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Date: 22 May 2024

Origin: International

Latest date for receipt of comments: 10 July 2024

Project No. 2024/01507

Responsible committee: PEL/17 High voltage switchgear, controlgear and assemblies

Interested committees:

Title: BS EN IEC 62271-3 High-voltage switchgear and controlgear

Part 3: Digital interfaces based on IEC 61850

Please notify the secretary if you are aware of any keywords that might assist in classifying or identifying the standard or if the content of this standard

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- iii) requires additional national guidance or information

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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

For national standards, comments will be reviewed by the relevant UK national committee and the resulting standards published as a British Standard.

UK Vote

Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/Figure/ Table/Note	Type of comment	Commend (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



17/1159/CD

COMMITTEE DRAFT (CD)

PROJECT NUMBER:

IEC 62271-3 ED3

DATE OF CIRCULATION:

2024-05-17

CLOSING DATE FOR COMMENTS:

2024-08-09

SUPERSEDES DOCUMENTS:

17/1154/RR

IEC TC 17 : HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR

SECRETARIAT:

Sweden

SECRETARY:

Mr Arjan Bronsveld

OF INTEREST TO THE FOLLOWING COMMITTEES:

SC 17A,TC 38,TC 57,TC 77,TC 95

PROPOSED HORIZONTAL STANDARD:

☐

Other TC/SCs are requested to indicate their interest, if any, in this CD to the secretary.

FUNCTIONS CONCERNED:

☒ EMC

☐ ENVIRONMENT

☐ QUALITY ASSURANCE

☒ SAFETY

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TITLE:

High-voltage switchgear and controlgear - Part 3: Digital interfaces based on IEC 61850

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

Part 3: Digital interfaces based on IEC 61850

FOREWORD

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International Standard IEC 62271-3 has been prepared by subcommittee 17C: High-voltage switchgear and controlgear assemblies, of IEC technical committee 17: Switchgear and controlgear.

This third edition cancels and replaces the second edition published in 2015. This edition constitutes a technical revision.

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

- a) Scope of this standard is explained in more detail
- b) Logical node classes, constructed classes structure and descriptions (clause 5.2)
- c) Definition of the terms "digital interfaces" and "communication devices" in the context of this standard has been added
- d) an update to the latest edition(s) of IEC 61850 series

- e) an update of normative references
- f) the Annex C gives an additional simplified example for performance type testing
- g) the definition of switchgear controller was improved
- h) attributes of data model Namespace name and version (clause 1.2)
- i) constructed classes structure and descriptions are part of the Code Component of this IEC standard (clause 1.3)

This standard has the status of a product family standard and may be used as a normative reference in a dedicated product standard for highvoltage switchgear and controlgear.

The text of this standard is based on the following documents:

FDIS	Report on voting
17/xxx/FDIS	17/xxx/RVD

Full information on the voting for the approval of this standard 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.

A list of all parts in the IEC 62271 series, published under the general title *High voltage switchgear and controlgear*, can be found on the IEC website.

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

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

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

0.1 General

This standard is a product family standard for high-voltage switchgear and controlgear and assemblies thereof. It provides an application of the horizontal standard series IEC 61850 which details layered power utility communication architecture, in the world of high-voltage switchgear and controlgear.

By providing tutorial material such as examples and explanations, it also gives an access for switchgear experts to concepts and methods applied in the IEC 61850 series.

Compared to switchgear equipment, digital communication technology is subject to ongoing changes which are expected to continue in the future. Profound experience with electronics integrated directly into switchgear has yet to be gathered on a broader basis, as this type of equipment is not widely spread in the industry and a change of metabolism has not yet occurred.

This situation is considered in this standard by setting an appropriate validity date and by specifying several options to most of the communication-related requirements, such as connectors or fibres.

0.2 Position of this standard in relation to the IEC 61850 series

The IEC 61850 series is a horizontal standard intended to be used for communication and systems in the power utility. The most important parts of this series define:

- 1) information models for the power utility automation system.
These information models include both the models of the switchgear (like circuit-breakers and disconnectors) and other process equipment (like instrument transformers), and the models of the power utility automation system (like protection relays);
- 2) the communication between intelligent electronic devices (IEDs) of the power utility automation system;
- 3) a configuration language used to describe the configuration aspects of the power utility automation system;
- 4) conformance testing of the communication interfaces of the IEDs of the power utility automation system including their data models.

