

# TECHNICAL REPORT



---

**Communication networks and systems for power utility automation –  
Part 90-27: Use of IEC 61850 for thermal energy systems connected to electric  
power grid**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

---

ICS 33.200

ISBN 978-2-8322-7339-5

**Warning! Make sure that you obtained this publication from an authorized distributor.**

## CONTENTS

FOREWORD.....	8
INTRODUCTION.....	10
1 Scope.....	11
1.1 General.....	11
1.2 Data model Namespace name and version .....	11
1.3 Data model Namespace Code Component distribution .....	12
2 Normative references .....	13
3 Terms and definitions .....	13
4 Abbreviated terms .....	16
4.1 General purpose abbreviated terms .....	16
4.2 Abbreviated terms used in data object names .....	17
5 Overview of thermal systems .....	17
5.1 General.....	17
5.2 System structure.....	18
5.3 Energy transformation.....	19
5.3.1 General .....	19
5.3.2 Transformation from electricity to thermal energy .....	19
5.3.3 Transformation from thermal energy to electricity .....	20
5.3.4 CHP device .....	20
6 Use cases .....	21
6.1 General.....	21
6.2 Common actors.....	21
6.2.1 General .....	21
6.2.2 Actors from IEC 62913-2-3 .....	21
6.2.3 Actors originating with the thermal energy domain .....	23
6.3 Use case 1: "Aggregated energy storage in buildings for electricity grid congestion management via electricity demand shifting" .....	23
6.3.1 Motivation.....	23
6.3.2 Solution .....	23
6.3.3 Benefit.....	24
6.4 Use case 2: Small-scale cogeneration for e-grid stabilisation and heat generation for use in building or injection .....	25
6.4.1 Motivation.....	25
6.4.2 Solution .....	25
6.4.3 Benefits .....	25
6.5 Use case 3: Centralised heat-pumps for hot water storage in DH plant facilities .....	26
6.5.1 Motivation.....	26
6.5.2 Solution .....	26
6.5.3 Benefit.....	26
6.6 Use case 4: Providing tertiary reserve to electric power systems by demand response using thermal energy storage.....	26
6.6.1 General .....	26
6.6.2 Motivation.....	26
6.6.3 Solution .....	27
6.6.4 Benefits .....	28
7 Information model requirements .....	28

7.1	General.....	28
7.2	Mappings of requirements on LN classes at the resource level .....	28
7.3	Mappings of requirements on LN classes at the operational function level .....	33
7.4	Mappings of requirements on LN classes at the reference point level in thermal energy network.....	34
8	Logical node classes and data objects modelling.....	36
8.1	General.....	36
8.1.1	General .....	36
8.1.2	Modelling principles of logical nodes considering sector coupling .....	36
8.2	Generic resource LN.....	39
8.2.1	Generic LN classes related to electrical DERs (DGEN, DSTO and DLOD) .....	39
8.2.2	Generic LN classes related to thermal energy resources (DGTH, DSTH and DLTH).....	39
8.2.3	Generic LN classes related to both electrical DERs and thermal energy resources (DETH and DETG).....	40
8.3	LN classes related to specific type of units.....	40
8.3.1	General .....	40
8.3.2	Modelling P2H units.....	41
8.3.3	Modelling of CHP.....	44
8.3.4	Modelling of thermal storage units .....	45
8.4	Modelling of operational functions for energy services .....	46
8.5	Modelling of reference points in thermal systems .....	48
9	LN class definitions .....	49
9.1	General.....	49
9.2	Abstract logical nodes for thermal systems (AbstractLNs_90_27).....	49
9.2.1	General .....	49
9.2.2	<<abstract>> LN: All energy (electricity, thermal energy, and gas) mixed DER Name: AllEnergyMixedDERLN.....	51
9.2.3	<<abstract>> LN: Transformation from electricity to thermal Name: TransformationFromElectricityToThermalLN .....	51
9.2.4	<<abstract>> LN: Transformation from thermal energy to electricity Name: TransformationFromThermalToElectricityLN .....	52
9.2.5	<<abstract>> LN: Mixed electricity and thermal generator Name: MixedElectricityAndThermalGeneratorLN.....	52
9.2.6	<<abstract>> LN: Thermal resource Name: ThermalResourceLN.....	52
9.2.7	<<abstract>> LN: Non thermal storage operational settings Name: NonThermalStorageOperationalSettingsLN.....	53
9.2.8	<<abstract>> LN: Thermal storage operational settings Name: ThermalStorageOperationalSettingsLN .....	54
9.2.9	<<abstract>> LN: Electricity to thermal energy unit Name: ElectricityToThermalUnitLN .....	54
9.2.10	<<abstract>> LN: Thermal operation function Name: ThermalOperationalFunctionLN .....	54
9.2.11	<<abstract>> LN: Thermal reference point Name: ThermalReferenceLN.....	54
9.2.12	<<abstract>> LN: Physical thermal reference Name: PhysicalThermalReferenceLN.....	55
9.2.13	<<abstract>> LN: Virtual Thermal Reference Point Name: VirtualThermalReferenceLN.....	55
9.3	Generic logical nodes for thermal resource (LNGroupD) .....	56
9.3.1	General .....	56

