European Network of
Transmission System Operators
for Electricity

VOLTAGE ANGLE LIMIT PROFILE SPECIFICATION

2021-04-21

SOC APPROVED
VERSION 1.0

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NOTE CONCERNING WORDING USED IN THIS DOCUMENT

The force of the following words is modified by the requirement level of the document in which they are used.

- SHALL: This word, or the terms “REQUIRED” or “MUST”, means that the definition is an absolute requirement of the specification.
- SHALL NOT: This phrase, or the phrase “MUST NOT”, means that the definition is an absolute prohibition of the specification.
- SHOULD: This word, or the adjective “RECOMMENDED”, means that there may exist valid reasons in particular circumstances to ignore a particular item, but the full implications must be understood and carefully weighed before choosing a different course.
- SHOULD NOT: This phrase, or the phrase “NOT RECOMMENDED”, means that there may exist valid reasons in particular circumstances when the particular behaviour is acceptable or even useful, but the full implications should be understood and the case carefully weighed before implementing any behaviour described with this label.
- MAY: This word, or the adjective “OPTIONAL”, means that an item is truly optional.

33

Revision History

Version	Release	Date	Paragraph	Comments
1	0	2021-04-21		Approved by SOC.

CONTENTS

78

79 **List of figures**

83

84 **List of tables**

108

1 Introduction

The voltage angle limit profile is a profile to exchange a voltage angle limit for a security analysis.

The voltage angle limits are input data for security analysis.

Normally this kind of data should be available together with IGM, but neither CGMES v2.4 nor CGMES v3.0 (IEC 61970-600-1&2 Ed1) have that capability. The need to define voltage angle limit is justified by the fact that in some areas there are specific constraints to a two-terminal equipment (elements with two ends such as line, breakers) in terms of voltage angle that has to be within limits in the optimized solution. It shall be noted that this is not a condition for the activation or application of a remedial action. It is also not a constraint that is applied to the power flow solution, so it is not a power flow setting, but its violation should be reported as a result of the power flow by the security analysis result profile. It is a constraint that is applied to RA optimisation solution. In addition, the voltage angle limit covers only the use case related to a single two-terminal equipment and does not cover e.g. three winding transformers or angle difference between any distant nodes of the grid.

The voltage angle limit profile enhances an IGM to cover the requirement. It shall be expected that in future editions of CGMES, voltage angle limit will be available in equipment and steady state hypothesis profiles.

2 Application profile specification

2.1 Version information

The content is generated from UML model file CGMES30v25_501-20v01_HeaderMetaData-10v08_CSA01v35.eap.

This edition is based on the IEC 61970 UML version ‘IEC61970CIM17v40’, dated ‘2020-08-24’.

- Title: Voltage Angle Limit Vocabulary
- Keyword: VAL
- Description: This vocabulary is describing the voltage angle limit profile.
- Version IRI: http://entsoe.eu/ns/CIM/VoltageAngleLimit-EU/1.0
- Version info: 1.0.0
- Prior version:
- Conforms to: urn:iso:std:iec:61970-600-2:ed-1|urn:iso:std:iec:61970-301:ed-7:amd1|file://iec61970cim17v40_iec61968cim13v13a_iec62325cim03v17a.eap|urn:iso:std:iec:61970-401:draft:ed-1|urn:iso:std:iec:61970-501:draft:ed-2|file://CGMES-30v25_501-20v01.eap
- Identifier: urn:uuid:ef75326c-a46d-4492-98f6-3b8b473027f6

2.2 Constraints naming convention

The naming of the rules shall not be used for machine processing. The rule names are just a string. The naming convention of the constraints is as follows.

“{rule.Type}:{rule.Standard}:{rule.Profile}:{rule.Property}:{rule.Name}”

where

rule.Type: C – for constraint; R – for requirement

rule.Standard: the number of the standard e.g. 301 for 61970-301, 456 for 61970-456, 13 for 61968-13. 61970-600 specific constraints refer to 600 although they are related to one or combination of the 61970-450 series profiles. For CSA profiles, CSA is used.

rule.Profile: the abbreviation of the profile, e.g. TP for Topology profile. If set to “ALL” the constraint is applicable to all IEC 61970-600 profiles.

rule.Property: for UML classes, the name of the class, for attributes and associations, the name of the class and attribute or association end, e.g. EnergyConsumer, IdentifiedObject.name, etc. If set to “NA” the property is not applicable to a specific UML element.

rule.Name: the name of the rule. It is unique for the same property.

