



BSI Standards Publication

<http://www.china-gauges.com/>

## Designation of phase differences by hour numbers in three-phase AC systems

---

## National foreword

This British Standard is the UK implementation of EN IEC 60152:2021. It is identical to IEC 60152:2021.

The UK participation in its preparation was entrusted to Technical Committee GEL/3, Documentation and graphical symbols.

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

### Contractual and legal considerations

This publication has been prepared in good faith, however no representation, warranty, assurance or undertaking (express or implied) is or will be made, and no responsibility or liability is or will be accepted by BSI in relation to the adequacy, accuracy, completeness or reasonableness of this publication. All and any such responsibility and liability is expressly disclaimed to the full extent permitted by the law.

This publication is provided as is, and is to be used at the recipient's own risk.

The recipient is advised to consider seeking professional guidance with respect to its use of this publication.

This publication is not intended to constitute a contract. Users are responsible for its correct application.

© The British Standards Institution 2021  
Published by BSI Standards Limited 2021

ISBN 978 0 539 12415 6

ICS 29.020; 29.240.20

### 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 30 September 2021.

### Amendments/corrigenda issued since publication

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

---

EUROPEAN STANDARD  
 NORME EUROPÉENNE  
 EUROPÄISCHE NORM

**EN IEC 60152**

September 2021

ICS 29.020

English Version

Designation of phase differences by hour numbers in three-  
 phase AC systems  
 (IEC 60152:2021)

Désignation des déphasages par les heures horaires des  
 réseaux en courant alternatif triphasés  
 (IEC 60152:2021)

Kennzeichnung der Phasenleiter in einem elektrischen  
 Dreiphasensystem durch Uhrziffern  
 (IEC 60152:2021)

This European Standard was approved by CENELEC on 2021-08-13. 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 CEN-CENELEC Management Centre 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 CEN-CENELEC Management Centre has the same status as the official versions.

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



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

**CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels**

## European foreword

The text of document 3/1490/FDIS, future edition 2 of IEC 60152, prepared by IEC TC 39 "Documentation, graphical symbols and representations of technical information" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 60152:2021.

The following dates are fixed:

- latest date by which the document has to be implemented at national (dop) 2022-05-13 level by publication of an identical national standard or by endorsement
- latest date by which the national standards conflicting with the (dow) 2024-08-13 document have to be withdrawn

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

Any feedback and questions on this document should be directed to the users' national committee. A complete listing of these bodies can be found on the CENELEC website.

## Endorsement notice

The text of the International Standard IEC 60152:2021 was approved by CENELEC as a European Standard without any modification.

## CONTENTS

FOREWORD .....	3
1 Scope .....	5
2 Normative references .....	5
3 Terms and definitions .....	5
4 Hour numbers .....	5
5 Phase difference .....	6
Figure 1 – Illustration of hour number for three phase transformer Dy11 .....	6
Figure 2 – Examples of hour numbers representing phase differences .....	7

<http://www.china-gauges.com/>

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**DESIGNATION OF PHASE DIFFERENCES BY  
HOUR NUMBERS IN THREE-PHASE AC SYSTEMS**

## 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.

IEC 60152 has been prepared by IEC technical committee 3: Documentation, graphical symbols and representations of technical information. It is an International Standard.

This second edition cancels and replaces the first edition published in 1963. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) the title has been updated to reflect the content of the document;
- b) the concept of identifying conductors with hour number has been removed as the concept is considered out of date and other means for identifying conductors exists;
- c) definition of hour number (clock number) and phase difference introduced.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
3/1490/FDIS	3/1516/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at [www.iec.ch/members\\_experts/refdocs](http://www.iec.ch/members_experts/refdocs). The main document types developed by IEC are described in greater detail at [www.iec.ch/standardsdev/publications](http://www.iec.ch/standardsdev/publications).

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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

## DESIGNATION OF PHASE DIFFERENCES BY HOUR NUMBERS IN THREE-PHASE AC SYSTEMS

### 1 Scope

This document specifies methods and rules for the designation of phase difference between two items in a three-phase AC system. The designations are intended to be applied in the technical documentation of industrial installations, equipment, and products, and also on markings of equipment and products.

### 2 Normative references

There are no normative references in this document.