9.3.2	LN: Thermal generating resource Name: DGTH .....	56
9.3.3	LN: Thermal storage resource Name: DSTH .....	61
9.3.4	LN: Thermal load resource Name: DLTH .....	65
9.3.5	LN: Mixed electricity and thermal generating unit Name: DETG .....	68
9.3.6	LN: Electricity to thermal transforming unit Name: DETH .....	71
9.4	Extended logical nodes for distributed energy resources (LNGroupD) .....	74
9.4.1	General .....	74
9.4.2	LN: DER generating unit extended in 90-27 Name: DGENExt .....	74
9.4.3	LN: DER load unit extended in 90-27 Name: DLODEExt .....	84
9.5	Unit type logical nodes for thermal resources (LNGroupD) .....	93
9.5.1	General .....	93
9.5.2	LN: CHP system controller Name: DCHCExt .....	93
9.5.3	LN: Fuel cell controller Name: DFCLEExt .....	96
9.5.4	LN: Electric heat pump Name: DHPM .....	99
9.5.5	LN: Electric resistance heater Name: DRSH .....	103
9.6	Logical nodes for operational functions related to thermal systems (LNGroupD) .....	105
9.6.1	General .....	105
9.6.2	LN: Thermal comfort profile Name: DTHP .....	105
9.6.3	LN: Mode to cause DER to set active power Name: DWGCEExt .....	107
9.7	Logical nodes for thermal reference points (LNGroupD) .....	112
9.7.1	General .....	112
9.7.2	LN: Thermal Connection Point Name: DTCP .....	113
9.7.3	LN: Thermal Point of Common Coupling Name: DTPC .....	115
9.7.4	LN: Virtual Thermal Connection Point Name: DVTR .....	117
9.8	Logical nodes for metering and measurement (LNGroupM) .....	119
9.8.1	General .....	119
9.8.2	LN: Local electric power system measurement Name: MLPS .....	120
9.8.3	LN: Thermal energy measurement Name: MTHM .....	122
9.9	Logical nodes for further power system equipment (LNGroupZ) .....	124
9.9.1	General .....	124
9.9.2	LN: Power cable Name: ZCABExt .....	124
9.9.3	LN: Power overhead line Name: ZLINEExt .....	127
9.10	Enumerated data attribute types .....	130
9.10.1	General .....	130
9.10.2	Classes list .....	131
9.10.3	ThermalGeneratorStateKind enumeration .....	131
9.10.4	ThermalGeneratorOperationModeType enumeration .....	132
9.10.5	ThermalStorageOperationControlKind enumeration .....	132
9.10.6	HeatSourceKind enumeration .....	132
9.10.7	CompressorKind enumeration .....	133
9.10.8	ThermalComfortStatusKind enumeration .....	133
9.10.9	ThermalStorageKind enumeration .....	133
9.10.10	ThermalMediumKind enumeration .....	134
9.10.11	FuelCellKind enumeration .....	134
9.10.12	TCPIslandStateKind enumeration .....	135
9.10.13	ThermalGenerationKind enumeration .....	135
Annex A (informative)	Complete descriptions of use cases .....	136