Example: C:600:ALL:IdentifiedObject.name:stringLength

2.3 Profile constraints

This clause defines requirements and constraints that shall be fulfilled by applications that conform to this document.

This document is the master for rules and constraints tagged "CSA". For the sake of self-containment, the list below also includes a copy of the relevant rules from IEC 61970-452, tagged "452".

- C:452:ALL:NA:datatypes

  According to 61970-501, datatypes are not exchanged in the instance data. The UnitMultiplier is 1 in cases none value is specified in the profile.

- R:452:ALL:NA:exchange

  Optional and required attributes and associations must be imported and exported if they are in the model file prior to import.

- R:452:ALL:NA:exchange1

  If an optional attribute does not exist in the imported file, it does not have to be exported in case exactly the same data set is exported, i.e. the tool is not obliged to automatically provide this attribute. If the export is resulting from an action by the user performed after the import, e.g. data processing or model update the export can contain optional attributes.

- R:452:ALL:NA:exchange2

  In most of the profiles the selection of optional and required attributes is made so as to ensure a minimum set of required attributes without which the exchange does not fulfil its basic purpose. Business processes governing different exchanges can require mandatory exchange of certain optional attributes or associations. Optional and required attributes and associations shall therefore be supported by applications which claim conformance with certain functionalities of the IEC 61970-452. This provides flexibility for the business processes to adapt to different business requirements and base the exchanges on IEC 61970-452 compliant applications.

- R:452:ALL:NA:exchange3

An exporter may, at his or her discretion, produce a serialization containing additional class data described by the CIM Schema but not required by this document provided these data adhere to the conventions established in Clause 5.

- R:452:ALL:NA:exchange4

From the standpoint of the model import used by a data recipient, the document describes a subset of the CIM that importing software shall be able to interpret in order to import exported models. Data providers are free to exceed the minimum requirements described herein as long as their resulting data files are compliant with the CIM Schema and the conventions established in Clause 5. The document, therefore, describes additional classes and class data that, although not required, exporters will, in all likelihood, choose to include in their data files. The additional classes and data are labelled as required (cardinality 1..1) or as optional (cardinality 0..1) to distinguish them from their required counterparts. Please note, however, that data importers could potentially receive data containing instances of any and all classes described by the CIM Schema.

- R:452:ALL:NA:cardinality

The cardinality defined in the CIM model shall be followed, unless a more restrictive cardinality is explicitly defined in this document. For instance, the cardinality on the association between VoltageLevel and BaseVoltage indicates that a VoltageLevel shall be associated with one and only one BaseVoltage, but a BaseVoltage can be associated with zero to many VoltageLevels.

- R:452:ALL:NA:associations

Associations between classes referenced in this document and classes not referenced here are not required regardless of cardinality.

- R:452:ALL:IdentifiedObject.name:rule

The attribute “name” inherited by many classes from the abstract class IdentifiedObject is not required to be unique. It must be a human readable identifier without additional embedded information that would need to be parsed. The attribute is used for purposes such as User Interface and data exchange debugging. The MRID defined in the data exchange format is the only unique and persistent identifier used for this data exchange. The attribute IdentifiedObject.name is, however, always required for CoreEquipment profile and Short Circuit profile.

- R:452:ALL:IdentifiedObject.description:rule

The attribute “description” inherited by many classes from the abstract class IdentifiedObject must contain human readable text without additional embedded information that would need to be parsed.

- R:452:ALL:NA:uniqueIdentifier

All IdentifiedObject-s shall have a persistent and globally unique identifier (Master Resource Identifier - mRID).

- R:452:ALL:NA:unitMultiplier

For exchange of attributes defined using CIM Data Types (ActivePower, Susceptance, etc.) a unit multiplier of 1 is used if the UnitMultiplier specified in this document is “none”.