Typically, IEDs like bay level controllers interface to switchgear. In that case, the data models of the switchgear are implemented in these devices. However, this is not the only realization. In the case where electronics are integrated direct into switchgear, the above-mentioned data models should be implemented within the switchgear and the switchgear supports a communication interface.

IEC 61850, being a horizontal standard series, leaves many options open in order to support present and future requirements of all sizes of power utility automation system at all voltage levels.

HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR

Part 3: Digital interfaces based on IEC 61850

1 Scope

1.1 General

This part of IEC 62271 is applicable to high-voltage switchgear and controlgear for all rated voltage levels above 1 kV and assemblies thereof and specifies equipment for digital communication with other parts of the power utility automation and its impact on testing. This equipment for digital communication, replacing metal parallel wiring, can be integrated into the high-voltage switchgear, controlgear, and assemblies thereof, or can be external equipment to provide compliance for existing switchgear and controlgear and assemblies thereof with the standards of the IEC 61850 series.

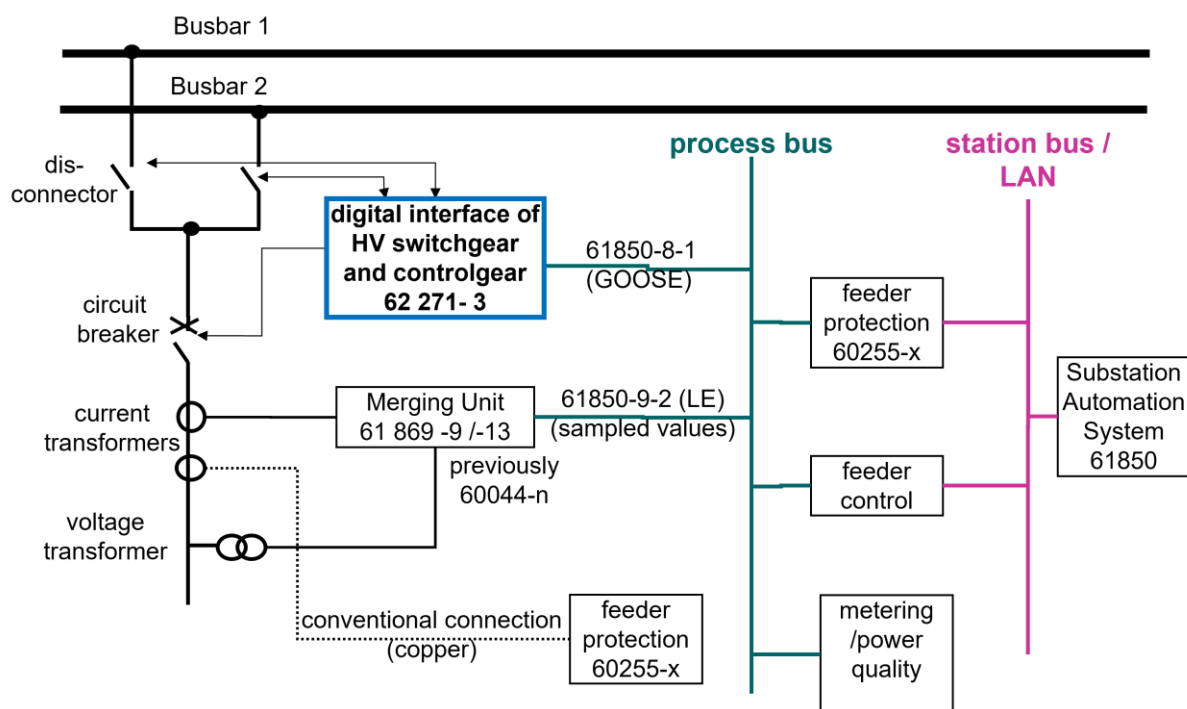


Figure 1-1 – Scope of standard IEC 62271-3

This International Standard is a product standard based on the IEC 61850 series. It deals with all relevant aspects of switchgear and controlgear, and assemblies thereof with digital interfaces. In the context of this standard the digital interfaces are according to IEC 61850 standard which uses Ethernet based communication. The physical realization of a digital interface in the context of this standard is not subject to this standard; e.g. a digital interface may be a stand-alone unit or may be a built-in unit of any IED. Merging units as well as protection IED's are outside the scope of this standard.

