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Telecontrol equipment and systems -- Part 5-6: Guidelines for conformance testing for the EN 60870-5 companion standards (IEC 60870-5-6:2006 (EQV))

I.S. EN 60870-5-6:2009

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English version

Telecontrol equipment and systems - Part 5-6: Guidelines for conformance testing for the EN 60870-5 companion standards

(IEC 60870-5-6:2006)

Matériels et systèmes de téléconduite - Partie 5-6: Recommandations pour les essais de conformité des normes compagnons de la EN 60870-5 (CEI 60870-5-6:2006)

Fernwirkeinrichtungen und -systeme - Teil 5-6: Richtlinien zur Konformitätsprüfung für die anwendungsbezogenen Normen der Reihe EN 60870-5 (IEC 60870-5-6:2006)

This European Standard was approved by CENELEC on 2009-06-01. 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.

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CENELEC

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Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: Avenue Marnix 17, B - 1000 Brussels

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Foreword

The text of the International Standard IEC 60870-5-6:2006, prepared by IEC TC 57, Power systems management and associated information exchange, was submitted to the Unique Acceptance Procedure and was approved by CENELEC as EN 60870-5-6 on 2009-06-01 without any modification.

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)	2010-06-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2012-06-01

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60870-5-6:2006 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60870-5-101	NOTE	Harmonized as EN 60870-5-101:2003 (not modified).
IEC 60870-5-103	NOTE	Harmonized as EN 60870-5-103:1998 (not modified).
IEC 60870-5-104	NOTE	Harmonized as EN 60870-5-104:2006 (not modified).
ISO 9000	NOTE	Harmonized as EN ISO 9000:2005 (not modified).

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 60870-5-1	-[1)]	Telecontrol equipment and systems - Part 5: Transmission protocols - Section 1: Transmission frame formats	EN 60870-5-1	1993[2)]
IEC 60870-5-2	-[1)]	Telecontrol equipment and systems - Part 5: Transmission protocols - Section 2: Link transmission procedures	EN 60870-5-2	1993[2)]
IEC 60870-5-3	-[1)]	Telecontrol equipment and systems - Part 5: Transmission protocols - Section 3: General structure of application data	EN 60870-5-3	1992[2)]
IEC 60870-5-4	-[1)]	Telecontrol equipment and systems - Part 5: Transmission protocols - Section 4: Definition and coding of application information elements	EN 60870-5-4	1993[2)]
IEC 60870-5-5	-[1)]	Telecontrol equipment and systems - Part 5: Transmission protocols - Section 5: Basic application functions	EN 60870-5-5	1995[2)]
ISO/IEC 9646	Series	Information technology - Open Systems Interconnection - Conformance testing methodology and framework	-	-

[1)] Undated reference.

[2)] Valid edition at date of issue.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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TELECONTROL EQUIPMENT AND SYSTEMS –

Part 5-6: Guidelines for conformance testing for the IEC 60870-5 companion standards

FOREWORD

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International Standard IEC 60870-5-6 has been prepared by IEC technical committee 57: Power systems management and associated information exchange.

The text of this part of IEC 60870-5 is based on the following documents:

FDIS	Report on voting
57/792/FDIS	57/807/RVD

Full information on the voting for the approval of this part of IEC 60870-5 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.

IEC 60870-5 consists of the following parts, under the general title *Telecontrol equipment and systems – Part 5: Transmission protocols:*

Part 5-1: Transmission frame formats

Part 5-2: Link transmission procedures

Part 5-3: General structure of application data

Part 5-4: Definition and coding of application information elements

Part 5-5: Basic application functions

Part 5-6: Guidelines for conformance testing for the IEC 60870-5 companion standards

Part 5-101: Companion standard for basic telecontrol tasks

Part 5-102 Companion standard for the transmission of integrated totals in electric power systems

Part 5-103: Companion standard for the informative interface of protection equipment

Part 5-104: Network access for IEC 60870-5-101 using standard transport profiles

Part 5-601: Conformance test cases for the IEC 60870-5-101 companion standard

The committee has decided that the contents of this publication will remain unchanged until the maintenance result 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

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

A bilingual version of this publication may be issued at a later date.

INTRODUCTION

This part of IEC 60870-5 specifies methods and procedures for conformance testing of Telecontrol equipment or systems using IEC 60870-5 standard(s).

This part of IEC 60870-5 contains general subjects and guidelines for the test environment. Detailed test cases, mandatory and optional mandatory test cases for the companion standards will become available as technical specifications (IEC 60870-5-60x).

Tests according to EMC requirements or related to environmental and organisational conditions are beyond the scope of this part of IEC 60870-5. This part of IEC 60870-5 only focuses on the protocol implementation and the related system functionality necessary to validate the protocol implementation.