- C:452:ALL:IdentifiedObject.name:stringLength

The string IdentifiedObject.name has a maximum of 128 characters.

- C:452:ALL:IdentifiedObject.description:stringLength

  The string IdentifiedObject.description is maximum 256 characters.

- C:452:ALL:NA:float

  An attribute that is defined as float (e.g. has a type Float or a type which is a Datatype with .value attribute of type Float) shall support ISO/IEC 60559:2020 for floating-point arithmetic using single precision floating point. A single precision float supports 7 significant digits where the significant digits are described as an integer, or a decimal number with 6 decimal digits. Two float values are equal when the significant with 7 digits are identical, e.g. 1234567 is equal 1.234567E6 and so are 1.2345678 and 1.234567E0.

- R:CSA:ALL:Region:reference

  The reference to the Region is normally a reference to the capacity calculation region, which is identified by “Y” EIC code of the capacity calculation region.

- R:CSA:ALL:SystemOperator:reference

  The reference to the System Operator is normally identified by “X” EIC code of TSO.

2.4 Metadata

ENTSO-E agreed to extend the header and metadata definitions by IEC 61970-552 Ed2. This new header definitions rely on W3C recommendations which are used worldwide and are positively recognised by the European Commission. The new definitions of the header mainly use Provenance ontology (PROV-O), Time Ontology and Data Catalog Vocabulary (DCAT). The global new header is included in the metadata and document header specification document.

For this profile, header definitions are embedded directly in the profile. The header and the payload are in principle two different profiles, but they are currently implemented as one profile specification due to limitation in the current standards. With the approval of IEC 61970-501 Ed2 it will be possible to export it as two embedded profiles.

2.4.1 Constraints

The identification of the constraints related to the metadata follows the same convention for naming of the constraints as for profile constraints.

- R:CSA:ALL:wasAttributedTo:usage

  The prov:wasAttributedTo should normally be the “X” EIC code of the actor (prov:Agent).

2.4.2 Reference metadata

The header defined for this profile requires availability of a set of reference metadata. For instance, the attribute prov:wasGeneratedBy requires a reference to an activity which produced the model or the related process. The activities are defined as reference metadata and their identifiers are referenced from the header to enable the receiving entity to retrieve the “static” (reference) information that is not modified frequently. This approach imposes a requirement that both the sending entity and the receiving entity have access to a unique version of the reference metadata. Therefore, each business process shall define which reference metadata is used and where it is located.

3 Detailed Profile Specification

3.1 General

This package contains voltage angle limit profile.