### 3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

#### 3.1

##### **hour number clock number**

designation of a phase difference between the same quantity of two items in an AC system

#### 3.2

##### **phase difference**

$\varphi$

for two sinusoidal quantities of the same frequency in a given order, difference between their initial phases with possible addition of a multiple of  $2\pi$  so that the difference is greater than  $-\pi$  and not greater than  $\pi$

Note 1 to entry: For the quantities  $a'(t) = \widehat{A}' \cos(\omega t + \vartheta'_0)$  and  $a''(t) = \widehat{A}'' \cos(\omega t + \vartheta''_0)$  the phase difference is  $\varphi = \vartheta''_0 - \vartheta'_0 + 2\pi n$  where  $n$  is an integer, chosen so that  $-\pi < \varphi \leq \pi$ .

[SOURCE: IEC 60050-103:2009, 103-07-06]

### 4 Hour numbers

For the designation of a phase difference in a three-phase AC system, the following hour numbers may be used:

0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 and 11.

Each hour number shall represent the corresponding multiple of a phase difference of  $30^\circ$ .



## EXAMPLE 1

A phase difference designated by the hour number 3 represents a difference in phase of  $90^\circ$ .

## EXAMPLE 2

A phase difference designated by the hour number 5 represents a difference in phase of  $150^\circ$ .

## 5 Phase difference

For designation of a phase difference between two quantities, the hour number shall indicate that the value of the second quantity is lagging the corresponding number of degrees compared with the value of the first quantity.

## EXAMPLE 1

To indicate the phase difference between the line conductors L1 and L2 in a three-phase transmission system, the hour number 4 can be used to represent the phase difference of  $120^\circ$ .

For the designation of a phase difference between values of the same quantities with reference to the input side and the output side of an item, the hour number shall indicate how many degrees the quantity value of the output side is lagging compared with the quantity value on the input side.

## EXAMPLE 2

To indicate the phase difference or phase rotation between the primary side to the secondary side of a two-winding three-phase transformer where the primary side is connected in a delta configuration (i.e. D connected windings), while the secondary windings are connected in a star configuration (i.e. y connected windings), the hour number 11 can be used to indicate that the secondary side is lagging  $330^\circ$  (or leading  $30^\circ$ ) compared with the primary side, e.g. Dy11 (normally, upper-case letters are used for the primary winding while lower-case letters are used for the secondary winding), see also Figure 1.

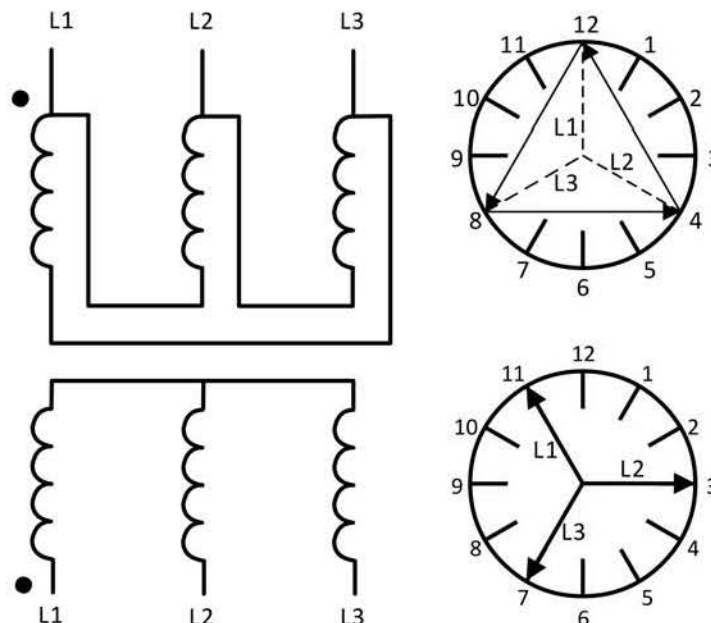


Figure 1 – Illustration of hour number for three-phase transformer Dy11

Figure 2 illustrates some phase differences using a clock.



Figure 2 – Examples of hour numbers representing phase differences

NOTE On a clock where the hours are indicated by the numbers 1 to 12, the hour indicated by the number 12 is also representing the hour 0. Thus, in the examples and figures, the hour indicated by the clock position 12 is the hour 0.