In particular, this standard defines:

- a) a selection of the information models from the IEC 61850 series that are supported by such switchgear and controlgear, and assemblies thereof;
- b) conformance classes for the set of communication services that are supported by the switchgear and controlgear, and assemblies thereof;
- c) modifications and extensions to type and routine tests of switchgear and controlgear, and assemblies thereof that are required due to the IEC 61850 interface .

This standard specifies the requirements for digital communication equipment used within high-voltage switchgear, controlgear, and assemblies thereof, as well as the relevant testing requirements.

The relevant switchgear standards of the IEC 62271 series are applicable in general, with the additional specifications described in this standard.

The physical realization (optical or copper) of a digital interface in the context of this standard is not subject of this standard; e.g. a digital interface may be a stand-alone unit or may be a built-in unit of any IED

NOTE 1 This standard intends to promote interoperability of communication interfaces. Interchangeability is outside the scope of this standard, as there is no requirement for it. Interchangeability is also outside the scope of the IEC 61850 series.

NOTE 2 For an introduction to power utility automation communication and the related terms, definitions and models, refer to IEC 61850-1 which provides an overview of the objectives and requirements of the IEC 61850 series in general. IEC 61850-7-1 provides an overview of modelling techniques.

1.2 Data model Namespace name and version

This new subclause is mandatory for any IEC 61850 namespace (as defined by IEC 61850-7-1:2011).

Table 1 shows all attributes of IEC 62271-3:2022A namespace.

Table 1 – Attributes of IEC 62271-3:2022A namespace

Attribute	Content
Namespace nameplate	
Namespace Identifier	IEC 62271-3
Version	2022
Revision	A
Full Namespace Name	IEC 62271-3:2022A
Full Code Component Name	IEC_62271-3.NSD.2022A.Full
Light Code Component Name	IEC_62271-3.NSD.2022A.Light
Namespace Type	product
Namespace dependencies	
extends	IEC 61850-7-4:2010/AMD1:2020

1.3 Data model Namespace Code Component distribution

The Code Components are in light and full version:

- The full version is named : *IEC_62271-3.NSD.2022A.Full*. It contains definition of the whole data model defined in this standard with the documentation associated and access is restricted to purchaser of this part

- The light version is named: *IEC_62271-3.NSD.2022A.Light*. It does not contain any documentations but contains the whole data model as per full version, and this light version is freely accessible on the IEC website for download at : <http://www.iec.ch/tc57/supportdocuments>, but the usage remains under the licensing conditions.

The Code Components for IEC 61850 data models are formatted in compliance with the NSD format defined by the standard IEC 61850-7-7. Each Code Component is a ZIP package containing:

- the electronic representation of the Code Component itself (possibly multiple files),
- the grammar files (XSD) enabling to check the consistency of the associated files against the defined version of NSD, but as well against the IEC 61850 flexibility rules in case of private extensions
- a file describing the content of the package (IECManifest.xml).

The IECManifest contains different sections giving information on:

- The copyright notice
- The identification of the code component
- The publication related to the code component
- The list of the electronic files which compose the code component
- An optional list of history files to track changes during the evolution process of the code component

The life cycle of a code component is not restricted to the life cycle of the related publication. The publication life cycle goes through two stages, Version (corresponding to an edition) and Revision (corresponding to an amendment). A third publication stage (Release) allows publication of Code Component in case of urgent fixes of InterOp Tissues, thus without need to publish an amendment.

Consequently new release(s) of the Code Component may be released, which supersede(s) the previous release, and will be distributed through the IEC TC57 web site at: <http://www.iec.ch/tc57/supportdocuments>.

The latest version/release of the document will be found by selecting the file named *IEC_62271-3.NSD.{VersionStateInfo}.Light* with the filed VersionStateInfo of the highest value.

2 Normative references

The following documents are referred to in the text in such a way that some or all 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.