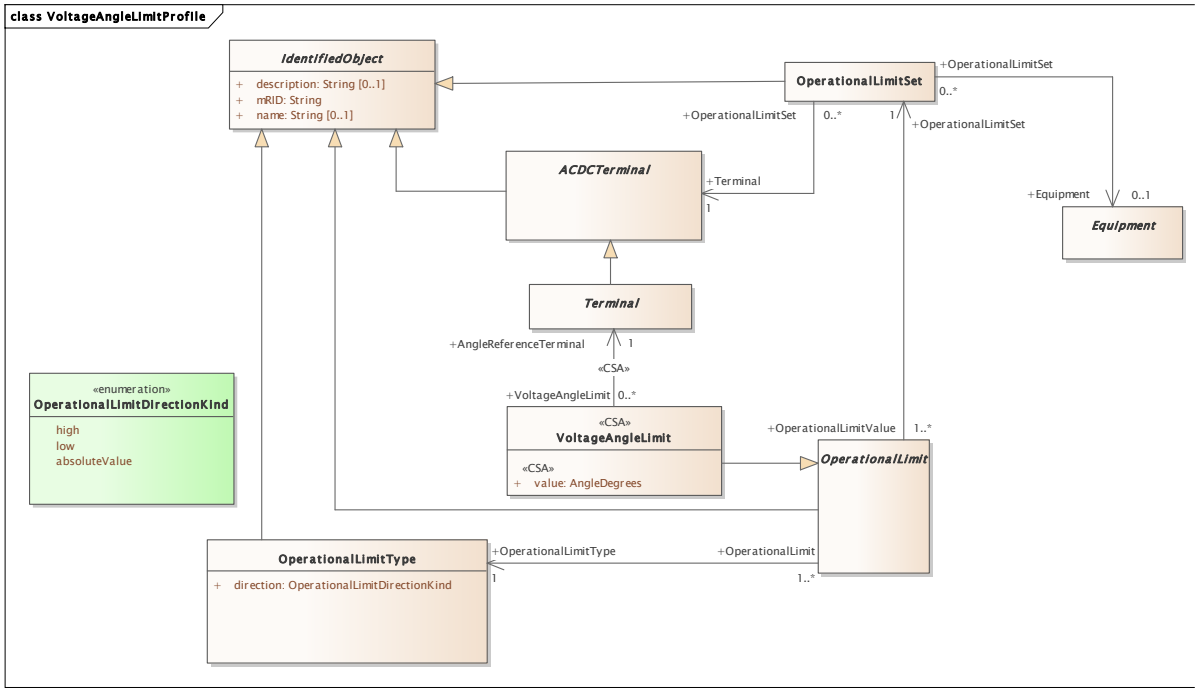

Figure 1 – Class diagram VoltageAngleLimitProfile::VoltageAngleLimitProfile

Figure 1: The diagram contains main classes related to the voltage angle limit profile.

