

TECHNICAL SPECIFICATION



**Power systems management and associated information exchange – Data and communications security –
Part 100-1: Conformance test cases for IEC TS 62351-5 and IEC TS 60870-5-7**

[IEC TS 62351-100-1:2018](https://standards.iteh.ai/catalog/standards/sist/f2a445f-4d10-4825-ab00-97ad41e6f40b/iec-ts-62351-100-1-2018)

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CONTENTS

FOREWORD.....	6
INTRODUCTION.....	8
1 Scope.....	9
2 Normative references	9
3 Terms, definitions and abbreviated terms	10
3.1 Terms and definitions.....	10
3.2 Abbreviated terms.....	12
4 General	12
4.1 Normatives covered by this technical specification.....	12
4.2 Conformance testing structure	12
4.2.1 General	12
4.2.2 Conformance testing of security extension procedures	13
4.2.3 Conformance testing addressed per station type	14
4.2.4 Normal procedure tests and resiliency tests.....	14
4.3 Conformance testing requirements.....	14
4.3.1 Testing base protocols with security extension.	14
4.3.2 Testing of profiles including TCP/IP	14
4.3.3 Requirements for the device under test.....	14
4.3.4 Requirements for the test facility.....	15
4.3.5 Test logging.....	15
5 Verification of configuration parameters.....	16
5.1 General.....	16
5.2 System definition	16
5.3 Application security extension.....	18
6 Verification of Communication	21
6.1 General.....	21
6.2 ASDU segmentation control	21
6.3 Verification of ASDUs	23
6.3.1 User management ASDUs	23
6.3.2 Update key maintenance ASDUs	26
6.3.3 Session key maintenance ASDUs	32
6.3.4 Challenge/reply and aggressive mode authentication ASDUs	35
6.3.5 Security statistics ASDU	39
7 Verification of procedures.....	39
7.1 General.....	39
7.2 User management.....	40
7.2.1 General	40
7.2.2 Controlling station.....	41
7.2.3 Controlled station	43
7.3 Update key maintenance - Symmetric	48
7.3.1 General	48
7.3.2 Controlling station.....	48
7.3.3 Controlled station	52
7.4 Update key maintenance - Asymmetric	54
7.4.1 General	54
7.4.2 Controlling station.....	55

7.4.3	Controlled station	59
7.5	Session key maintenance	61
7.5.1	General	61
7.5.2	Controlling station.....	62
7.5.3	Controlled station	67
7.6	Challenge/reply authentication	69
7.6.1	General	69
7.6.2	Controlling station.....	70
7.6.3	Controlled station	76
7.7	Aggressive mode authentication	80
7.7.1	General	80
7.7.2	Controlling station.....	81
7.7.3	Controlled station	84
8	Tests results chart.....	87
8.1	Verification of configuration parameters	87
8.2	Verification of communication	88
8.2.1	ASDUs segmentation control	88
8.2.2	User management ASDUs	89
8.2.3	Update key maintenance ASDUs	90
8.2.4	Session key maintenance ASDUs	92
8.2.5	Challenge/reply and aggressive mode authentication ASDUs	93
8.2.6	Security statistics ASDU	94
8.3	Verification of procedures	95
8.3.1	User management	95
8.3.2	Update key maintenance - Symmetric	98
8.3.3	Update key maintenance - Asymmetric	100
8.3.4	Session key maintenance	102
8.3.5	Challenge/reply authentication.....	105
8.3.6	Aggressive mode authentication	109
Figure 1	– IEC TS 62351-5 Security extension procedures	13
Table 1	– Configuration parameters: System definition	17
Table 2	– Configuration parameters: Application security extension	19
Table 3	– ASDU segmentation control.....	22
Table 4	– User management ASDUs	23
Table 5	– Update key maintenance ASDUs	26
Table 6	– Session key maintenance ASDUs.....	32
Table 7	– Challenge/reply and aggressive mode authentication ASDUs	35
Table 8	– Security statistics ASDU	39
Table 9	– User management: Controlling station normal procedure tests	41
Table 10	– User management: Controlling station resiliency tests	42
Table 11	– User management: Controlled station normal procedure tests	43
Table 12	– User management: Controlled station resiliency tests	44
Table 13	– Update key maintenance - Symmetric: Controlling station triggering conditions	48