A.1	Aggregated energy storage in buildings for electricity grid congestion management via electricity demand shifting .....	136
A.1.1	Description of the use case .....	136
A.1.2	Diagrams of use case .....	138
A.1.3	Technical details.....	139
A.1.4	Step by step analysis of use case .....	142
A.1.5	Information exchanged .....	147
A.1.6	Common terms and definitions.....	147
A.2	Small-scale cogeneration for e-grid stabilisation and heat generation for use in building or injection .....	147
A.2.1	Description of use case .....	147
A.2.2	Diagrams of use case .....	149
A.2.3	Technical details.....	151
A.2.4	Step by step analysis of use case .....	153
A.2.5	Information exchanged .....	158
A.2.6	Common terms and definitions.....	158
A.3	Centralised heat-pumps for hot water storage in DH plant facilities .....	158
A.3.1	Description of use case .....	158
A.3.2	Diagrams of use case .....	160
A.3.3	Technical details.....	162
A.3.4	Step by step analysis of use case .....	164
A.3.5	Information exchanged .....	166
A.3.6	Common terms and definitions.....	167
A.4	Providing tertiary reserve to electric power systems by demand response using thermal energy storage.....	167
A.4.1	Description of use case .....	167
A.4.2	Use case diagram.....	172
A.4.3	Technical details.....	173
A.4.4	Step by step analysis of user case.....	174
A.4.5	Information exchanged .....	177
A.4.6	Common terms and definitions.....	179
Annex B (informative)	Considerations of LN design for CHP .....	180
Figure 1	– A typical structure of thermal system.....	18
Figure 2	– A configuration of heat pump.....	19
Figure 3	– A typical configuration of a CHP device.....	20
Figure 4	– Configuration and behaviour of a polymer electrolyte fuel cell .....	21
Figure 5	– UC1 Case 1: The aggregated electricity demand is lower than electricity generation .....	24
Figure 6	– UC1 Case 2: The aggregated electricity demand is higher than electricity generation .....	24
Figure 7	– Main use case diagram of UC4: Providing tertiary reserve to electric power systems by demand response using thermal energy storage.....	27
Figure 8	– Hierarchical class model of DER resources – basic principles .....	37
Figure 9	– Principles to guide the extension of IEC 61850-7-420 for supporting other types of energies .....	38
Figure 10	– Logical nodes representing data related to thermal system .....	40
Figure 11	– An example of a simple DER resource model of a PV generating unit .....	41
Figure 12	– Modelling of a heat pump .....	43

Figure 13 – Data objects in DLOD and DETH.....	44
Figure 14 – Modelling of a CHP .....	45
Figure 15 – An example of thermal storage resources including thermal mass in a building with mappings to logical nodes .....	46
Figure 16 – DER Generic model.....	47
Figure 17 – Modelling of operational functions for thermal systems.....	48
Figure 18 – Class model of an Electric Reference Point.....	48
Figure 19 – Proposed extension of the class model of an Electric Reference Point .....	49
Figure 20 – Class diagram AbstractResourceLNs .....	50
Figure 21 – Class diagram AbstractUnitLNs .....	50
Figure 22 – Class diagram AbstractOperationalFunctionLNs .....	51
Figure 23 – Class diagram for resources.....	56
Figure 24 – Class diagram for resource units .....	93
Figure 25 – Class diagram for thermal reference points .....	113
Figure 26 – Class diagram for measurements .....	120
Figure 27 – Class diagram for lines and cables .....	124
Figure 28 – Class diagram DOEnums_90_27::DOEnums_90_27.....	131
Figure A.1 – Facility HVAC system with Thermal Energy Storage – Normal Operation (Peak Shift).....	169
Figure A.2 – Facility HVAC system with Thermal Energy Storage – Demand Response with Normal Operation .....	169
Figure A.3 – Thermal energy storage system configuration .....	170
Figure A.4 – Thermal system and related actors .....	170
Figure A.5 – HVAC&R facilities operations in regular rotation .....	171
Figure A.6 – Use case diagram for providing tertiary reserve to electric power systems by demand response using thermal energy storage .....	172
Figure A.7 – Sequence diagram for providing tertiary reserve to electric power systems by demand response using thermal energy storage .....	173
Table 1 – Tracking information of (Tr)IEC 61850-90-27:2023A namespace .....	12
Table 2 – Attributes of (Tr)IEC 61850-90-27:2023A namespace.....	12
Table 3 – Normative abbreviations for data object names .....	17
Table 4 – Common actors from IEC SRD 62913-2-3 .....	22
Table 5 – Actors originating with thermal energy domain .....	23
Table 6 – Mappings of requirements and IEC 61850 for DER system and coupling point .....	29
Table 7 – Mappings of requirements and IEC 61850 for P2H resource.....	29
Table 8 – Mappings of requirements and IEC 61850 for aggregated energy storage resource .....	31
Table 9 – Mappings of requirements and IEC 61850 for CHP resource .....	32
Table 10 – Mappings of requirements and IEC 61850 for operational function level .....	34
Table 11 – Mappings of requirements and IEC 61850 for reference point.....	34
Table 12 – Data objects of AllEnergyMixedDERLN .....	51
Table 13 – Data objects of TransformationFromElectricityToThermalLN.....	52
Table 14 – Data objects of ThermalResourceLN .....	52
Table 15 – Data objects of NonThermalStorageOperationalSettingsLN .....	53

Table 16 – Data objects of ElectricityToThermalUnitLN.....	54
Table 17 – Data objects of ThermalOperationalFunctionLN.....	54
Table 18 – Data objects of ThermalReferenceLN.....	55
Table 19 – Data objects of PhysicalThermalReferenceLN.....	55
Table 20 – Data objects of VirtualThermalReferenceLN.....	56
Table 21 – Data objects of DGTH.....	57
Table 22 – Data objects of DSTH.....	61
Table 23 – Data objects of DLTH.....	65
Table 24 – Data objects of DETG.....	68
Table 25 – Relations of DETG with other classes.....	71
Table 26 – Data objects of DETH.....	71
Table 27 – Relations of DETH with other classes.....	74
Table 28 – Data objects of DGENExt.....	74
Table 29 – Data objects of DLODExt.....	85
Table 30 – Data objects of DCHCExt.....	94
Table 31 – Data objects of DFCLExt.....	96
Table 32 – Data objects of DHPM.....	100
Table 33 – Data objects of DRSH.....	103
Table 34 – Data objects of DTHP.....	106
Table 35 – Data objects of DWGCEExt.....	108
Table 36 – Data objects of DTCP.....	113
Table 37 – Data objects of DTPC.....	116
Table 38 – Data objects of DVTR.....	118
Table 39 – Data objects of MLPS.....	120
Table 40 – Data objects of MTHM.....	122
Table 41 – Data objects of ZCABExt.....	125
Table 42 – Data objects of ZLINEExt.....	128
Table 43 – List of classes defined in DOEnums_90_27 package.....	131
Table 44 – Literals of ThermalGeneratorStateKind.....	132
Table 45 – Literals of ThermalGeneratorOperationModeType.....	132
Table 46 – Literals of ThermalStorageOperationControlKind.....	132
Table 47 – Literals of HeatSourceKind.....	133
Table 48 – Literals of CompressorKind.....	133
Table 49 – Literals of ThermalComfortStatusKind.....	133
Table 50 – Literals of ThermalStorageKind.....	134
Table 51 – Literals of ThermalMediumKind.....	134
Table 52 – Literals of FuelCellKind.....	134
Table 53 – Literals of TCPIslandStateKind.....	135
Table 54 – Literals of ThermalGenerationKind.....	135
Table A.1 – Conditions of use case 4.....	171