IEC 61850-3, *Communication networks and systems for power utility automation – Part 3: General requirements*

- 213 IEC 61850-4, *Communication networks and systems for power utility automation –*
214 *Part 4: System and project management*
- 215 IEC 61850-5, *Communication networks and systems for power utility automation –*
216 *Part 5: Communication requirements for functions and device models*
- 217 IEC 61850-7-2, *Communication networks and systems for power utility automation – Part 7-2:*
218 *Basic information and communication structure – Abstract communication service interface*
219 *(ACSI)*
- 220 IEC 61850-7-3, *Communication networks and systems for power utility automation – Part 7-3:*
221 *Basic communication structure – Common data classes*
- 222 IEC 61850-7-4:2010/AMD1:2020, *Communication networks and systems for power utility*
223 *automation – Part 7-4: Basic communication structure – Compatible logical node classes and*
224 *data object classes*
- 225 IEC 61850-8-1, *Communication networks and systems for power utility automation – Part 8-1:*
226 *Specific communication service mapping (SCSM) – Mappings to MMS (ISO 9506-1 and*
227 *ISO 9506-2) and to ISO/IEC 8802-3*
- 228 IEC 61850-9-2, *Communication networks and systems for power utility automation – Part 9-2:*
229 *Specific communication service mapping (SCSM) – Sampled values over ISO/IEC 8802-3*
- 230 IEC 61850-10, *Communication networks and systems for power utility automations – Part 10:*
231 *Conformance testing*
- 232 IEC TR 61850-90-4, *Communication networks and systems for power utility automation –*
233 *Part 90-4: Network engineering guidelines*
- 234 IEC 62271-1:2017, *High-voltage switchgear and controlgear – Part 1: Common specifications*
235 IEC 62271-1:2017+AMD1:2021
- 236 IEC 62271-100:2021, *High-voltage switchgear and controlgear – Part 100: Alternating current*
237 *circuit-breakers*
238

239 **3 Terms and definitions**

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

241 **3.1**

242 **time requirement**

243 maximum acceptable time delay between source and sink

244 **3.2**

245 **mandatory data**

246 data where coding is specified and the information always present

247 Note 1 to entry: Mandatory data ensures interoperability in power utility automation.

248 **3.3**

249 **optional data**

250 data where the coding is specified but the information not necessarily present

3.4**data integrity**

ability of a communication system to deliver data from its originator to its destinations with an acceptable residual error rate

Note 1 to entry: In the case of switchgear with a digital interface, data integrity concerns the probability of undetected errors resulting in wrong information about actual process states in the monitoring direction or unintended actions in the control direction of the system.

3.5**interoperability**

ability of two or more IEDs from the same vendor, or from different vendors, to exchange information and use that information for correct execution of specified functions

[SOURCE: IEC TR 61850-1:2013, 3.1.8]

3.6**logical node****LN**

smallest part of a function that exchanges data

Note 1 to entry: A logical node is an object defined by its data and methods.

[SOURCE: IEC TR 61850-1:2013, 3.1.9]

3.7**abstract communication service interface****ACSI**

virtual interface to an IED providing abstract communication services, for example, connection, variable access, unsolicited data transfer, device control and file transfer services, independent of the actual communication stack and profiles used

[SOURCE: IEC TR 61850-1:2013, 3.1.1]

3.8**intelligent electronic device****IED**

any device incorporating one or more processors with the capability to receive or send data/controls from or to an external source (for example, electronic multifunction meters, digital relays, controllers)

[SOURCE: IEC TR 61850-1:2013, 3.1.6]

3.9**protocol implementation conformance statements****PICS**

summary of the capabilities of the system to be tested

Note 1 to entry: PICS contain information regarding the ACSI. This information could typically be optional parts, specific restrictions, or add-ons (see IEC 61850-7-2:2010).

[SOURCE: adapted from ISO/IEC 8823-2:1997]

3.10**model implementation conformance statement****MICS**

statement which details the standard data object model elements supported by the system or device

295 [SOURCE: IEC 61850-10:2012, 3.4]

296 **3.11**

297 **service**

298 functional capability of a resource which can be modelled by a sequence of service primitives

299 Note 1 to entry: A resource in the context of this standard is an IED. A service primitive is an abstract,
300 implementation independent representation of an interaction between the service user and the service provider.