TELECONTROL EQUIPMENT AND SYSTEMS –

Part 5-6: Guidelines for conformance testing for the IEC 60870-5 companion standards

1 Scope

This part of the IEC 60870-5 series specifies methods for conformance testing of telecontrol equipment, amongst Substation Automation Systems (SAS) and telecontrol systems, including front-end functions of SCADA.

The use of this part of IEC 60870-5 facilitates interoperability by providing a standard method of testing protocol implementations, but it does not guarantee interoperability of devices. It is expected that using this part of IEC 60870-5 during testing will minimize the risk of non-interoperability.

The goal of this part of IEC 60870-5 is to enable unambiguous and standardised evaluation of IEC 60870-5 companion standard protocol implementations. The guidelines and conditions for the testing environment are described in this part of IEC 60870-5. The detailed test cases per companion standard, containing among others mandatory and optional mandatory test cases per Basic Application Function, ASDU and transmission procedure, will become available as technical specifications (IEC 60870-5-60x). Other functionalities may need test cases, but this is beyond the scope of this part of IEC 60870-5.

This part of IEC 60870-5 deals mainly with communication conformance testing; therefore other requirements, such as safety or EMC are not covered. These requirements are covered by other standards (if applicable) and the proof of compliance for these topics should be done according to those standards.

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 60870-5-1, *Telecontrol equipment and systems – Part 5: Transmission protocols – Section One: Transmission frame formats*

IEC 60870-5-2, *Telecontrol equipment and systems – Part 5: Transmission protocols – Section 2: Link transmission procedures*

IEC 60870-5-3, *Telecontrol equipment and systems – Part 5: Transmission protocols – Section 3: General structure of application data*

IEC 60870-5-4, *Telecontrol equipment and systems – Part 5: Transmission protocols – Section 4: Definition and coding of application information elements*

IEC 60870-5-5, *Telecontrol equipment and systems – Part 5: Transmission protocols – Section 5: Basic application functions*

ISO/IEC 9646 (all parts), *Information technology – Open Systems Interconnection – Conformance testing methodology and framework*

3 Terms and definitions

For the purposes of this part of IEC 60870-5, the following terms and definitions apply.

3.1
configuration (of a system or device)
step in system design: selecting functional units, assigning their locations and defining their interconnections

3.2
configuration list
supplies an overview of all compatible hardware and software versions of components of controlled/controlling stations including the software versions of relevant supporting tools

3.3
address config
address config is the configuration file containing the ASDU-addressing including the information object addresses necessary to test all the functionality defined as in the PID

3.4
conformance test
verification process of the protocol implementation in a device by executing tests according to the applicable test plan, which contain mandatory and possibly mandatory optional test cases, so as to be able to answer the following question:

"Does the protocol implementation in device xxx of supplier yyy conform to the IEC 60870-5-10x standard and the applicable Protocol Implementation Document (PID)?"

NOTE A supplier-independent party that is allowed to issue a Conformance Statement can carry out a conformance test.

3.5
device
mechanism or piece of equipment designed to serve a purpose or perform a function

[IEEE STD 100-1996, IEEE Dictionary of Electrical and Electronic Terms]

3.6
direction
communication direction in which the device exchanges the data

NOTE IEC 60870-5 companion standards describe functions and ASDU's in the monitor direction (from the controlled to the controlling station) and control direction (from controlling to controlled station) as Normal direction (N). For some purposes, the functions or ASDU's can be used also in the Reverse direction (R) or in Both directions (B). The way they are used should be indicated in the PICS. If reversed direction is enabled, by using R or B, the functionality is used in the reverse direction, the applicable test cases in the normal direction are applicable for the reversed functionality.

3.7
error
behaviour, which does not conform to the standard and/or the applicable test cases as described in this part of IEC 60870-5

3.8
Factory Acceptance Test
FAT
customer agreed functional tests of the specifically manufactured telecontrol equipment or its parts using the parameter set for the planned application

NOTE The FAT should be carried out in the factory of the manufacturer by the use of process simulating test equipment.

3.9
function
tasks performed by the telecontrol equipment

NOTE Generally, functions will exchange data with each other.

3.10
hold point
H
point, defined in the appropriate document beyond which an activity should not proceed without the approval of the initiator of the conformance test. If necessary, the test facility could provide a written notice to the initiator at an agreed time prior to the hold point. The initiator or his representative is obliged to verify the hold point and approve the proceeding of the activity

3.11
quality program
quality program for the IEC 60870-5 series as described in Figure 3

3.12
initiator of conformance test
party initiating a conformance test that may be executed by a test facility

3.13
interface
shared boundary between two functional units, defined by functional characteristics, signal characteristics, or other characteristics as appropriate

3.14
interoperability
ability of two or more telecontrol devices from the same vendor, or different vendors, to exchange information and use that information for correct co-operation

3.15
interoperability test
verification of the information exchange of two or more devices from the same vendor or different vendors.