# INTERNATIONAL ELECTROTECHNICAL COMMISSION

## COMMUNICATION NETWORKS AND SYSTEMS FOR POWER UTILITY AUTOMATION –

### Part 90-27: Use of IEC 61850 for thermal energy systems connected to an electric power grid

#### FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

IEC TR 61850-90-27 has been prepared by IEC technical committee 57: Power systems management and associated information exchange. It is a Technical Report.

The text of this Technical Report is based on the following documents:

Draft	Report on voting
57/2571/DTR	57/2584/RVDTR

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

The language used for the development of this Technical Report is English.



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

A list of all parts in the IEC 61850 series, published under the general title *Communication networks and systems for power utility automation*, can be found on the IEC website.

This IEC standard includes Code Components i.e. components that are intended to be directly processed by a computer. Such content is any text found between the markers <CODE BEGINS> and <CODE ENDS>, or otherwise is clearly labelled in this standard as a Code Component.

The purchase of this IEC standard carries a copyright license for the purchaser to sell software containing Code Components from this standard to end users either directly or via distributors, subject to IEC software licensing conditions, which can be found at: <http://www.iec.ch/CCv1>.

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

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

**IMPORTANT – The "colour inside" logo on the cover page of this document 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

The world-wide need to reduce greenhouse gas emissions considerably in order to further reduce detrimental effects on the climate requires that all sectors – power generation, industry, transport, buildings construction and agriculture – contribute to the low-carbon transition.

The power sector has been identified as having the biggest potential for cutting emissions and measures. Ways to accomplish that have also been identified: more renewable energy generation. As some renewable energy sources are intermittent, their integration into the electrical grid calls for adequate measures in order not to endanger system stability and reliability. To accomplish the increased renewable energy integration, there are several measures at hand, one of them being the conversion of excess electrical energy into another energy carrier such as gas or heat and hence to couple the electrical grid with the heat network and the gas network.

In order to allow for future sector coupling activities using the IEC 61850 series, the IEC is aware that the scope of the IEC 61850 series of standards needs to be enhanced. This is true especially for IEC 61850-7-420 tackling distributed energy resources. Hence this report is a crucial first step towards introducing relevant non-electric energy sectors such as gas and heat as cross sectors to the electric energy system.

## COMMUNICATION NETWORKS AND SYSTEMS FOR POWER UTILITY AUTOMATION –

### Part 90-27: Use of IEC 61850 for thermal energy systems connected to an electric power grid

## 1 Scope

### 1.1 General

The scope of this part of IEC 61850, which is a Technical Report, is to provide basic aspects that need to be considered when using IEC 61850 for information exchange between systems and components to support applications for thermal systems connected to electric power networks. Thermal systems isolated from electric power networks are outside the scope of this document.

From the perspective of category, this document considers thermal systems that provide thermal energy services for residential and/or commercial buildings and districts. In other words, industrial thermal systems are outside the scope of this document.

From the perspective of energy transformation, this document deals with ones between electricity and thermal energy. Other types of energy such as gas will be documented in a future report.

From the perspective of resource, this document considers generic aspects of thermal energy generators, storage, and loads that may contribute to the operations and management of electric power networks. It also deals with specific types of resources that have electric parts such as power to heat (P2H) that is a kind of electric load, and combined heat and power (CHP) that is an electric generator. This document models the characteristics for such specific units of resources including alarms and ratings. On the other hand, it does not deal with other types of specific units according to the scope of this document. For example, gas boilers, thermal energy tanks, heat exchangers, HVAC, auxiliary devices for thermal systems are not modelled as logical nodes in this document.