<http://www.china-gauges.com/>

# British Standards Institution (BSI)

BSI is the national body responsible for preparing British Standards and other standards-related publications, information and services.

BSI is incorporated by Royal Charter. British Standards and other standardization products are published by BSI Standards Limited.

## About us

We bring together business, industry, government, consumers, innovators and others to shape their combined experience and expertise into standards-based solutions.

The knowledge embodied in our standards has been carefully assembled in a dependable format and refined through our open consultation process. Organizations of all sizes and across all sectors choose standards to help them achieve their goals.

## Information on standards

We can provide you with the knowledge that your organization needs to succeed. Find out more about British Standards by visiting our website at [bsigroup.com/standards](http://bsigroup.com/standards) or contacting our Customer Services team or Knowledge Centre.

## Buying standards

You can buy and download PDF versions of BSI publications, including British and adopted European and international standards, through our website at [bsigroup.com/shop](http://bsigroup.com/shop), where hard copies can also be purchased.

If you need international and foreign standards from other Standards Development Organizations, hard copies can be ordered from our Customer Services team.

## Copyright in BSI publications

All the content in BSI publications, including British Standards, is the property of and copyrighted by BSI or some person or entity that owns copyright in the information used (such as the international standardization bodies) and has formally licensed such information to BSI for commercial publication and use.

Save for the provisions below, you may not transfer, share or disseminate any portion of the standard to any other person. You may not adapt, distribute, commercially exploit or publicly display the standard or any portion thereof in any manner whatsoever without BSI's prior written consent.

## Storing and using standards

Standards purchased in soft copy format:

- user for personal or internal company use only.
- The standard may be stored on more than one device provided that it is accessible by the sole named user only and that only one copy is accessed at any one time.
- A single paper copy may be printed for personal or internal company use only.

Standards purchased in hard copy format:

- A British Standard purchased in hard copy format is for personal or internal company use only.
- It may not be further reproduced – in any format – to create an additional copy. This includes scanning of the document.

If you need more than one copy of the document, or if you wish to share the document on an internal network, you can save money by choosing a subscription product (see 'Subscriptions').

## Reproducing extracts

For permission to reproduce content from BSI publications contact the BSI Copyright and Licensing team.

## Subscriptions

Our range of subscription services are designed to make using standards easier for you. For further information on our subscription products go to [bsigroup.com/subscriptions](http://bsigroup.com/subscriptions).

With **British Standards Online (BSOL)** you'll have instant access to over 55,000 British and adopted European and international standards from your desktop. It's available 24/7 and is refreshed daily so you'll always be up to date.

You can keep in touch with standards developments and receive substantial discounts on the purchase price of standards, both in single copy and subscription format, by becoming a **BSI Subscribing Member**.

**PLUS** is an updating service exclusive to BSI Subscribing Members. You will automatically receive the latest hard copy of your standards when they're revised or replaced.

To find out more about becoming a BSI Subscribing Member and the benefits of membership, please visit [bsigroup.com/shop](http://bsigroup.com/shop).

With a **Multi-User Network Licence (MUNL)** you are able to host standards publications on your intranet. Licences can cover as few or as many users as you wish. With updates supplied as soon as they're available, you can be sure your documentation is current. For further information, email [cservices@bsigroup.com](mailto:cservices@bsigroup.com).

## Revisions

Our British Standards and other publications are updated by amendment or revision.

We continually improve the quality of our products and services to benefit your business. If you find an inaccuracy or ambiguity within a British Standard or other BSI publication please inform the Knowledge Centre.

## Useful Contacts

### Customer Services

**Tel:** +44 345 086 9001

**Email:** [cservices@bsigroup.com](mailto:cservices@bsigroup.com)

### Subscriptions

**Tel:** +44 345 086 9001

**Email:** [subscriptions@bsigroup.com](mailto:subscriptions@bsigroup.com)

### Knowledge Centre

**Tel:** +44 20 8996 7004

**Email:** [knowledgecentre@bsigroup.com](mailto:knowledgecentre@bsigroup.com)

### Copyright & Licensing

**Tel:** +44 20 8996 7070

**Email:** [copyright@bsigroup.com](mailto:copyright@bsigroup.com)

## BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK