

Telecontrol equipment and systems —

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

ICS 33.200

National foreword

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Cross-references

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



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TELECONTROL EQUIPMENT AND SYSTEMS –

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

1 Scope

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

The use of this part of IEC 60870 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 during testing will minimize the risk of non-interoperability.

The goal of this part of IEC 60870 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 IEC 60870-5-6. The detailed test cases per companion standard, containing among others mandatory and optional mandatory test cases per Basic Application Function, ASDU and transmission procedures, will become available as a technical specification (TS). Other functionality may need additional test cases but this is beyond the scope of this part of IEC 60870. For proper testing, it is recommended to define these additional test cases.

This part of IEC 60870 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 is done in accordance with these 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.¹

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*

¹ The base standard always takes precedence. In case of ambiguity between this part of IEC 60870 and the base standards (IEC 60870-5-1 to IEC 60870-5-5, IEC 60870-5-101), this part of IEC 60870 needs to be clarified or amended.

When testing negative behavior is not described in the base standard, the behavior described in this part of IEC 60870 shall prevail and shall be observed.

The conformance statement produced after testing shall indicate any lack of conformance to either the test plan or the base standard.

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*

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

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

IEEE 754, *Standard for Binary Floating-Point Arithmetic*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60870-5-6 apply.

4 Abbreviated terms

For the purposes of this document, the abbreviations given in IEC 60870-5-6 apply.

5 Conformance testing for IEC 60870-5-101

5.1 Overview and legend

Procedural and functional testing should always start with the Station Initialisation function and proceeds with the next Basic Application Functions. The procedure in each test case should be followed, which means that the DUT is able to function as described in the specific test case.

The test procedures in Tables 1 to 14 should be tested with no errors detected during testing of all the Basic Application Functions in Tables 15 to 32. These tests are preferably automatically performed by the used test platform.

In addition to the performance criteria listed in the test procedures, 5.3 lists the protocol specifications that should be verified automatically by the testing software or verified manually by review of the test history log after execution of the test procedures. The verification should result in no errors detected during the complete test procedure.

This test plan has a direct reference to the PICS and possibly a PIXIT. Without a reference to a PICS or PIXIT, this test plan is obsolete.

Test case numbering syntax is Subclause number + Table number + test case number.

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

- M = Mandatory test case regardless if enabled in the PICS/PIXIT, not only in one situation but during execution of all the tests as in the PICS and/or PIXIT
- 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 Subclause number of the PICS (x.x); For example: PICS 8.x always refers to 60870-5-101:2003, Clause 8

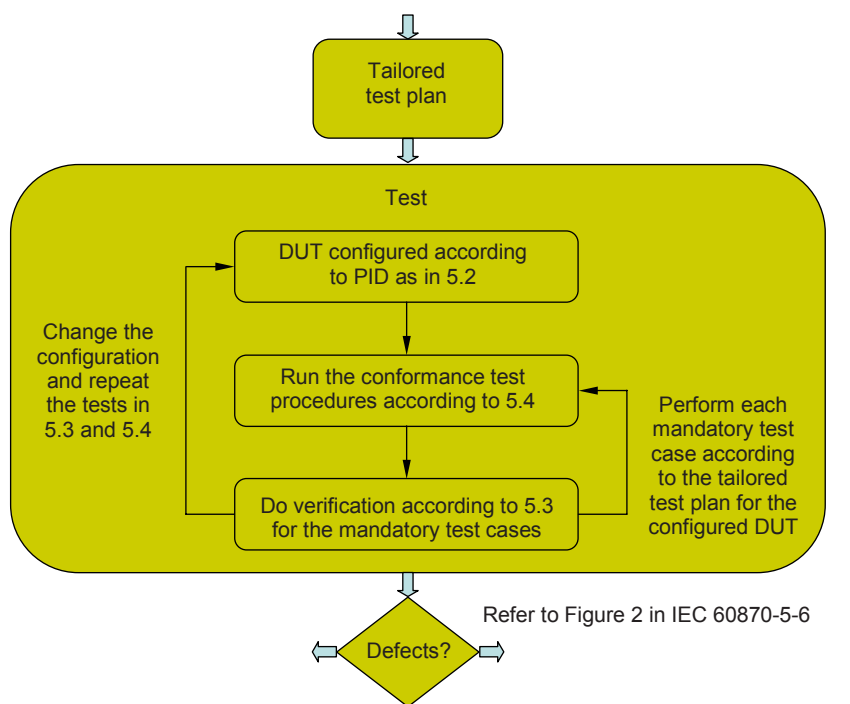
PIXIT = Mandatory test case if the functionality is enabled/described in the PIXIT. Verification of these test cases by the user/owner of the PIXIT is required before the test is started.

For each test case, the test results need to be marked in the appropriate column of the test result chart in 5.5 and 5.6. Each test case can either pass the test (Passed), fail the test (Failed), be not applicable when the configuration value is not supported by the device (N.A.), or the test case was not performed (Empty). Ideally there should be no empty boxes when testing is complete.

The test Tables are divided in five subclauses:

- Subclause 5.2 Configuration Parameters for IEC 60870-5-101
- Subclause 5.3 Verification of IEC 60870-5-101 communication
- Subclause 5.4 Conformance Test Procedures
- Subclause 5.5 Test Result Chart
- Subclause 5.6 Test Results of Command Transmission

The procedure to perform all the mandatory test cases according to the PID, is shown in Figure 1.



IEC 1132/06

Figure 1 – Test procedure

5.2 Configuration Parameters for IEC 60870-5-101

Table 1 – Configuration Parameters for IEC 60870-5-101

Table 1a – Configuration Parameter Values

Since IEC 60870-5-101 contains a number of configuration parameters affecting protocol behaviour, it should be tested that the functionality in 5.3 and 5.4 is correct for the configuration(s) in Table 1a.

Test No.	Test	Description	Reference	Required
5.2.1.1	System definition	Controlling station test (Master)		PICS, 8.1
5.2.1.2		Controlled station test (Slave)		PICS, 8.1
5.2.1.20	Physical layer	Transmission speed(s) in control direction test maximum baud rate, minimum baud rate, and one other baud rate.	IEC 60870-5-101, 5.1	PICS, 8.3
5.2.1.21		Transmission speed(s) in monitor direction test maximum baud rate, minimum baud rate, and one other baud rate.	IEC 60870-5-101, 5.1	PICS, 8.3
5.2.1.30	Link Layer	Unbalanced transmission	IEC 60870-5-2, 6	PICS, 8.4
5.2.1.31		Balanced transmission	IEC 60870-5-2, 6	PICS, 8.4
5.2.1.40	Address field of the Link	Zero (0) octets for address field (balanced only)	IEC 60870-5-2, 5.1.3, 6.1.3	PICS, 8.4
5.2.1.41		One (1) octet for address field	IEC 60870-5-2, 5.1.3, 6.1.3	PICS, 8.4
5.2.1.42		Two (2) octets for address field	IEC 60870-5-2, 5.1.3, 6.1.3	PICS, 8.4
5.2.1.50	Frame length	Maximum length L (control direction)	IEC 60870-5-101, 6.2	PICS, 8.4
5.2.1.51		Maximum length L (monitor direction)	IEC 60870-5-101, 6.2	PICS, 8.4
5.2.1.60	Assignment Class 2 messages	Standard assignment of class 2 messages	IEC 60870-5-101, 6.2, 7.4.2	PICS, 8.4
5.2.1.61		Special assignments of class 2 messages	IEC 60870-5-101, 6.2, 7.4.2	PIXIT
5.2.1.70	COMMON ADDRESS of ASDU	One (1) octet for Common Address of ASDU (CASDU)	IEC 60870-5-101, 7.2.4	PICS, 8.5
5.2.1.71		Two (2) octets for Common Address of ASDU (CASDU)	IEC 60870-5-101, 7.2.4	PICS, 8.5
5.2.1.80	INFORMATION OBJECT ADDRESS	One (1) octet for Information Object Address (structured or unstructured)	IEC 60870-5-101, 7.2.5	PICS, 8.5
5.2.1.81		Two (2) octets for Information Object Address (structured or unstructured)	IEC 60870-5-101, 7.2.5	PICS, 8.5
5.2.1.82		Three (3) octets for Information Object Address (structured or unstructured)	IEC 60870-5-101, 7.2.5	PICS, 8.5
5.2.1.90	CAUSE OF TRANSMISSION	One (1) octet for COT field	IEC 60870-5-101, 7.2.3	PICS, 8.5
5.2.1.91		Two (2) octets for COT field (2 nd octet is Originator address)	IEC 60870-5-101, 7.2.3	PICS, 8.5

Table 1b – Conformance Test Procedures only for system testing (for example in the case of interoperability testing)

Test No.	Test	Description	Reference	Required
5.2.1.100	System definition	System test (in case of interoperability testing)		PICS, 8.1
5.2.1.110	Network configuration	Point-to-point	IEC 60870-5-101, 5.1	PICS, 8.2
5.2.1.111		Multiple point-to-point	IEC 60870-5-101, 5.1	PICS, 8.2
5.2.1.112		Multipoint party line	IEC 60870-5-101, 5.1	PICS, 8.2
5.2.1.113		Multipoint star	IEC 60870-5-101, 5.1	PICS, 8.2
5.2.1.120	Address field of the Link	Link address unstructured	IEC 60870-5-2, 5.1.3, 6.1.3	PICS, 8.4
5.2.1.121		Link address structured	IEC 60870-5-2, 5.1.3, 6.1.3	PICS, 8.4, PIXIT
5.2.1.130	INFORMATION OBJECT ADDRESS	Information Object Address unstructured	IEC 60870-5-101, 7.2.5	PICS, 8.5
5.2.1.131		Information Object Address structured	IEC 60870-5-101, 7.2.5	PICS, 8.5 PIXIT

5.3 Verification of IEC 60870-5-101 communication

This Subclause lists the protocol specifications that should be verified automatically by the testing software or verified manually by review of the test history log after execution of the test procedures. Each test case describes a functionality that has passed the test if the functionality as in the description column was proved to be correct. Correct means: the functionality should be checked either automatically or manually, and also be checked by the test engineer in a human readable format log-file. For example, to test the IV qualifier of some information elements, the ASDU containing this element should be sent with the IV=1. This should be automatically checked by the test software or observed by the test engineer in the log-file. Each test case marked “Passed”, should be verifiable during testing and archived in log-files for post assessment.

To identify if a test case is mandatory, it is necessary to read 5.1 carefully.

Table 2 – Verification of the Physical Level

Test No.	Test	Description	Reference	Required
5.3.2.1	BYTEFRAME	Start-/stop-bit, even parity	IEC 60870-5-1, 6.2.4.2	M

Table 3 – Verification of the Link Level

Test No.	Test	Description	Reference	Required
5.3.3.10	FT1.2 FRAME LAYOUT (Single, Fixed and Variable)	Single control character I: E5 _H	IEC 60870-5-1, 6.2.4.2	PIXIT
5.3.3.11		Start character of fixed length frames: 10 _H	IEC 60870-5-1, 6.2.4.2	M
5.3.3.12		0 octets (No User data) as Link User data length of fixed length frames	IEC 60870-5-1, 6.2.4.2	M
5.3.3.13		Start character of variable length frames: 68 _H	IEC 60870-5-1, 6.2.4.2	M
5.3.3.14		Configured number of octets L (repeated) as the maximum number of User Data octets from Controlling to Controlled station in variable length frames: max. 255	IEC 60870-5-1, 6.2.4.2	PICS, 8.4
5.3.3.15		Configured number of octets L (repeated) as the maximum number of User Data octets from Controlled to Controlling station in variable length frames: max. 255	IEC 60870-5-1, 6.2.4.2	PICS, 8.4
5.3.3.16		Second start character of variable length frames: 68 _H	IEC 60870-5-1, 6.2.4.2	M
5.3.3.17		Single octet Control Field	IEC 60870-5-1, 6.2.4.2	M
5.3.3.18		Configured number of octets for Link address field	IEC 60870-5-1, 6.2.4.2	PICS, 8.4
5.3.3.19		Checksum (8-bit arithmetic sum)	IEC 60870-5-1, 6.2.4.2	M
5.3.3.20		Stop character of fixed and variable length frames: 16 _H	IEC 60870-5-1, 6.2.4.2	M
5.3.3.30	BYTELAG	Line idle intervals (stream of "1" bits) between characters of a frame do not exceed one bit time (octets are received within 110 % of raw transmission time)	IEC 60870-5-1, 6.2.4.2 IEC 60870-5-101, 6.1	M
5.3.3.40	CONTROL FIELD	High order bit RES = 0 (unbalanced only)	IEC 60870-5-2, 5.1.2	PICS, 8.4
5.3.3.41		DIR = 1 for messages from Controlling station (A) to Controlled station (B) (balanced only)	IEC 60870-5-2, 6.1.2	PICS, 8.4
5.3.3.42		DIR = 0 for messages from Controlled station (B) to Controlling station (A) (balanced only)	IEC 60870-5-2, 6.1.2	PICS, 8.4
5.3.3.43		PRM = 0 in messages from the Controlled station	IEC 60870-5-2, 5.1.2, 6.1.2	M
5.3.3.44		PRM = 0: only FCODEs 0, 1, 8, 9, 11, 14, or 15 (unbalanced only)	IEC 60870-5-2, 5.1.2	PICS, 8.4
5.3.3.45		PRM = 0: only FCODEs 0, 1, 11, 14, or 15 (balanced only)	IEC 60870-5-2, 6.1.2	PICS, 8.4
5.3.3.46		PRM = 1 in messages from the Controlling station	IEC 60870-5-2, 5.1.2, 6.1.2	M
5.3.3.47		PRM = 1: only Primary FCODEs 0, 1, 3, 4, 8, 9, 10 or 11 (unbalanced only)	IEC 60870-5-2, 5.1.2	PICS, 8.4
5.3.3.48		PRM = 1: only Primary FCODEs 0, 1, 2, 3, 4 or 9 (balanced only)	IEC 60870-5-2, 6.1.2	PICS, 8.4
5.3.3.49		In case of FCV = 1 and FCB unchanged, the last message is repeated	IEC 60870-5-2, 5.1.2, 6.1.2	M
5.3.3.50		In case of reset commands F-CODE 0 or 1 FCB = 0 (expect next FCB=1)	IEC 60870-5-2, 5.1.2, 6.1.2	M
5.3.3.51		DFC = 0 : further messages are acceptable	IEC 60870-5-2, 5.1.2, 6.1.2	M
5.3.3.52		DFC = 1 : further messages may cause data overflow	IEC 60870-5-2, 5.1.2	M

Table 3 (continued)

Test No.	Test	Description	Reference	Required
5.3.3.60	UNBALANCED TRANSMISSION PROCEDURE	Unbalanced transmission	IEC 60870-5-2, Clause 5	PICS, 8.4
5.3.3.61		Service S1 – SEND/No reply	IEC 60870-5-2, 4.1	PIXIT
5.3.3.62		Service S2 – SEND/CONFIRM expected	IEC 60870-5-2, 4.2	M
5.3.3.63		Service S3 – REQUEST/RESPOND expected	IEC 60870-5-2, 4.3	M
5.3.3.64		Primary F-CODE 0 : answered with Secondary F-CODE 0,1,14,15	IEC 60870-5-2, 4.2.2, 5.1.2	PIXIT
5.3.3.65		Primary F-CODE 1 : answered with Secondary F-CODE 0,1,14,15	IEC 60870-5-2, 4.2.2, 5.1.2	PIXIT
5.3.3.66		Primary F-CODE 3 : answered with Secondary F-CODE 0,1,14,15	IEC 60870-5-2, 4.2.2, 5.1.2	PIXIT
5.3.3.67		Primary F-CODE 4 : not answered by Secondary	IEC 60870-5-2, 4.1.2, 5.1.2	PIXIT
5.3.3.68		Primary F-CODE 8 : answered with Secondary F-CODE 11, 14, 15	IEC 60870-5-2, 4.3.2, 5.1.2	PIXIT
5.3.3.69		Primary F-CODE 9 : answered with Secondary F-CODE 11, 14, 15	IEC 60870-5-2, 4.3.2, 5.1.2	PIXIT
5.3.3.70		Primary F-CODE 10 : answered with Secondary F-CODE 8, 9, 14, 15	IEC 60870-5-2, 4.3.2, 5.1.2	PIXIT
5.3.3.71		Primary F-CODE 11 : answered with Secondary F-CODE 8, 9, 14, 15	IEC 60870-5-2, 4.3.2, 5.1.2	PIXIT
5.3.3.72		Primary F-CODE 2, 5...7, 12...15: answered with Secondary F-CODE 15	IEC 60870-5-2, 4.2.2, 5.1.2	PIXIT
5.3.3.73		A not supported or implemented F-code is answered with Secondary F-CODE 14 or 15	IEC 60870-5-2, 4.2.2, 5.1.2	M
5.3.3.80	BALANCED TRANSMISSION PROCEDURE	Balanced transmission	IEC 60870-5-2, Clause 6	PICS, 8.4
5.3.3.81		Service S1 – SEND/No reply	IEC 60870-5-2, 4.1	M
5.3.3.82		Service S2 – SEND/CONFIRM expected	IEC 60870-5-2, 4.2	M
5.3.3.83		Service S3 – REQUEST/RESPOND expected	IEC 60870-5-2, 4.3	M
5.3.3.84		Primary F-CODE 0 : answered with Secondary F-CODE 0,1,14,15	IEC 60870-5-2, 4.2.2, 6.1.2	PIXIT
5.3.3.85		Primary F-CODE 1 : answered with Secondary F-CODE 0,1,14,15	IEC 60870-5-2, 4.2.2, 6.1.2	PIXIT
5.3.3.86		Primary F-CODE 2 : answered with Secondary F-CODE 0,1,14,15	IEC 60870-5-2, 4.1.2, 6.1.2	PIXIT
5.3.3.87		Primary F-CODE 3 : answered with Secondary F-CODE 0,1,14,15	IEC 60870-5-2, 4.3.2, 6.1.2	PIXIT
5.3.3.88		Primary F-CODE 4 : not answered by Secondary	IEC 60870-5-2, 4.3.2, 6.1.2	PIXIT
5.3.3.89		Primary F-CODE 9 : answered with Secondary F-CODE 11, 14, 15	IEC 60870-5-2, 4.3.2, 6.1.2	PIXIT
5.3.3.90		Primary F-CODE 5...8, 10...15: answered with Secondary F-CODE 15	IEC 60870-5-2, 4.2.2, 6.1.2	PIXIT
5.3.3.91		A not supported or implemented F-code is answered with Secondary F-CODE 14 or 15	IEC 60870-5-2, 4.2.2, 6.1.2	M

Table 3 (continued)

Test No.	Test	Description	Reference	Required
5.3.3.100	TIME OUT INTERVAL	Maximum time out interval (calculated) - Controlling station does a retry when no answer is received - Controlled station answers always within specified time	IEC 60870-5-2, Clause A.1, case 1, Figure A.2	PIXIT
5.3.3.101		Controlling station uses the configured maximum number of retries for data link services that are unanswered within the time out interval	IEC 60870-5-2, Clause 4	PICS, 8.4

Table 4 – Verification of the Data Unit Identifier

Test No.	Test	Description	Reference	Required
5.3.4.1	TYPE IDENTIFICATION	Compatible ASDU type used/accepted for all ASDUs as in the PICS	IEC 60870-5-101, 7.2.1.1	PICS, 8.5
5.3.4.10	VARIABLE STRUCTURE QUALIFIER	Variable structure qualifier SQ=0 (Sequence or Set) as defined for each ASDU		M
5.3.4.11		SQ:=1 only for COT Spontaneous (3), Cyclic/Periodic (1), Requested (5) or Interrogation (20...36). Check the PICS for the supported COT values. Make sure SQ=1 is only used for ASDU types that admit sequential packing.	IEC 60870-5-101, 7.2.2	PIXIT
5.3.4.12		Variable structure qualifier I (Number of elements) according to transmitted number of information elements for each ASDU	IEC 60870-5-101, 7.2.2	M
5.3.4.13		The number of octets for ASDU are supported as in the PICS	IEC 60870-5-101, 7.2	M
5.3.4.20	CAUSE OF TRANSMISSION	Originator address of Primary station is 0 if not used	IEC 60870-5-101, 7.2.3	PICS, 8.5
5.3.4.21		Originator address identifies source application of Primary station	IEC 60870-5-101, 7.2.3	PIXIT
5.3.4.22		Compatible Cause Of Transmission (COT) used/accepted. Check the PICS for the supported COT values	IEC 60870-5-101, 7.2.3	PICS, 8.5
5.3.4.23		P/N bit = 0: positive confirmation of activation	IEC 60870-5-101, 7.2.3	M
5.3.4.24		P/N bit = 1: negative confirmation of activation	IEC 60870-5-101, 7.2.3	M
5.3.4.25		Test bit = 0: ASDU generated during normal conditions	IEC 60870-5-101, 7.2.3	M
5.3.4.26		Test bit = 1: ASDU generated during test conditions	IEC 60870-5-101, 7.2.3	PIXIT
5.3.4.40	COMMON ADDRESS of ASDU	The options of the Common Address of ASDU (CASDU) are tested and reported in 5.5	IEC 60870-5-101, 7.2.4	PICS, 8.5

Table 5 – Verification of the object address

Test No.	Test	Description	Reference	Required
5.3.5.50	INFORMATION OBJECT ADDRESS	The options of the Information Object Address are tested and reported in 5.5	IEC 60870-5-101, 7.2.5	PICS, 8.5

Table 6 – Verification of ASDUs for Process information in monitor (Normal) direction

Test No.	Test	Description	Reference	Required
5.3.6.10	M_SP_NA_1	SIQ with SQ = 0, each element with its own IOA	IEC 60870-5-101, 7.3.1.1	PICS, 8.5
5.3.6.11	ASDU 1 Single-point information	SIQ with SQ = 1, with only the IOA of the first element and the following Information Elements are identified by numbers incrementing continuously by +1 from this offset (see IEC 60870-5-101, 7.2.2.1)	IEC 60870-5-101, 7.3.1.1	PIXIT
5.3.6.12		COT as defined in the attached PICS	IEC 60870-5-101, 7.3.1.1	PICS, 8.5
5.3.6.13	SIQ	SPI = 0 (OFF), 1 (ON)	IEC 60870-5-101, 7.2.6.1	PICS, 8.5
5.3.6.14		RES = 0	IEC 60870-5-101, 7.2.6.1	PICS, 8.5
5.3.6.15		BL = 0,1	IEC 60870-5-101, 7.2.6.1	PIXIT
5.3.6.16		SB = 0,1	IEC 60870-5-101, 7.2.6.1	PIXIT
5.3.6.17		NT = 0,1	IEC 60870-5-101, 7.2.6.1	PIXIT
5.3.6.18		IV = 0,1	IEC 60870-5-101, 7.2.6.1	PICS, 8.5
5.3.6.30	M_SP_TA_1	SIQ with SQ = 0, each element with its own IOA	IEC 60870-5-101, 7.3.1.2	PICS, 8.5
5.3.6.31	ASDU 2 Single-point information with time-tag	COT as defined in the attached PICS	IEC 60870-5-101, 7.3.1.2	PICS, 8.5
5.3.6.32	SIQ	SPI = 0 (OFF), 1 (ON)	IEC 60870-5-101, 7.2.6.1	PICS, 8.5
5.3.6.33		RES = 0	IEC 60870-5-101, 7.2.6.1	PICS, 8.5
5.3.6.34		BL = 0,1	IEC 60870-5-101, 7.2.6.1	PIXIT
5.3.6.35		SB = 0,1	IEC 60870-5-101, 7.2.6.1	PIXIT
5.3.6.36		NT = 0,1	IEC 60870-5-101, 7.2.6.1	PIXIT
5.3.6.37		IV = 0,1	IEC 60870-5-101, 7.2.6.1	PICS, 8.5
5.3.6.38	CP24TIME2a	milliseconds = 0..59999	IEC 60870-5-101, 7.2.6.19	PICS, 8.5
5.3.6.39		minutes = 0..59	IEC 60870-5-101, 7.2.6.19	PICS, 8.5
5.3.6.40		RES1 = 0	IEC 60870-5-101, 7.2.6.19	PICS, 8.5
5.3.6.41		IV = 0, 1	IEC 60870-5-101, 7.2.6.19	PICS, 8.5

Table 6 (continued)

Test No.	Test	Description	Reference	Required
5.3.6.50	M_DP_NA_1	DIQ with SQ = 0, each element with its own IOA	IEC 60870-5-101, 7.3.1.3	PICS, 8.5
5.3.6.51	ASDU 3 Double-point information	DIQ with SQ = 1, with only the IOA of the first element and the following Information Elements are identified by numbers incrementing continuously by +1 from this offset (see IEC 60870-5-101, 7.2.2.1)	IEC 60870-5-101, 7.3.1.3	PIXIT
5.3.6.52		COT as defined in the attached PICS	IEC 60870-5-101, 7.3.1.3	PICS, 8.5
5.3.6.53	DIQ	DPI = 0 (indeterminate or intermediate state), 1 (OFF), 2 (ON), 3 (indeterminate state)	IEC 60870-5-101, 7.2.6.2	PICS, 8.5
5.3.6.54		RES = 0	IEC 60870-5-101, 7.2.6.2	PICS, 8.5
5.3.6.55		BL = 0,1	IEC 60870-5-101, 7.2.6.2	PIXIT
5.3.6.56		SB = 0,1	IEC 60870-5-101, 7.2.6.2	PIXIT
5.3.6.57		NT = 0,1	IEC 60870-5-101, 7.2.6.2	PIXIT
5.3.6.58		IV = 0,1	IEC 60870-5-101, 7.2.6.2	PICS, 8.5
5.3.6.70	M_DP_TA_1	DIQ with SQ = 0, each element with its own IOA	IEC 60870-5-101, 7.3.1.4	PICS, 8.5
5.3.6.71	ASDU 4 Double-point information with time-tag	COT as defined in the attached PICS	IEC 60870-5-101, 7.3.1.4	PICS, 8.5
5.3.6.72	DIQ	DPI = 0 (indeterminate or intermediate state), 1 (OFF), 2 (ON), 3 (indeterminate state)	IEC 60870-5-101, 7.2.6.2	PICS, 8.5
5.3.6.73		RES = 0	IEC 60870-5-101, 7.2.6.2	PICS, 8.5
5.3.6.74		BL = 0,1	IEC 60870-5-101, 7.2.6.2	PIXIT
5.3.6.75		SB = 0,1	IEC 60870-5-101, 7.2.6.2	PIXIT
5.3.6.76		NT = 0,1	IEC 60870-5-101, 7.2.6.2	PIXIT
5.3.6.77		IV = 0,1	IEC 60870-5-101, 7.2.6.2	PICS, 8.5
5.3.6.78	CP24TIME2a	milliseconds = 0..59999	IEC 60870-5-101, 7.2.6.19	PICS, 8.5
5.3.6.79		Minutes = 0..59	IEC 60870-5-101, 7.2.6.19	PICS, 8.5
5.3.6.80		RES1 = 0	IEC 60870-5-101, 7.2.6.19	PICS, 8.5
5.3.6.81		IV = 0, 1	IEC 60870-5-101, 7.2.6.19	PICS, 8.5

Table 6 (continued)

Test No.	Test	Description	Reference	Required
5.3.6.90	M_ST_NA_1	VTI with SQ = 0, each element with its own IOA	IEC 60870-5-101, 7.3.1.5	PICS, 8.5
5.3.6.91	ASDU 5 Step-position information	VTI with SQ = 1, with only the IOA of the first element and the following Information Elements are identified by numbers incrementing continuously by +1 from this offset (see IEC 60870-5-101, 7.2.2.1)	IEC 60870-5-101, 7.3.1.5	PIXIT
5.3.6.92		COT as defined in the attached PICS	IEC 60870-5-101, 7.3.1.5	PICS, 8.5
5.3.6.93	VTI	Value valid range -64..+63	IEC 60870-5-101, 7.2.6.5	PICS, 8.5
5.3.6.94		Transient = 0,1	IEC 60870-5-101, 7.2.6.5	PICS, 8.5
5.3.6.95	QDS	RES = 0	IEC 60870-5-101, 7.2.6.3	PICS, 8.5
5.3.6.96		BL = 0,1	IEC 60870-5-101, 7.2.6.3	PIXIT
5.3.6.97		SB = 0,1	IEC 60870-5-101, 7.2.6.3	PIXIT
5.3.6.98		NT = 0,1	IEC 60870-5-101, 7.2.6.3	PIXIT
5.3.6.99		IV = 0,1	IEC 60870-5-101, 7.2.6.3	PICS, 8.5
5.3.6.100		OV = 0,1	IEC 60870-5-101, 7.2.6.3	PICS, 8.5
5.3.6.110	M_ST_TA_1	VTI with SQ = 0, each element with its own IOA	IEC 60870-5-101, 7.3.1.6	PICS, 8.5
5.3.6.111	ASDU 6 Step-position information with time-tag!	COT as defined in the attached PICS	IEC 60870-5-101, 7.3.1.6	PICS, 8.5
5.3.6.112				
5.3.6.112	VTI	Value valid range -64..+63	IEC 60870-5-101, 7.2.6.5	PICS, 8.5
5.3.6.113		Transient = 0,1	IEC 60870-5-101, 7.2.6.5	PICS, 8.5
5.3.6.114	QDS	RES = 0	IEC 60870-5-101, 7.2.6.3	PICS, 8.5
5.3.6.115		BL = 0,1	IEC 60870-5-101, 7.2.6.3	PIXIT
5.3.6.116		SB = 0,1	IEC 60870-5-101, 7.2.6.3	PIXIT
5.3.6.117		NT = 0,1	IEC 60870-5-101, 7.2.6.3	PIXIT
5.3.6.118		IV = 0,1	IEC 60870-5-101, 7.2.6.3	PICS, 8.5
5.3.6.119		OV = 0,1	IEC 60870-5-101, 7.2.6.3	PICS, 8.5
5.3.6.120	CP24TIME2a	milliseconds = 0..59999	IEC 60870-5-101, 7.2.6.19	PICS, 8.5
5.3.6.121		minutes = 0..59	IEC 60870-5-101, 7.2.6.19	PICS, 8.5
5.3.6.122		RES1 = 0	IEC 60870-5-101, 7.2.6.19	PICS, 8.5
5.3.6.123		IV = 0, 1	IEC 60870-5-101, 7.2.6.19	PICS, 8.5

Table 6 (continued)

Test No.	Test	Description	Reference	Required
5.3.6.130	M_BO_NA_1	BSI with SQ = 0, each element with its own IOA	IEC 60870-5-101, 7.3.1.7	PICS, 8.5
5.3.6.131	ASDU 7 Bitstring of 32 bit	BSI with SQ = 1, with only the IOA of the first element and the following Information Elements are identified by numbers incrementing continuously by +1 from this offset (see IEC 60870-5-101, 7.2.2.1)	IEC 60870-5-101, 7.3.1.7	PIXIT
5.3.6.132		COT as defined in the attached PICS	IEC 60870-5-101, 7.3.1.7	PICS, 8.5
5.3.6.133	BSI	BSI = 0,1	IEC 60870-5-101, 7.2.6.13	PICS, 8.5
5.3.6.134	QDS	RES = 0	IEC 60870-5-101, 7.2.6.3	PICS, 8.5
5.3.6.135		BL = 0,1	IEC 60870-5-101, 7.2.6.3	PIXIT
5.3.6.136		SB = 0,1	IEC 60870-5-101, 7.2.6.3	PIXIT
5.3.6.137		NT = 0,1	IEC 60870-5-101, 7.2.6.3	PIXIT
5.3.6.138		IV = 0,1	IEC 60870-5-101, 7.2.6.3	PICS, 8.5
5.3.6.139		OV = 0,1	IEC 60870-5-101, 7.2.6.3	PICS, 8.5
5.3.6.150	M_BO_TA_1	BSI with SQ = 0, each element with its own IOA	IEC 60870-5-101, 7.3.1.8	PICS, 8.5
5.3.6.151	ASDU 8 Bitstring of 32 bit with time-tag	COT as defined in the attached PICS	IEC 60870-5-101, 7.3.1.8	PICS, 8.5
5.3.6.152	BSI	BSI = 0,1	IEC 60870-5-101, 7.2.6.13	PICS, 8.5
5.3.6.153	QDS	RES = 0	IEC 60870-5-101, 7.2.6.3	PICS, 8.5
5.3.6.154		BL = 0,1	IEC 60870-5-101, 7.2.6.3	PIXIT
5.3.6.155		SB = 0,1	IEC 60870-5-101, 7.2.6.3	PIXIT
5.3.6.156		NT = 0,1	IEC 60870-5-101, 7.2.6.3	PIXIT
5.3.6.157		IV = 0,1	IEC 60870-5-101, 7.2.6.3	PICS, 8.5
5.3.6.158		OV = 0,1	IEC 60870-5-101, 7.2.6.3	PICS, 8.5
5.3.6.159	CP24TIME2a	milliseconds = 0..59999	IEC 60870-5-101, 7.2.6.19	PICS, 8.5
5.3.6.160		minutes = 0..59	IEC 60870-5-101, 7.2.6.19	PICS, 8.5
5.3.6.161		RES1 = 0	IEC 60870-5-101, 7.2.6.19	PICS, 8.5
5.3.6.162		IV = 0, 1	IEC 60870-5-101, 7.2.6.19	PICS, 8.5

Table 6 (continued)

Test No.	Test	Description	Reference	Required
5.3.6.170	M_ME_NA_1	NVA with SQ = 0, each element with its own IOA	IEC 60870-5-101, 7.3.1.9	PICS, 8.5
5.3.6.171	ASDU 9 Measured value, normalised value	NVA with SQ = 1, with only the IOA of the first element and the following Information Elements are identified by numbers incrementing continuously by +1 from this offset (see IEC 60870-5-101, 7.2.2.1)	IEC 60870-5-101, 7.3.1.9	PIXIT
5.3.6.172		COT as defined in the attached PICS	IEC 60870-5-101, 7.3.1.9	PICS, 8.5
5.3.6.173	NVA	Value (translation considering the scaling factor)	IEC 60870-5-101, 7.2.6.6	PICS, 8.5 PIXIT
5.3.6.174		Range -1 to +1-2 ⁻¹⁵	IEC 60870-5-101, 7.2.6.6	PICS, 8.5
5.3.6.175	QDS	RES = 0	IEC 60870-5-101, 7.2.6.3	PICS, 8.5
5.3.6.176		BL = 0,1	IEC 60870-5-101, 7.2.6.3	PIXIT
5.3.6.177		SB = 0,1	IEC 60870-5-101, 7.2.6.3	PIXIT
5.3.6.178		NT = 0,1	IEC 60870-5-101, 7.2.6.3	PIXIT
5.3.6.179		IV = 0,1	IEC 60870-5-101, 7.2.6.3	PICS, 8.5
5.3.6.180		OV = 0,1	IEC 60870-5-101, 7.2.6.3	PICS, 8.5
5.3.6.190	M_ME_TA_1	NVA with SQ = 0, each element with its own IOA	IEC 60870-5-101, 7.3.1.10	PICS, 8.5
5.3.6.191	ASDU 10 Measured value, normalised value with time-tag!	COT as defined in the attached PICS	IEC 60870-5-101, 7.3.1.10	PICS, 8.5
5.3.6.192	NVA	Value (translation considering the scaling factor)	IEC 60870-5-101, 7.2.6.6	PICS, 8.5 PIXIT
5.3.6.193		Range -1 to +1-2 ⁻¹⁵	IEC 60870-5-101, 7.2.6.6	PICS, 8.5
5.3.6.194	QDS	RES = 0	IEC 60870-5-101, 7.2.6.3	PICS, 8.5
5.3.6.195		BL = 0,1	IEC 60870-5-101, 7.2.6.3	PIXIT
5.3.6.196		SB = 0,1	IEC 60870-5-101, 7.2.6.3	PIXIT
5.3.6.197		NT = 0,1	IEC 60870-5-101, 7.2.6.3	PIXIT
5.3.6.198		IV = 0,1	IEC 60870-5-101, 7.2.6.3	PICS, 8.5
5.3.6.199		OV = 0,1	IEC 60870-5-101, 7.2.6.3	PICS, 8.5
5.3.6.200	CP24TIME2a	milliseconds = 0..59999	IEC 60870-5-101, 7.2.6.19	PICS, 8.5
5.3.6.201		minutes = 0..59	IEC 60870-5-101, 7.2.6.19	PICS, 8.5
5.3.6.202		RES1 = 0	IEC 60870-5-101, 7.2.6.19	PICS, 8.5
5.3.6.203		IV = 0, 1	IEC 60870-5-101, 7.2.6.19	PICS, 8.5

Table 6 (continued)

Test No.	Test	Description	Reference	Required
5.3.6.210	M_ME_NB_1	SVA with SQ = 0, each element with its own IOA	IEC 60870-5-101, 7.3.1.11	PICS, 8.5
5.3.6.211	ASDU 11 Measured value, scaled value	SVA with SQ = 1, with only the IOA of the first element and the following Information Elements are identified by numbers incrementing continuously by +1 from this offset (see IEC 60870-5-101, 7.2.2.1)	IEC 60870-5-101, 7.3.1.11	PIXIT
5.3.6.212		COT as defined in the attached PICS	IEC 60870-5-101, 7.3.1.11	PICS, 8.5
5.3.6.213	SVA	Value (translation considering the scaling factor)	IEC 60870-5-101, 7.2.6.7	PICS, 8.5 PIXIT
5.3.6.214		Range -2^{15} to $2^{15} - 1$	IEC 60870-5-101, 7.2.6.7	PICS, 8.5
5.3.6.215	QDS	RES = 0	IEC 60870-5-101, 7.2.6.3	PICS, 8.5
5.3.6.216		BL = 0,1	IEC 60870-5-101, 7.2.6.3	PIXIT
5.3.6.217		SB = 0,1	IEC 60870-5-101, 7.2.6.3	PIXIT
5.3.6.218		NT = 0,1	IEC 60870-5-101, 7.2.6.3	PIXIT
5.3.6.219		IV = 0,1	IEC 60870-5-101, 7.2.6.3	PICS, 8.5
5.3.6.220		OV = 0,1	IEC 60870-5-101, 7.2.6.3	PICS, 8.5
5.3.6.230	M_ME_TB_1	SVA with SQ = 0, each element with its own IOA	IEC 60870-5-101, 7.3.1.12	PICS, 8.5
5.3.6.231	ASDU 12 Measured value, scaled value with time-tag!	COT as defined in the attached PICS	IEC 60870-5-101, 7.3.1.12	PICS, 8.5
5.3.6.232	SVA	Value (translation considering the scaling factor)	IEC 60870-5-101, 7.2.6.7	PICS, 8.5 PIXIT
5.3.6.233		Range -2^{15} to $2^{15} - 1$	IEC 60870-5-101, 7.2.6.7	PICS, 8.5
5.3.6.234	QDS	RES = 0	IEC 60870-5-101, 7.2.6.3	PICS, 8.5
5.3.6.235		BL = 0,1	IEC 60870-5-101, 7.2.6.3	PIXIT
5.3.6.236		SB = 0,1	IEC 60870-5-101, 7.2.6.3	PIXIT
5.3.6.237		NT = 0,1	IEC 60870-5-101, 7.2.6.3	PIXIT
5.3.6.238		IV = 0,1	IEC 60870-5-101, 7.2.6.3	PICS, 8.5
5.3.6.239		OV = 0,1	IEC 60870-5-101, 7.2.6.3	PICS, 8.5
5.3.6.240	CP24TIME2a	milliseconds = 0..59999	IEC 60870-5-101, 7.2.6.19	PICS, 8.5
5.3.6.241		minutes = 0..59	IEC 60870-5-101, 7.2.6.19	PICS, 8.5
5.3.6.242		RES1 = 0	IEC 60870-5-101, 7.2.6.19	PICS, 8.5
5.3.6.243		IV = 0, 1	IEC 60870-5-101, 7.2.6.19	PICS, 8.5

Table 6 (continued)

Test No.	Test	Description	Reference	Required
5.3.6.250	M_ME_NC_1	IEEE STD 754 with SQ = 0, each element with its own IOA	IEC 60870-5-101, 7.3.1.13	PICS, 8.5
5.3.6.251	ASDU 13 Measured value, short floating point number	IEEE STD 754 with SQ = 1, with only the IOA of the first element and the following Information Elements are identified by numbers incrementing continuously by +1 from this offset (see IEC 60870-5-101, 7.2.2.1)	IEC 60870-5-101, 7.3.1.13	PIXIT
5.3.6.252		COT as defined in the attached PICS	IEC 60870-5-101, 7.3.1.13	PICS, 8.5
5.3.6.253	IEEE STD 754	Fraction = 0 .. $1-2^{-23}$	IEC 60870-5-101, 7.2.6.8 IEC 60870-5-4, 6.5	PICS, 8.5
5.3.6.254		Exponent = 0 .. 255	IEC 60870-5-101, 7.2.6.8 IEC 60870-5-4, 6.5	PICS, 8.5
5.3.6.255		Sign = 0,1	IEC 60870-5-101, 7.2.6.8 IEC 60870-5-4, 6.5	PICS, 8.5
5.3.6.256	QDS	RES = 0	IEC 60870-5-101, 7.2.6.3	PICS, 8.5
5.3.6.257		BL = 0,1	IEC 60870-5-101, 7.2.6.3	PIXIT
5.3.6.258		SB = 0,1	IEC 60870-5-101, 7.2.6.3	PIXIT
5.3.6.259		NT = 0,1	IEC 60870-5-101, 7.2.6.3	PIXIT
5.3.6.260		IV = 0,1	IEC 60870-5-101, 7.2.6.3	PICS, 8.5
5.3.6.261		OV = 0,1	IEC 60870-5-101, 7.2.6.3	PICS, 8.5
5.3.6.270	M_ME_TC_1	IEEE STD 754 with SQ = 0, each element with its own IOA	IEC 60870-5-101, 7.3.1.14	PICS, 8.5
5.3.6.271	ASDU 14 Measured value, short floating point number with time-tag	COT as defined in the attached PICS	IEC 60870-5-101, 7.3.1.14	PICS, 8.5
5.3.6.272	IEEE STD 754	Fraction = 0 .. $1-2^{-23}$	IEC 60870-5-101, 7.2.6.8 IEC 60870-5-4, 6.5	PICS, 8.5
5.3.6.273		Exponent = 0 .. 255	IEC 60870-5-101, 7.2.6.8 IEC 60870-5-4, 6.5	PICS, 8.5
5.3.6.274		Sign = 0,1	IEC 60870-5-101, 7.2.6.8 IEC 60870-5-4, 6.5	PICS, 8.5
5.3.6.275	QDS	RES = 0	IEC 60870-5-101, 7.2.6.3	PICS, 8.5
5.3.6.276		BL = 0,1	IEC 60870-5-101, 7.2.6.3	PIXIT
5.3.6.277		SB = 0,1	IEC 60870-5-101, 7.2.6.3	PIXIT
5.3.6.278		NT = 0,1	IEC 60870-5-101, 7.2.6.3	PIXIT
5.3.6.279		IV = 0,1	IEC 60870-5-101, 7.2.6.3	PICS, 8.5
5.3.6.280		OV = 0,1	IEC 60870-5-101, 7.2.6.3	PICS, 8.5

Table 6 (continued)

Test No.	Test	Description	Reference	Required
5.3.6.281	CP24TIME2a	milliseconds = 0..59999	IEC 60870-5-101, 7.2.6.19	PICS, 8.5
5.3.6.282		minutes = 0..59	IEC 60870-5-101, 7.2.6.19	PICS, 8.5
5.3.6.283		RES1 = 0	IEC 60870-5-101, 7.2.6.19	PICS, 8.5
5.3.6.284		IV = 0, 1	IEC 60870-5-101, 7.2.6.19	PICS, 8.5
5.3.6.300	M_IT_NA_1	BCR with SQ = 0, each element with its own IOA	IEC 60870-5-101, 7.3.1.15	PICS, 8.5
5.3.6.301	ASDU 15 Integrated totals	BCR with SQ = 1, with only the IOA of the first element and the following Information Elements are identified by numbers incrementing continuously by +1 from this offset (see IEC 60870-5-101, 7.2.2.1)	IEC 60870-5-101, 7.3.1.15	PIXIT
5.3.6.302		COT as defined in the attached PICS	IEC 60870-5-101, 7.3.1.15	PICS, 8.5
5.3.6.303	BCR	Value range -2^{31} to $+2^{31}-1$	IEC 60870-5-101, 7.2.6.9	PICS, 8.5
5.3.6.304		Sequence Number SQ range 0 to 31	IEC 60870-5-101, 7.2.6.9	PICS, 8.5
5.3.6.305		CY = 0,1	IEC 60870-5-101, 7.2.6.9	PICS, 8.5
5.3.6.306		CA = 0,1	IEC 60870-5-101, 7.2.6.9	PICS, 8.5
5.3.6.307		IV = 0,1	IEC 60870-5-101, 7.2.6.9	PICS, 8.5
5.3.6.320	M_IT_TA_1	BCR test with SQ = 0, each element with its own IOA	IEC 60870-5-101, 7.3.1.16	PICS, 8.5
5.3.6.321	ASDU 16 Integrated totals with time tag	COT as defined in the attached PICS	IEC 60870-5-101, 7.3.1.16	PICS, 8.5
5.3.6.322	BCR	Value range -2^{31} to $+2^{31}-1$	IEC 60870-5-101, 7.2.6.9	PICS, 8.5
5.3.6.323		Sequence Number SQ range 0 to 31	IEC 60870-5-101, 7.2.6.9	PICS, 8.5
5.3.6.324		CY = 0,1	IEC 60870-5-101, 7.2.6.9	PICS, 8.5
5.3.6.325		CA = 0,1	IEC 60870-5-101, 7.2.6.9	PICS, 8.5
5.3.6.326		IV = 0,1	IEC 60870-5-101, 7.2.6.9	PICS, 8.5
5.3.6.327	CP24TIME2a	milliseconds = 0..59999	IEC 60870-5-101, 7.2.6.19	PICS, 8.5
5.3.6.328		minutes = 0..59	IEC 60870-5-101, 7.2.6.19	PICS, 8.5
5.3.6.329		RES1 = 0	IEC 60870-5-101, 7.2.6.19	PICS, 8.5
5.3.6.330		IV = 0, 1	IEC 60870-5-101, 7.2.6.19	PICS, 8.5

Table 6 (continued)

Test No.	Test	Description	Reference	Required
5.3.6.340	M_EP_TA_1	SEP with SQ = 0, each element with its own IOA	IEC 60870-5-101, 7.3.1.17	PICS, 8.5
5.3.6.341	ASDU 17 Event of protection equipment with time-tag	COT as defined in the attached PICS	IEC 60870-5-101, 7.3.1.17	PICS, 8.5
5.3.6.342	SEP	RES = 0	IEC 60870-5-101, 7.2.6.10	PICS, 8.5
5.3.6.343		ES = 0,1	IEC 60870-5-101, 7.2.6.10	PIXIT
5.3.6.344		RES = 0	IEC 60870-5-101, 7.2.6.10	PIXIT
5.3.6.345		BL = 0,1	IEC 60870-5-101, 7.2.6.10	PIXIT
5.3.6.346		SB = 0,1	IEC 60870-5-101, 7.2.6.10	PIXIT
5.3.6.347		NT = 0,1	IEC 60870-5-101, 7.2.6.10	PIXIT
5.3.6.348		IV = 0,1	IEC 60870-5-101, 7.2.6.10	PICS, 8.5
5.3.6.349		EI = 0,1	IEC 60870-5-101, 7.2.6.10	PICS, 8.5
5.3.6.350	CP16Time2a	milliseconds = 0..59999	IEC 60870-5-101, 7.2.6.20	PICS, 8.5
5.3.6.351	CP24TIME2a	milliseconds = 0..59999	IEC 60870-5-101, 7.2.6.19	PICS, 8.5
5.3.6.352		minutes = 0..59	IEC 60870-5-101, 7.2.6.19	PICS, 8.5
5.3.6.353		RES1 = 0	IEC 60870-5-101, 7.2.6.19	PICS, 8.5
5.3.6.354		IV = 0, 1	IEC 60870-5-101, 7.2.6.19	PICS, 8.5
5.3.6.360	M_EP_TB_1	SPE with SQ = 0, each element with its own IOA	IEC 60870-5-101, 7.3.1.18	PICS, 8.5
5.3.6.361	ASDU 18 Packed start events of protection equipment with time-tag	COT as defined in the attached PICS	IEC 60870-5-101, 7.3.1.18	PICS, 8.5
5.3.6.362	SPE	RES = 0	IEC 60870-5-101, 7.2.6.11	PICS, 8.5
5.3.6.363		GS = 0,1	IEC 60870-5-101, 7.2.6.11	PIXIT
5.3.6.364		SL1 = 0,1	IEC 60870-5-101, 7.2.6.11	PIXIT
5.3.6.365		SL2 = 0,1	IEC 60870-5-101, 7.2.6.11	PIXIT
5.3.6.366		SL3 = 0,1	IEC 60870-5-101, 7.2.6.11	PIXIT
5.3.6.367		SIE = 0,1	IEC 60870-5-101, 7.2.6.11	PIXIT
5.3.6.368		SRD = 0,1	IEC 60870-5-101, 7.2.6.11	PIXIT

Table 6 (continued)

Test No.	Test	Description	Reference	Required
5.3.6.369	QDP	EI = 0,1	IEC 60870-5-101, 7.2.6.4	PIXIT
5.3.6.370		BL = 0,1	IEC 60870-5-101, 7.2.6.4	PIXIT
5.3.6.371		SB = 0,1	IEC 60870-5-101, 7.2.6.4	PIXIT
5.3.6.372		NT = 0,1	IEC 60870-5-101, 7.2.6.4	PIXIT
5.3.6.373		EI = 0,1	IEC 60870-5-101, 7.2.6.4	PIXIT
5.3.6.374		IV = 0,1	IEC 60870-5-101, 7.2.6.4	PICS, 8.5
5.3.6.375	CP16Time2a	milliseconds = 0..59999	IEC 60870-5-101, 7.2.6.20	PICS, 8.5
5.3.6.376	CP24TIME2a	milliseconds = 0..59999	IEC 60870-5-101, 7.2.6.19	PICS, 8.5
5.3.6.377		minutes = 0..59	IEC 60870-5-101, 7.2.6.19	PICS, 8.5
5.3.6.378		RES1 = 0	IEC 60870-5-101, 7.2.6.19	PICS, 8.5
5.3.6.379		IV = 0, 1	IEC 60870-5-101, 7.2.6.19	PICS, 8.5
5.3.6.390	M_EP_TC_1	OCI with SQ = 0, each element with its own IOA	IEC 60870-5-101, 7.3.1.19	PICS, 8.5
5.3.6.391	ASDU 19 Packet output circuit information of protection equipment with time tag	COT as defined in the attached PICS	IEC 60870-5-101, 7.3.1.19	PICS, 8.5
5.3.6.392	OCI	GC = 0,1	IEC 60870-5-101, 7.2.6.11	PIXIT
5.3.6.393		CL1 = 0,1	IEC 60870-5-101, 7.2.6.11	PIXIT
5.3.6.394		CL2 = 0,1	IEC 60870-5-101, 7.2.6.11	PIXIT
5.3.6.395		CL3 = 0,1	IEC 60870-5-101, 7.2.6.11	PIXIT
5.3.6.396		RES = 0	IEC 60870-5-101, 7.2.6.11	PICS, 8.5
5.3.6.397	QDP	RES = 0	IEC 60870-5-101, 7.2.6.4	PICS, 8.5
5.3.6.398		BL = 0,1	IEC 60870-5-101, 7.2.6.4	PIXIT
5.3.6.399		SB = 0,1	IEC 60870-5-101, 7.2.6.4	PIXIT
5.3.6.400		NT = 0,1	IEC 60870-5-101, 7.2.6.4	PIXIT
5.3.6.401		IV = 0,1	IEC 60870-5-101, 7.2.6.4	PICS, 8.5
5.3.6.402		EI = 0,1	IEC 60870-5-101, 7.2.6.4	PICS, 8.5
5.3.6.403	CP16Time2a	milliseconds = 0..59999	IEC 60870-5-101, 7.2.6.20	PICS, 8.5
5.3.6.404	CP24TIME2a	milliseconds = 0..59999	IEC 60870-5-101, 7.2.6.19	PICS, 8.5
5.3.6.405		minutes = 0..59	IEC 60870-5-101, 7.2.6.19	PICS, 8.5
5.3.6.406		RES1 = 0	IEC 60870-5-101, 7.2.6.19	PICS, 8.5
5.3.6.407		IV = 0, 1	IEC 60870-5-101, 7.2.6.19	PICS, 8.5

Table 6 (continued)

Test No.	Test	Description	Reference	Required
5.3.6.420	M_PS_NA_1	SCD with SQ = 0, each element with its own IOA	IEC 60870-5-101, 7.3.1.20	PICS, 8.5
5.3.6.421	ASDU 20 Packed single-point information with status change detection	SCD with SQ = 1, with only the IOA of the first element and the following Information Elements are identified by numbers incrementing continuously by +1 from this offset (see IEC 60870-5-101, 7.2.2.1)	IEC 60870-5-101, 7.3.1.20	PIXIT
5.3.6.422		COT as defined in the attached PICS	IEC 60870-5-101, 7.3.1.20	PICS, 8.5
5.3.6.423	SCD	STi = 0,1	IEC 60870-5-101, 7.2.6.40	PIXIT
5.3.6.424		CDi = 0,1	IEC 60870-5-101, 7.2.6.40	PIXIT
5.3.6.425	QDS	RES = 0	IEC 60870-5-101, 7.2.6.3	PICS, 8.5
5.3.6.426		BL = 0,1	IEC 60870-5-101, 7.2.6.3	PICS, 8.5
5.3.6.427		SB = 0,1	IEC 60870-5-101, 7.2.6.3	PIXIT
5.3.6.428		NT = 0,1	IEC 60870-5-101, 7.2.6.3	PIXIT
5.3.6.429		IV = 0,1	IEC 60870-5-101, 7.2.6.3	PICS, 8.5
5.3.6.430		OV = 0,1	IEC 60870-5-101, 7.2.6.3	PICS, 8.5
5.3.6.440	M_ME_ND_1	NVA with SQ = 0, each element with its own IOA	IEC 60870-5-101, 7.3.1.21	PICS, 8.5
5.3.6.441	ASDU 21 Measured value, normalised value without quality descriptor	NVA with SQ = 1, with only the IOA of the first element and the following Information Elements are identified by numbers incrementing continuously by +1 from this offset (see IEC 60870-5-101, 7.2.2.1)	IEC 60870-5-101, 7.3.1.21	PIXIT
5.3.6.442		COT as defined in the attached PICS	IEC 60870-5-101, 7.3.1.21	PICS, 8.5
5.3.6.443	NVA	Value (translation considering the scaling factor)	IEC 60870-5-101, 7.2.6.6	PICS, 8.5 PIXIT
5.3.6.444		Range -1 to +1·2 ⁻¹⁵	IEC 60870-5-101, 7.2.6.6	PICS, 8.5
5.3.6.450	M_SP_TB_1	SIQ with SQ = 0, each element with its own IOA	IEC 60870-5-101, 7.3.1.22	PICS, 8.5
5.3.6.451	ASDU 30 Single-point information with time tag CP56Time2a	COT as defined in the attached PICS	IEC 60870-5-101, 7.3.1.22	PICS, 8.5
5.3.6.452	SIQ	SPI = 0 (OFF), 1 (ON)	IEC 60870-5-101, 7.2.6.1	PICS, 8.5
5.3.6.453		RES = 0	IEC 60870-5-101, 7.2.6.1	PICS, 8.5
5.3.6.454		BL = 0,1	IEC 60870-5-101, 7.2.6.1	PIXIT
5.3.6.455		SB = 0,1	IEC 60870-5-101, 7.2.6.1	PIXIT
5.3.6.456		NT = 0,1	IEC 60870-5-101, 7.2.6.1	PIXIT
5.3.6.457		IV = 0,1	IEC 60870-5-101, 7.2.6.1	PICS, 8.5

Table 6 (continued)

Test No.	Test	Description	Reference	Required
5.3.6.458	CP56TIME2A	milliseconds = 0..59999	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.459		minutes = 0..59	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.460		hours = 0..23	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.461		Res1 = <0> genuine time, or <1> substituted time	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.462		res2, res3, res4 = 0	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.463		IV = 0..1	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.464		SU = 0..1	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.465		day of week = 0 or 1..7	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.466		day of month = 1..31	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.467		month = 1..12	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.468		year = 0..99 (year 2000 = 00, year 1999 is 99)	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.480	M_DP_TB_1	DIQ with SQ = 0, each element with its own IOA	IEC 60870-5-101, 7.3.1.23	PICS, 8.5
5.3.6.481	ASDU 31 Double-point information with time- tag CP56Time2a	COT as defined in the attached PICS	IEC 60870-5-101, 7.3.1.23	PICS, 8.5
5.3.6.482	DIQ	DIQ = 0 (indeterminate or intermediate state), 1 (OFF), 2 (ON), 3 (indeterminate state)	IEC 60870-5-101, 7.2.6.2	PICS, 8.5
5.3.6.483		RES = 0	IEC 60870-5-101, 7.2.6.2	PICS, 8.5
5.3.6.484		BL = 0,1	IEC 60870-5-101, 7.2.6.2	PIXIT
5.3.6.485		SB = 0,1	IEC 60870-5-101, 7.2.6.2	PIXIT
5.3.6.486		NT = 0,1	IEC 60870-5-101, 7.2.6.2	PIXIT
5.3.6.487		IV = 0,1	IEC 60870-5-101, 7.2.6.2	PICS, 8.5
5.3.6.488	CP56TIME2A	milliseconds = 0..59999	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.489		minutes = 0..59	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.490		hours = 0..23	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.491		Res1 = <0> genuine time, or <1> substituted time	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.492		res2, res3, res4 = 0	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.493		IV = 0..1	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.494		SU = 0..1	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.495		day of week = 0 or 1..7	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.496		day of month = 1..31	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.497		month = 1..12	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.498		year = 0..99 (year 2000 = 00, year 1999 is 99)	IEC 60870-5-101, 7.2.6.18	PICS, 8.5

Table 6 (continued)

Test No.	Test	Description	Reference	Required
5.3.6.510	M_ST_TB_1	VTI with SQ = 0, each element with its own IOA	IEC 60870-5-101, 7.3.1.24	PICS, 8.5
5.3.6.511	ASDU 32 Step-position information with time- tag CP56Time2a	COT as defined in the attached PICS	IEC 60870-5-101, 7.3.1.24	PICS, 8.5
5.3.6.512	VTI	Value valid range –64..+63	IEC 60870-5-101, 7.2.6.5	PICS, 8.5
5.3.6.513		Transient = 0,1	IEC 60870-5-101, 7.2.6.5	PICS, 8.5
5.3.6.514	QDS	RES = 0	IEC 60870-5-101, 7.2.6.3	PICS, 8.5
5.3.6.515		BL = 0,1	IEC 60870-5-101, 7.2.6.3	PIXIT
5.3.6.516		SB = 0,1	IEC 60870-5-101, 7.2.6.3	PIXIT
5.3.6.517		NT = 0,1	IEC 60870-5-101, 7.2.6.3	PIXIT
5.3.6.518		IV = 0,1	IEC 60870-5-101, 7.2.6.3	PICS, 8.5
5.3.6.519		OV = 0,1	IEC 60870-5-101, 7.2.6.3	PICS, 8.5
5.3.6.520	CP56TIME2A	milliseconds = 0..59999	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.521		minutes = 0..59	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.522		hours = 0..23	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.523		Res1 = <0> genuine time, or <1> substituted time	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.524		res2, res3, res4 = 0	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.525		IV = 0..1	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.526		SU = 0..1	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.527		day of week = 0 or 1..7	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.528		day of month = 1..31	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.529		month = 1..12	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.530		year = 0..99 (year 2000 = 00, year 1999 is 99)	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.540	M_BO_TB_1	BSI with SQ = 0, each element with its own IOA	IEC 60870-5-101, 7.3.1.25	PICS, 8.5
5.3.6.541	ASDU 33 Bitstring of 32 bit with time-tag CP56Time2a	COT as defined in the attached PICS	IEC 60870-5-101, 7.3.1.25	PICS, 8.5
5.3.6.542	BSI	BSI = 0,1	IEC 60870-5-101, 7.2.6.13	PICS, 8.5
5.3.6.543	QDS	RES = 0	IEC 60870-5-101, 7.2.6.3	PICS, 8.5
5.3.6.544		BL = 0,1	IEC 60870-5-101, 7.2.6.3	PIXIT
5.3.6.545		SB = 0,1	IEC 60870-5-101, 7.2.6.3	PIXIT
5.3.6.546		NT = 0,1	IEC 60870-5-101, 7.2.6.3	PIXIT
5.3.6.547		IV = 0,1	IEC 60870-5-101, 7.2.6.3	PICS, 8.5
5.3.6.548		OV = 0,1	IEC 60870-5-101, 7.2.6.3	PICS, 8.5

Table 6 (continued)

Test No.	Test	Description	Reference	Required
5.3.6.549	CP56TIME2A	milliseconds = 0..59999	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.550		minutes = 0..59	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.551		hours = 0..23	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.552		Res1 = <0> genuine time, or <1> substituted time	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.553		res2, res3, res4 = 0	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.554		IV = 0..1	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.555		SU = 0..1	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.556		day of week = 0 or 1..7	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.557		day of month = 1..31	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.558		month = 1..12	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.559		year = 0..99 (year 2000 = 00, year 1999 is 99)	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.570	M_ME_TD_1	NVA with SQ = 0, each element with its own IOA	IEC 60870-5-101, 7.3.1.26	PICS, 8.5
5.3.6.571	ASDU 34 Measured value, normalised value with time-tag CP56Time2a	COT as defined in the attached PICS	IEC 60870-5-101, 7.3.1.26	PICS, 8.5
5.3.6.572	NVA	Value (translation considering the scaling factor)	IEC 60870-5-101, 7.2.6.6	PICS, 8.5 PIXIT
5.3.6.573		Range -1 to +1·2 ⁻¹⁵	IEC 60870-5-101, 7.2.6.6	PICS, 8.5
5.3.6.574	QDS	RES = 0	IEC 60870-5-101, 7.2.6.3	PICS, 8.5
5.3.6.575		BL = 0,1	IEC 60870-5-101, 7.2.6.3	PIXIT
5.3.6.576		SB = 0,1	IEC 60870-5-101, 7.2.6.3	PIXIT
5.3.6.577		NT = 0,1	IEC 60870-5-101, 7.2.6.3	PIXIT
5.3.6.578		IV = 0,1	IEC 60870-5-101, 7.2.6.3	PICS, 8.5
5.3.6.579		OV = 0,1	IEC 60870-5-101, 7.2.6.3	PICS, 8.5
5.3.6.580	CP56TIME2A	milliseconds = 0..59999	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.581		minutes = 0..59	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.582		hours = 0..23	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.583		Res1 = <0> genuine time, or <1> substituted time	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.584		res2, res3, res4 = 0	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.585		IV = 0..1	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.586		SU = 0..1	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.587		day of week = 0 or 1..7	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.588		day of month = 1..31	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.589		month = 1..12	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.590		year = 0..99 (year 2000 = 00, year 1999 is 99)	IEC 60870-5-101, 7.2.6.18	PICS, 8.5

Table 6 (continued)

Test No.	Test	Description	Reference	Required
5.3.6.600	M_ME_TE_1	SVA with SQ = 0, each element with its own IOA	IEC 60870-5-101, 7.3.1.27	PICS, 8.5
5.3.6.601	ASDU 35 Measured value, scaled value with time-tag CP56Time2a	COT as defined in the attached PICS	IEC 60870-5-101, 7.3.1.27	PICS, 8.5
5.3.6.602	SVA	Value (translation considering the scaling factor)	IEC 60870-5-101, 7.2.6.7	PICS, 8.5 PIXIT
5.3.6.603		Range -2^{15} to $2^{15} - 1$	IEC 60870-5-101, 7.2.6.7	PICS, 8.5
5.3.6.604	QDS	RES = 0	IEC 60870-5-101, 7.2.6.3	PICS, 8.5
5.3.6.605		BL = 0,1	IEC 60870-5-101, 7.2.6.3	PIXIT
5.3.6.606		SB = 0,1	IEC 60870-5-101, 7.2.6.3	PIXIT
5.3.6.607		NT = 0,1	IEC 60870-5-101, 7.2.6.3	PIXIT
5.3.6.608		IV = 0,1	IEC 60870-5-101, 7.2.6.3	PICS, 8.5
5.3.6.609		OV = 0,1	IEC 60870-5-101, 7.2.6.3	PICS, 8.5
5.3.6.610	CP56TIME2A	milliseconds = 0..59999	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.611		minutes = 0..59	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.612		hours = 0..23	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.613		Res1 = <0> genuine time, or <1> substituted time	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.614		res2, res3, res4 = 0	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.615		IV = 0..1	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.616		SU = 0..1	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.617		day of week = 0 or 1..7	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.618		day of month = 1..31	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.619		month = 1..12	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.620		year = 0..99 (year 2000 = 00, year 1999 is 99)	IEC 60870-5-101, 7.2.6.18	PICS, 8.5
5.3.6.630	M_ME_TF_1	IEEE STD 754 with SQ = 0, each element with its own IOA	IEC 60870-5-101, 7.3.1.28	PICS, 8.5
5.3.6.631	ASDU 36 Measured value, short floating point number with time-tag CP56Time2a	COT as defined in the attached PICS	IEC 60870-5-101, 7.3.1.28	PICS, 8.5