and the following apply.