301 [SOURCE: IEC TS 61850-2:2003, 2.121, modified – addition of a new note to entry]

302 **3.12**

303 **configuration (of a system or device)**

304 step in system design, for example, selecting functional units, assigning their locations and
305 defining their interconnections

306 [SOURCE: IEC TS 61850-2:2003, 2.14]

307 **3.13**

308 **data security**

309 ability to avoid placing the controlled system in a potentially dangerous or unstable situation
310 by an undetected error

311 **3.14**

312 **reliability**

313 measure of a system or equipment to perform its intended function under specified conditions
314 for a specified period of time

315 Note 1 to entry: It is a probability figure, based on failure data and length of operating time.

316 [SOURCE: adapted from IEC 60050-191:1990, 191-02-06]

317 **3.15**

318 **availability**

319 the ability of an item to be in a state to perform a required function under given conditions at a
320 given instant of time or over a given time interval, assuming that the required external
321 resources are provided

322 Note 1 to entry: This ability depends on the combined aspects of the reliability performance, the maintainability
323 performance and the maintenance support performance.

324 Note 2 to entry: Required external resources, other than maintenance resources do not affect the availability
325 performance of the item.

326 Note 3 to entry: In French the term "disponibilité" is also used in the sense of "instantaneous availability".

327 **3.16**

328 **maintainability**

329 the ability of an item under given conditions of use, to be retained in, or restored to, a state in
330 which it can perform a required function, when maintenance is performed under given
331 conditions and using stated procedures and resources

332 Note 1 to entry: The term "maintainability" is also used as a measure of maintainability performance.

333 **3.17**

334 **dependability**

335 collective term used to describe the availability performance and its influencing factors:
336 reliability performance, maintainability performance, and maintenance support performance

337 [SOURCE: IEC 60050-191:1990, 191-02-03]

3.18**communication conformance test**

check of data flow on communication channels in accordance with the standard conditions concerning access organization, formats and bit sequences, time synchronization, timing, signal form and level and reaction to errors

Note 1 to entry: The conformance test can be carried out and certified to the standard or to specifically described parts of the standard.

Note 2 to entry: The term "communication" has been added to "conformance test" in order to state that this test refers to communication conformance.

3.19**performance test**

test on complete intelligent switchgear system to characterize it under operating conditions

3.20**intelligent switchgear**

switchgear composed of its primary part, its mechanism and one or more switchgear controllers containing at a minimum set of logical nodes according to the IEC 61850 series

Note 1 to entry: Minimum set of logical nodes are as per 5.1. of this standard.

3.21**switchgear controller**

an IED used to operate and monitor / supervise switches (such as circuit breakers, disconnectors,..)

Note 1 to entry: A switchgear controller can be:

- a circuit-breaker controller (abbreviated as CBC in this standard);
- a disconnector controller (abbreviated as DCC in this standard);
- an earthing switch controller (abbreviated as ESC in this standard);

a controller of another type of switchgear.

Note 2 to entry: These functions may be integrated in one common IED or may be separated within dedicated IED such as bay control unit (BCU) or merging unit [MU]; stand-alone merging unit [SAMU]-

Note 3 to entry: Function of a switchgear controller shall be to convert electrical signals such as switching status position to "digital" signals; and "digital" received open / close commands shall be converted to electrical signals. This functionality might be located within any IED (e.g. bay control unit [BCU]; merging unit [MU]; stand-alone merging unit [SAMU]; CBC/DCC/ESC as stated in note 1 to this entry)

3.22**intelligent sensor**

sensor with a processor and communication interface according to the IEC 61850 series

EXAMPLE An interface according to IEC 61850-9-2:2011, used for current and voltage measurement via a merging unit as specified within IEC 61869-9.

3.23**Communication device**

equipment that provides IEC 61850-8-1 interface.

Note 1 to entry: in addition, a communication device may be used for interconnection of distributed switchgear controllers, or it hosts switchgear controllers itself. It could be Ethernet switch, Bay Controller Unit, Protection and Control Unit, ... dependent on location of switchgear controllers. Use cases examples are stated in new Annex "D"

Note 2 to entry: The term "communication switch" is used in this standard in order to distinguish this type of equipment from switches as defined in IEC 62271-103. Such a communication switch is used in local area communication networks to combine communication network segments with different communication hardware, such as copper- based and fibre optic ethernet based communication networks. The defined data rate is available on every network segment in parallel. A communication switch is a device which implements layers 1 and 2 of the ISO/OSI reference model according to ISO/IEC 7498 series.