In case of an open protocol, the test shall give an answer to the following question:

“Are the devices under test (DUT) able to communicate correctly according to the IEC 60870-5-10x standard and the Protocol Implementation Document (PID)?”

The interoperability test can be carried by a supplier-independent party that may result in an interoperability statement. A basic condition for this interoperability test is a passed conformance test of both devices

NOTE Interoperability does not necessarily mean that both systems are communicating according a specific protocol, but that both those devices are able to communicate and this might be an open protocol. Interoperability is not interchangability.

3.16
interchangability
ability to replace a device from the same vendor, or from different vendors, using the same communication interface and as a minimum, with the same functionality, and with no impact on the rest of the system

3.17
mandatory optional test case
test case initially marked as optional in the column “required”, indicated by “PICS, ….” or “PIXIT” which becomes a mandatory test case if this functionality is enabled and/or described in the PICS or the PIXIT. This optional test case then becomes a mandatory test case

3.18
negative test
test to verify the correct response of a device or a system on:

– IEC 60870-5 series conformant information and services, which are not implemented;
– non conformant communication traffic

3.19
open protocol
communication protocol of which the protocol specification is freely accessible for all market parties, for example an IEC protocol communication standard

3.20
Physical Connection
PC
communication link between physical devices

3.21
Physical Device
PD
independent physical entity capable of performing one or more specified device functions in a particular context and delimited by its interfaces. A physical device is equivalent to or is part of a controlling or controlled station

3.22
plausibility test
a plausibility test is passed if the corresponding time, value, status or other items have been shown to have the correct value (no tolerance) for time-stamp, values, status and for the other items regarding the requirements in 5.6.3.

NOTE Applicable tolerances may be part of the PIXIT.

3.23
Protocol Implementation eXtra Information for Testing
PIXIT
the PIXIT document contains system specific information regarding the capabilities of the system to be tested and specifies which items are optional, in the applicable Companion Standard or outside the scope of the 60870-5 series. The PIXIT is not subject to standardisation, but 5.5.1.4 describes guidelines and recommendations for setting up a PIXIT

NOTE It is recommended is to integrate the PIXIT and the PICS into one document, which is the PID.

3.24
positive test
test to ensure the correct implementation of the system capabilities as defined by the supplier. A positive test has a described and defined response

3.25
Protocol Implementation Conformance Statement
PICS
summary of the capabilities of the system to be tested. Every companion standard contains a PICS. The use of the interoperability sheets of the particular standard for the definition of the PICS is mandatory

NOTE It is recommended to integrate PIXIT and PICS into one document, which is the PID.

3.26
Protocol Implementation Document
PID
describes the way a specific area (country, company, functionality) uses and implements the protocol. The PID consists of the PICS and the PIXIT. The PID shall not be subject to standardisation and is system specific. The PID always contains the PICS and is mandatory for conformance testing

NOTE It is recommended to integrate the PIXIT and the PICS into one document, which is the PID.

3.27
Remote Terminal Unit
RTU
acts as an interface between the communication network and the substation equipment

NOTE An RTU is typically an outstation.

3.28
review
R
optional systematic examination, defined in the appropriate document, of the quality document(s) for an activity

NOTE The test facility can provide the documentation to be reviewed to the initiator of the conformance test at an agreed time prior to the associated hold or witness point. It is subject to agreement how the review will be conducted.

3.29
system
set of interrelated elements considered in a defined context as a whole and separated from its environment

3.30
logical system
union of all communicating functions performing some overall tasks such as “management of a substation”

3.31
physical system
composition of all devices and the interconnecting physical communication network

NOTE The boundary of a system is given by its logical or physical interfaces. Within the scope of IEC 60870-5, system always refers to Telecontrol equipment and systems, if not mentioned otherwise.

3.32
system test
check of correct behaviour of the controlled/controlling station under various application conditions

NOTE The system test marks the final stage of the development of a Telecontrol equipment or system.

3.33
test equipment
all tools and instruments, which simulate and verify the communication traffic, input or outputs of the system under test

3.34
test facility
supplier-independent organisations, which are able to provide appropriate test equipment and trained staff for conformance testing

NOTE The management of conformance tests and the resulting information should follow a quality system according to ISO 9001/ISO 9002 as far as applicable.

Test facilities should comply with the requirements as described in this part of IEC 60870-5.