Table 14 – Update key maintenance - Symmetric: Controlling station normal procedure tests	49
Table 15 – Update key maintenance - Symmetric: Controlling station resiliency tests	50
Table 16 – Update key maintenance - Symmetric: Controlled station normal procedure tests	52
Table 17 – Update key maintenance - Symmetric: Controlled station resiliency tests	53
Table 18 – Update key maintenance - Asymmetric: Controlling station triggering conditions	55
Table 19 – Update key maintenance - Asymmetric: Controlling station normal procedure tests	56
Table 20 – Update key maintenance - Asymmetric: Controlling station resiliency tests	57
Table 21 – Update key maintenance - Asymmetric: Controlled station normal procedure tests	59
Table 22 – Update key maintenance - Asymmetric: Controlled station resiliency tests	60
Table 23 – Session key maintenance: Controlling station triggering conditions	62
Table 24 – Session key maintenance: Controlling station normal procedure tests	63
Table 25 – Session key maintenance: Controlling station resiliency tests	64
Table 26 – Session key maintenance: Controlled station invalidating session key	67
Table 27 – Session key maintenance: Controlled station normal procedure tests	68
Table 28 – Session key maintenance: Controlled station resiliency tests	69
Table 29 – Challenge/reply authentication: Controlling station triggering conditions	70
Table 30 – Challenge/reply authentication: Controlling station normal procedure tests	71
Table 31 – Challenge/reply authentication: Controlling station resiliency tests	72
Table 32 – Challenge/reply authentication: Controlled station normal procedure tests	76
Table 33 – Challenge/reply authentication: Controlled station resiliency tests	77
Table 34 – Aggressive mode authentication: Controlling station normal procedure tests	81
Table 35 – Aggressive mode authentication: Controlling station resiliency tests	82
Table 36 – Aggressive mode authentication: Controlled station normal procedure tests	84
Table 37 – Aggressive Mode Authentication: Controlled station resiliency tests	85
Table 38 – Test results chart: Configuration parameters	87
Table 39 – Test results chart: ASDU segmentation control	88
Table 40 – Test results chart: User managements ASDUs	89
Table 41 – Test results chart: Update key maintenance ASDUs	90
Table 42 – Test results chart: Session key maintenance ASDUs	92
Table 43 – Test results chart: Challenge/reply and aggressive mode authentication ASDUs	93
Table 44 – Test results chart: Security statistics ASDU	94
Table 45 – Test results chart: User management procedure – Controlling station	95
Table 46 – Test results chart: User management procedure – Controlled Station	96
Table 47 – Test results chart: Update key maintenance – Symmetric – Controlling station	98
Table 48 – Test results chart: Update key maintenance – Symmetric – Controlled station	99
Table 49 – Test results chart: Update key maintenance – Asymmetric – Controlling station	100

Table 50 – Test results chart: Update key maintenance – Asymmetric – Controlled station	101
Table 51 – Test results chart: Session key maintenance – Controlling station	102
Table 52 – Test results chart: Session key maintenance – Controlled station	104
Table 53 – Test results chart: Challenge/reply authentication – Controlling station	105
Table 54 – Test results chart: Challenge/reply authentication – Controlled station	107
Table 55 – Test results chart: Aggressive mode authentication – Controlling station	109
Table 56 – Test results chart: Aggressive mode authentication – Controlled station	110

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**POWER SYSTEMS MANAGEMENT AND ASSOCIATED INFORMATION
EXCHANGE – DATA AND COMMUNICATIONS SECURITY –****Part 100-1: Conformance test cases for IEC TS 62351-5
and IEC TS 60870-5-7**

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IEC TS 62351-100-1, which is a technical specification, has been prepared by IEC technical committee 57: Power systems management and associated information exchange.

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

Enquiry draft	Report on voting
57/1980/DTS	57/2016/RVDTS

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

A list of all parts in the IEC 62351 series, published under the general title *Power systems management and associated information exchange – Data and communications security*, can be found on the IEC website.

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

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INTRODUCTION

This technical specification describes test cases for conformance testing of telecontrol equipment or systems using the IEC TS 62351-5 security extension and its application in IEC TS 60870-5-7 for IEC 60870-5-101 and IEC 60870-5-104 communication protocols.

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POWER SYSTEMS MANAGEMENT AND ASSOCIATED INFORMATION EXCHANGE – DATA AND COMMUNICATIONS SECURITY –

Part 100-1: Conformance test cases for IEC TS 62351-5 and IEC TS 60870-5-7

1 Scope

This part of IEC 62351, which is a technical specification, describes test cases of data and communication security for telecontrol equipment, substation automation systems (SAS) and telecontrol systems, including front-end functions of SCADA.

The goal of this document is to enable interoperability by providing a standard method of testing protocol implementations to verify that a device fulfils the requirement of the standard. Note that conformity to the standard does not guarantee interoperability between devices using different implementations. It is expected that using this specification during testing will minimize the risk of non-interoperability. A basic condition for this interoperability is a passed conformance test of both devices.

The scope of this document is to specify commonly available procedures and definitions for conformance and/or interoperability testing of IEC TS 62351-5 and IEC TS 60870-5-7. The conformance test cases defined herein are focused to verify the conformant integration of the underlying authentication, as specified in IEC TS 62351-5 and IEC TS 60870-5-7, to protect IEC 60870-5-101 and IEC 60870-5-104-based communications.

This document deals with data and communication security 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 is done according to these standards.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.¹

IEC 60870-5-6:2006, *Telecontrol equipment and systems – Part 5-6: Guidelines for conformance testing for the IEC 60870-5 companion standards*

IEC TS 60870-5-7:2013, *Telecontrol equipment and systems – Part 5-7: Transmission protocols – Security extensions to IEC 60870-5-101 and IEC 60870-5-104 protocols (applying IEC 62351)*

IEC 60870-5-101:2003, *Telecontrol equipment and systems – Part 5-101: Transmission protocols – Companion standard for basic telecontrol tasks*

¹ The base standard always takes precedence. In case of ambiguity between this document and the base standards (IEC TS 62351-5 and IEC TS 60870-5-7), this part of IEC 62351 needs to be clarified or amended.

When testing, negative behaviour is not described in the base standard. The behaviour described in this document prevails and should be observed. The conformance statement produced after testing indicates any lack of conformance to either the test plan or the base standard.

IEC 60870-5-104:2006, *Telecontrol equipment and systems – Part 5-104: Transmission protocols – Network access for IEC 60870-5-101 using standard transport profiles*

IEC TS 60870-5-601:2015, *Telecontrol equipment and systems – Part 5-601: Transmission protocols – Conformance test cases for the IEC 60870-5-101 companion standard*

IEC TS 60870-5-604:2016, *Telecontrol equipment and systems – Part 5-604: Conformance test cases for the IEC 60870-5-104 companion standard*

IEC TS 62351-2, *Power systems management and associated information exchange – Data and communications security – Part 2: Glossary of terms*

IEC TS 62351-5:2013, *Power systems management and associated information exchange – Data and communications security – Part 5: Security for IEC 60870-5 and derivatives*

IEC 62351-9:2017, *Power systems management and associated information exchange – Data and communications security – Part 9: Cyber security key management for power system equipment*

3 Terms, definitions and abbreviated terms

For the purposes of this document, the terms and definitions given in IEC TS 62351-2 and the following 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 Terms and definitions

3.1.1

Application Service Data Unit

ASDU

application layer message submitted to lower layers for transmission

3.1.2

control direction

direction of transmission from the controlling station to a controlled station

3.1.3

controlled station

station which is monitored, or commanded and monitored by a master (controlling) station

Note 1 to entry: This is commonly called an “outstation” or “slave” or “server” in some specifications.

3.1.4

controlling station

station which performs the telecontrol of outstations (controlled station)

Note 1 to entry: This is commonly called a “master” or “master station” or “client” in some specifications.

3.1.5

interoperability

ability of two or more telecontrol devices from the same vendor, or different vendors, to exchange information and use that information for correct cooperation

3.1.6

Message Authentication Code MAC

calculated value used by a receiving station to authenticate and check the integrity of an information

3.1.7

monitor direction

direction of transmission from a controlled station to a controlling station

3.1.8

normal procedure tests

set of test cases to verify that the device fulfils the requirements of the standard in the expected (normal) conditions

3.1.9

Protocol Implementation Conformance Statement PICS

summary of the referencing standard capabilities of the system to be tested

3.1.10

Protocol Implementation Document PID

document which describes complete functionalities and system specific information

Note 1 to entry: The PID consists of the PICS and the PIXIT.

3.1.11

Protocol Implementation eXtra Information for Testing PIXIT

document containing system specific information regarding the capabilities of the system to be tested and specifying which items are optional

3.1.12

resiliency tests

set of test cases to verify that the device fulfils the requirements of the standard in reacting to the unexpected (error) conditions

3.1.13

test equipment

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

3.1.14

test initiator

party initiating a conformance test of a device that is executed by a test facility

3.1.15

test facility

supplier-independent organization which is able to provide appropriate test equipment and trained staff for conformance testing

3.1.16

user number

USR

numeric value that unambiguously identifying a user in the protocol

3.2 Abbreviated terms

For the purposes of this document, the abbreviated terms given in IEC TS 62351-2 and the following apply.

ASDU	Application service data unit
CASDU	Common address of ASDU
COT	Cause of transmission
DUT	Device under test
IOA	Information object address
IP	Inter-networking protocol
MAC	Message authentication code
PICS	Protocol implementation conformance statement
PID	Protocol implementation document (=PICS + PIXIT)
PIXIT	Protocol implementation extra information for testing
SAS	Substation automation system
SCADA	Supervisory control and data acquisition
TCP	Transport control protocol
USR	User number

4 General

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4.1 Normatives covered by this technical specification

This document defines the conformance test cases for IEC TS 62351-5 and IEC TS 60870-5-7 and the security extensions for IEC 60870-5-101 and IEC 60870-5-104 base protocols.

Test cases for IEC 60870-5-101 and IEC 60870-5-104 base protocols are not in the scope of this document since they are already defined respectively in IEC TS 60870-5-601 and IEC TS 60870-5-604.

4.2 Conformance testing structure

4.2.1 General

The security extension defined in IEC TS 62351-5 and IEC TS 60870-5-7 introduces new procedures and new ASDU types to be exchanged at application level, each procedure has its own set of messages exchanged during execution.

The conformance test cases are divided into five clauses:

- Clause 5: Verification of configuration parameters. This clause contains the configuration parameters affecting the message contents and/or the protocol behaviour.
- Clause 6: Verification of communication. The goal of this clause is to verify that DUT is able to implement the security extension messages as described in IEC TS 60870-5-7.
- Clause 7: Verification of procedures. The goal of this clause is to verify that DUT is able to execute the security extension procedures as described in IEC TS 62351-5.
- Clause 8: Test result chart. This clause contains the results of the test cases listed in Clauses 6 and 7 for each supported value of the configuration parameters listed in Clause 5.

The test cases are organized in tables (see Tables 4 to 56). They are numbered; their numbering syntax is: Subclause number (where the Table is located) + test case number.

In the column 'reference' each test case has a direct reference to IEC TS 62351-5 or IEC TS 60870-5-7 where the clause under test is defined.

Test cases are mandatory depending on the description in the column 'Required'. The following situations are possible:

M = Mandatory test case. The test is referencing a clause that is mandatory in IEC TS 62351-5 or IEC TS 60870-5-7.

PICS x, x = Mandatory test case if the functionality is enabled in the PICS (by marking the applicable check box), with a reference to the section number of the PICS (x.x).

4.2.2 Conformance testing of security extension procedures

The security extension procedures can be summarized as follows:

- User management
- Update key maintenance
- Session key maintenance
- Challenge/Reply authentication
- Aggressive Mode authentication

In general, these procedures are executed in sequence as shown in Figure 1.

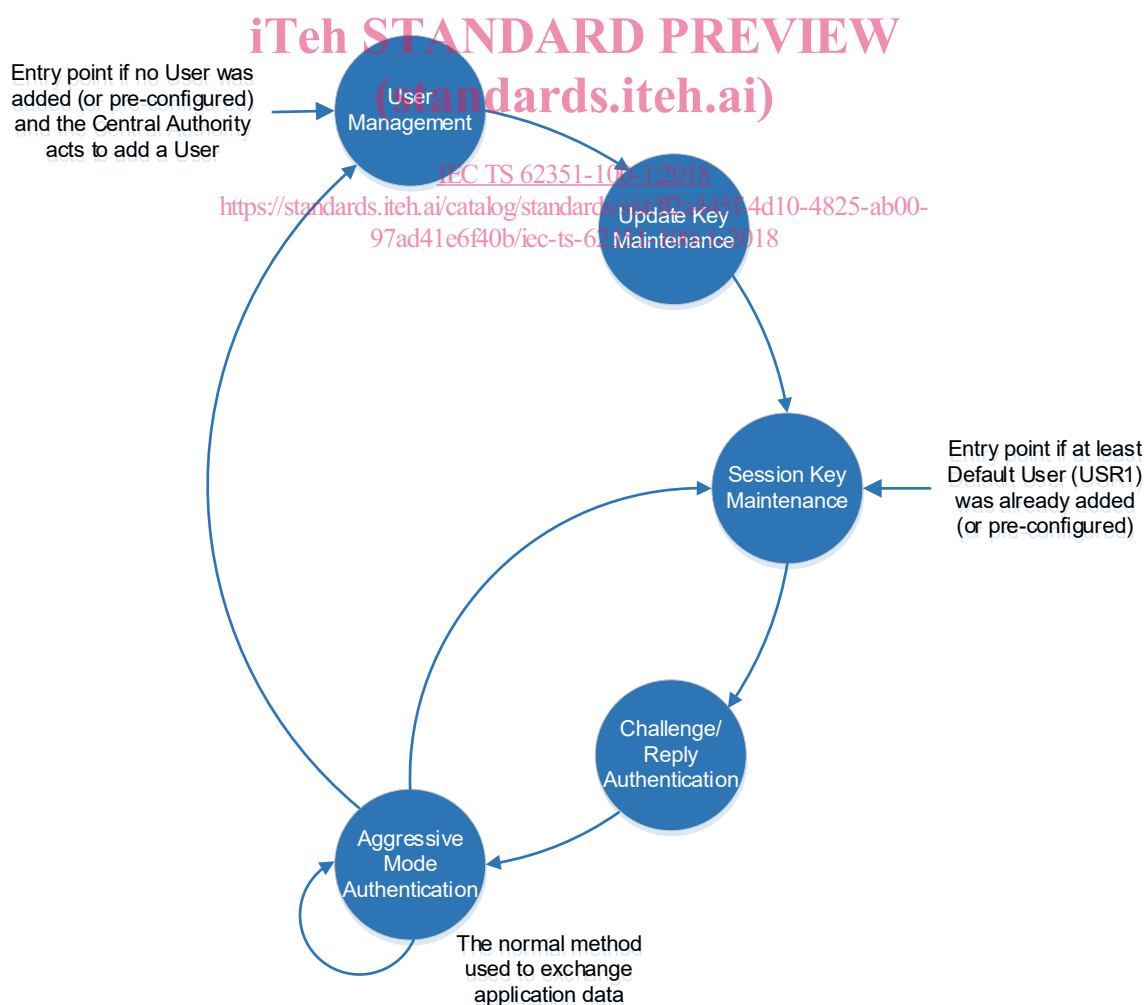


Figure 1 – IEC TS 62351-5 Security extension procedures