Note 3 to entry: A communication gateway is a communication device used for interconnection of several IEDs which may use completely different communication methods (for example, one IED with proprietary communication and another IED with communication according to IEC 61850 series). A communication gateway is a device which implements all 7 layers of the ISO/OSI communication reference model according to ISO/IEC 7498 series.

Note 4 to entry: The communication device does not provide for application functionality.

Note 5 to entry: A RedBox can be considered as an ethernet switch supporting HSR/PRP function

Note 6 to entry: an ethernet switch may be a built-in function in any other IED- (e.g. BCU, CBC, DCC) or a stand-alone unit

3.24

test device

equipment used for generation of test signals and/or test functions

3.25

test object

device under test

3.26

Abbreviated terms

NOTE 1 Abbreviations used for the identification of the common data classes and as name of attributes are specified in the specific clauses of this document and are not repeated here.

Table 2 shows normative terms that are combined to create data object names.

Table 2 – Normative abbreviations for data object names

Term	Description
Bk	Back-to-back
Br	breaking
Clas	class, classification
E	endurance
Flu	Fluid
Inr	Inrush
Kpp	first-pole-to-clear factor
Lwv	Lightning impulse withstand voltage
Mass	Mass
Swv	Switching impulse withstand voltage
Year	Year

4 Normal and special service conditions

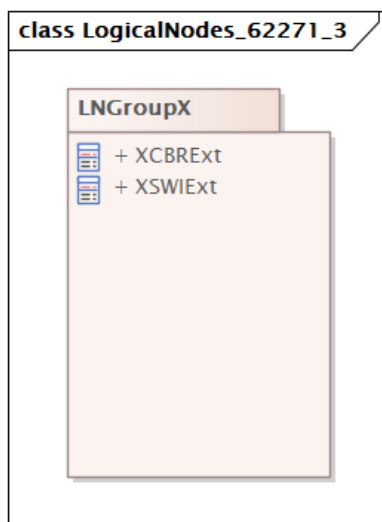
Clause 4 of IEC 62271-1 giving service conditions, such as ambient air temperature, altitude is applicable.

5 Ratings and classifications / logical node classes

5.1 General

This clause specifies logical nodes defined in IEC 62271-3.

415 The constructed classes structure and descriptions are part of the Code Component of this
416 IEC standard and are available as electronic machine readable file in related NSD file.



417
418 **Figure 5-1 – Class diagram LogicalNodes_62271_3: LogicalNodes_62271_3**