As a summary, this document

- gives an overview of thermal energy resources connected to electric power networks.
- provides use cases for typical operations of thermal system and deduces exchanged information necessary for information modelling.
- provides mapping of requirements on LNs based on the use cases.
- defines generic logical nodes for resources in thermal systems.
- defines logical nodes for specific unit types of P2H and CHP.
- defines logical nodes for operations that may contribute to the operations of electric power networks.

### 1.2 Data model Namespace name and version

Table 1 shows all tracking information of (Tr)IEC 61850-90-27:2023A namespace.

**Table 1 – Tracking information of (Tr)IEC 61850-90-27:2023A namespace**

Attribute	Content
<b>Namespace IEC specific information</b>	
Version of the UML model used for generating the document (informative)	WG17build10
Date of the UML model used for generating the document (informative)	2023-07-11
Autogeneration software name and version(informative)	j61850DocBuilder 02.02 based on jCleanCim noNS beta9.2 (derived from jCleanCim 02-02)

Table 2 shows all attributes of the (Tr)IEC 61850-90-27:2023A namespace.

**Table 2 – Attributes of (Tr)IEC 61850-90-27:2023A namespace**

Attribute	Content
<b>Namespace nameplate</b>	
Namespace Identifier	(Tr)IEC 61850-90-27
Version	2023
Revision	A
Release	1
Full Namespace Name	(Tr)IEC 61850-90-27:2023A
Full Code Component Name	IEC_TR_61850-90-27.NSD.2023A.Full
Light Code Component Name	IEC_TR_61850-90-27.NSD.2023A.Light
Namespace Type	transitional
<b>Namespace dependencies</b>	
extends	IEC 61850-7-4:2007B version:2007 revision:B
extends	IEC 61850-7-420:2019A version:2019 revision:A
<b>Namespace transitional status</b>	
Future handling of namespace content	The name space (Tr)IEC 61850-90-27:2023A is considered as "transitional" since the models are expected to be included in further editions IEC 61850-7-4xx. Potential extensions/modifications may happen if/when the models are moved to the International Standard status

### 1.3 Data model Namespace Code Component distribution

This document is associated with Code components. Each Code Component is a ZIP package containing at least the electronic representation of the Code Component itself and a file describing the content of the package (IECManifest.xml).

The life cycle of a code component is not restricted to the life cycle of this document. 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 Inter-operability Tissues, thus without need to publish an amendment.

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

The latest version/release of the document will be found by selecting the file for the code component with the highest value for `VersionStateInfo`, e.g. *IEC\_TR\_61850-90-27.NSD.{VersionStateInfo}.Light*.

The Code Components associated with this document are reflecting the data model specified in this document formatted in NSD files as described in IEC 61850-7-7. They are available in light and full version:

- The full version is named: *IEC\_TR\_61850-90-27.NSD.2023A.Full*. It contains definition of the whole data model defined in this document with the documentation associated and access is restricted to purchaser of this document.
- The light version is named: *IEC\_TR\_61850-90-27.NSD.2023A.Light*. It does not contain any documentation but contains the whole data model as per full version.

The light version is freely accessible on the IEC website for download at: <http://www.iec.ch/tc57/supportdocuments> but its usage remains under the licensing conditions.

In case of any differences between the downloadable code and the IEC pdf published content, the downloadable code(s) is(are) the valid one; it may be subject to updates. See included history files.

## 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.

IEC 61850-7-4:2010/AMD1:2020, *Communication networks and systems for power utility automation - Part 7-4: Basic communication structure - Compatible logical node classes and data object classes*

IEC 61850-7-420:2021, *Communication networks and systems for power utility automation - Part 7-420: Basic communication structure - Distributed energy resources and distribution automation logical nodes*

IEC SRD 62913-2-3:2019, *Generic smart grid requirements – Part 2-3: Resources connected to the grid domains*