5.2 Package LNgrouP

5.2.1 General

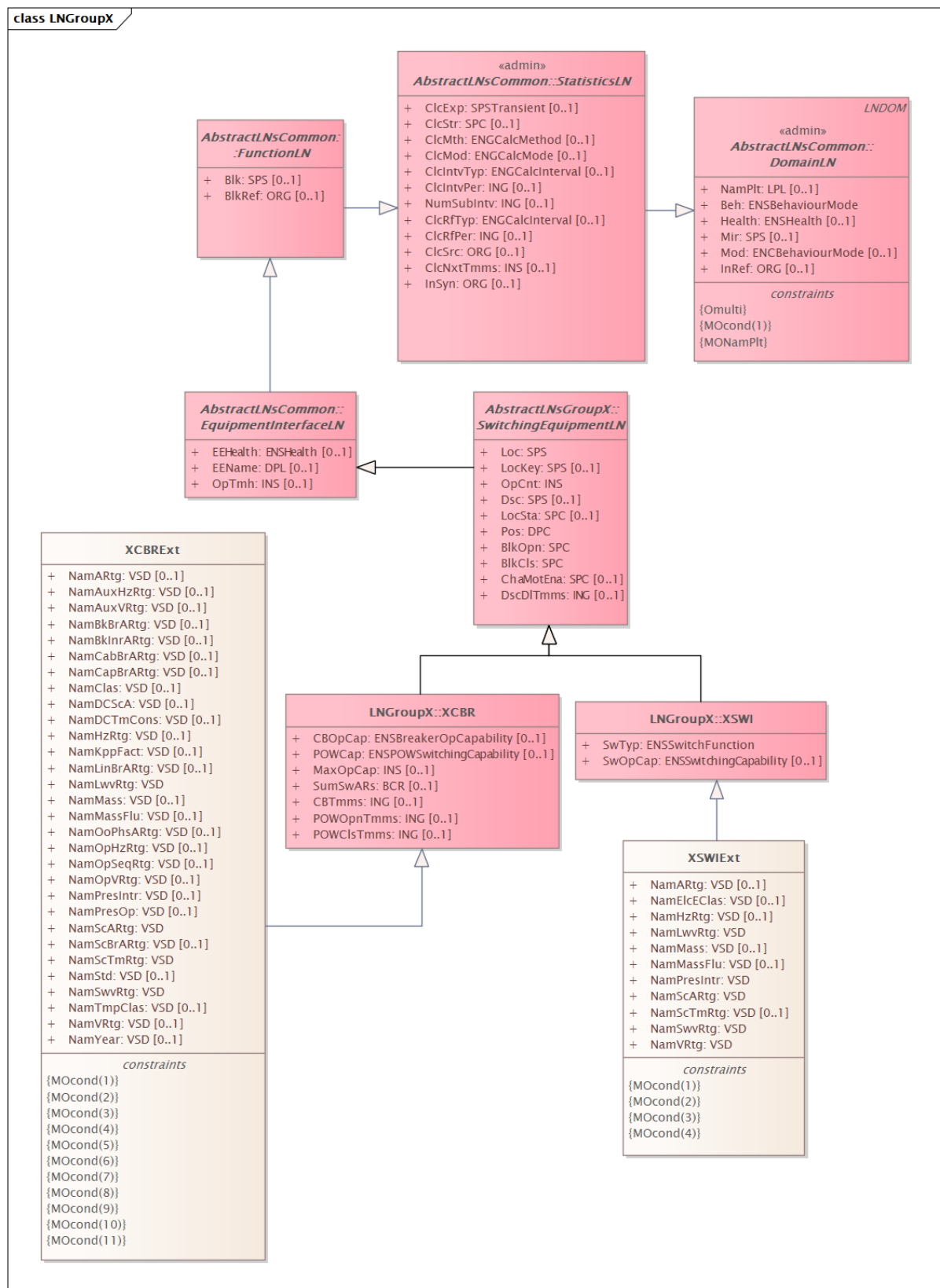


Figure 5-2 – Class diagram LNgrouP::LNgrouP

5.2.2 Classes list

Table 3 shows all classes defined in LNGroupX package.

Table 3 – List of classes defined in LNGroupX package

Name	Description
<u>XCBRExt</u>	Set of information objects to extend the XCBR LN. Name plate definitions of a circuit breaker in IEC are referring to 62271-100 This logical node is used for representing a circuit breaker. The "Ext" suffix attached to the LN name is only there for editorial purpose and is not present in the real model.
<u>XSWIExt</u>	Set of information objects to extend the XSWI LN. Name plate definitions of a circuit switch in IEC are referring to 62271-100 This logical node is used for representing a circuit switch. The "Ext" suffix attached to the LN name is only there for editorial purpose and is not present in the real model.

5.2.3 LN: Circuit breaker Name: XCBRExt

Set of information objects to extend the XCBR LN.

Name plate definitions of a circuit breaker in IEC are referring to 62271-100

This logical node is used for representing a circuit breaker.

The "Ext" suffix attached to the LN name is only there for editorial purpose and is not present in the real model.

Conditions:

MOcond(1): Required if different from E1, M1, S1 for rated voltages less than 100kV or required if different from E1, M1 for rated voltages 100 kV and above

MOcond(10): Required if different from 1 s

MOcond(11): Required if rated voltage Ur is equal or above 300 kV

MOcond(2): Required if rating is not applicable at both 50 Hz and 60 Hz.

MOcond(3): Required if more than 20 %.

MOcond(4): Required if different from 1,3 for rated voltages 100 kV to 170 kV

MOcond(5): Required if rated voltage equal to or greater than 72,5 kV

MOcond(6): Required if more than 300 kg

MOcond(7): Required if contains fluid.