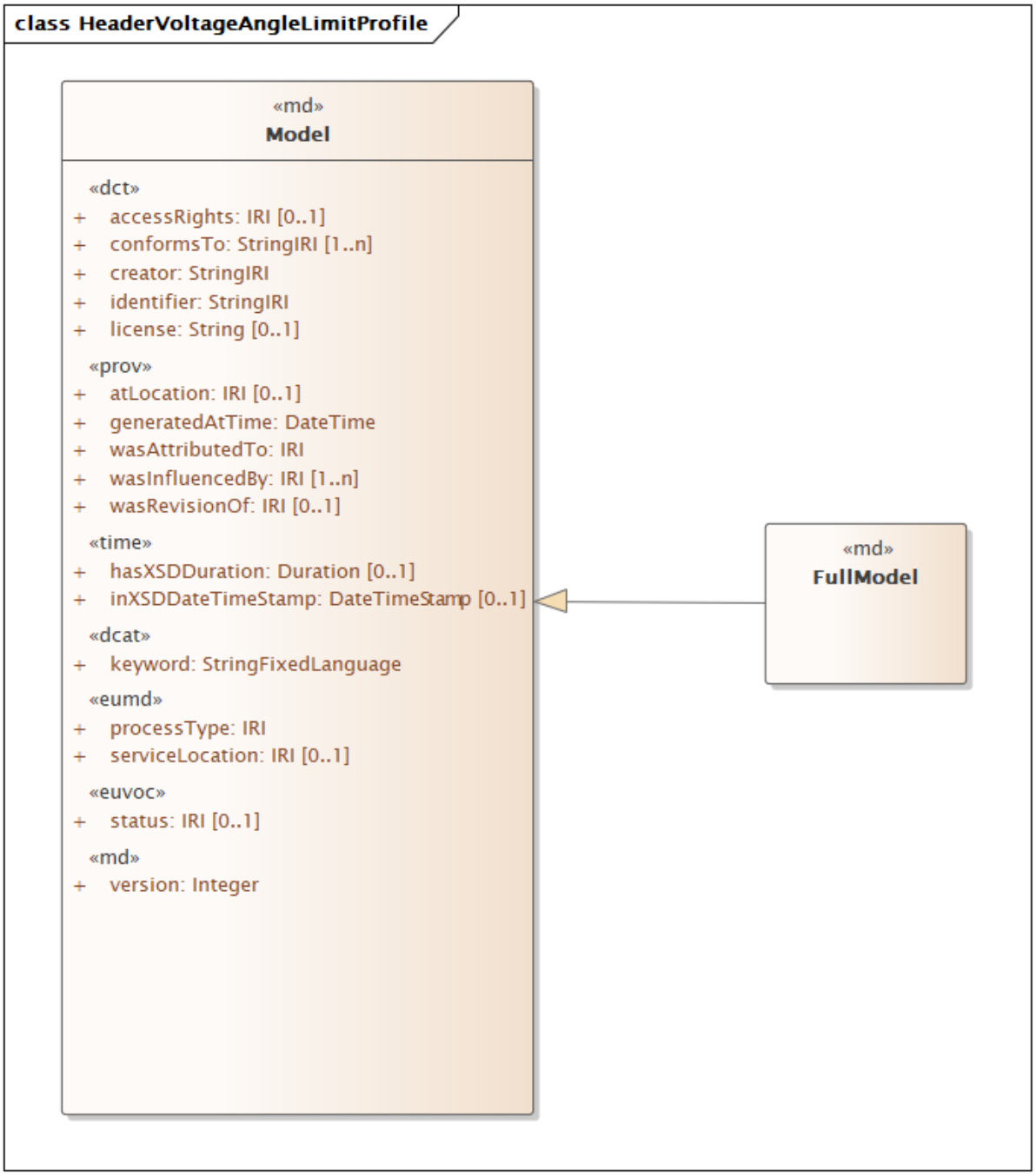

Figure 2 – Class diagram VoltageAngleLimitProfile::HeaderVoltageAngleLimitProfile

Figure 2: The diagram contains classes related to the header.

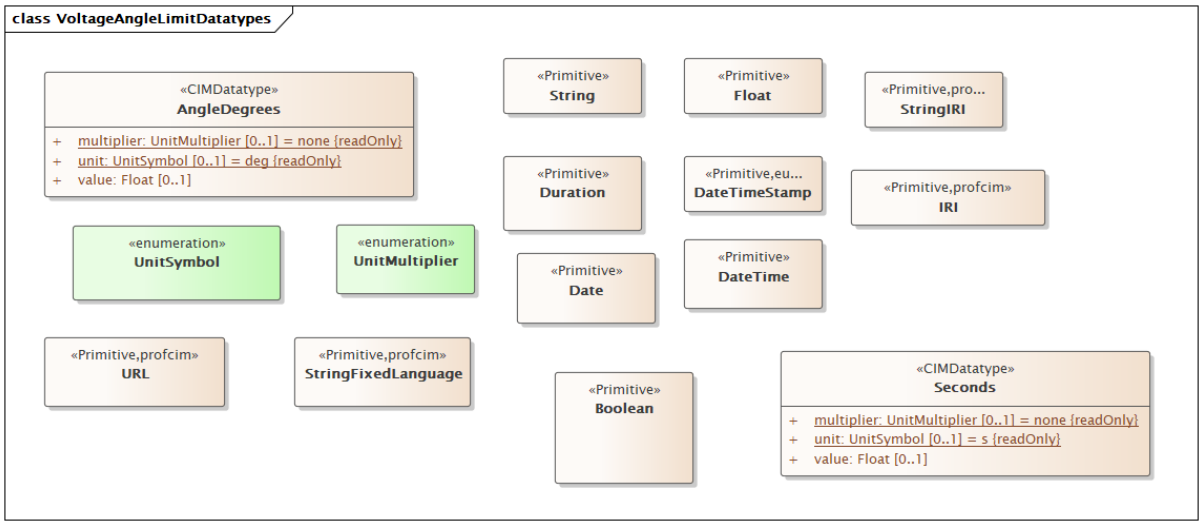

Figure 3 – Class diagram VoltageAngleLimitProfile::VoltageAngleLimitDatatypes

Figure 3: The diagram shows datatypes that are used by classes in the profile. Stereotypes are used to describe the datatypes. The following stereotypes are defined:
<<enumeration>> A list of permissible constant values.
<<Primitive>> The most basic data types used to compose all other data types.
<<CIMDatatype>> A datatype that contains a value attribute, an optional unit of measure and a unit multiplier. The unit and multiplier may be specified as a static variable initialized to the allowed value.
<<Compound>> A composite of Primitive, enumeration, CIMDatatype or other Compound classes, as long as the Compound classes do not recurse.
For all datatypes both positive and negative values are allowed unless stated otherwise for a particular datatype.

3.2 (abstract) Terminal

Inheritance path = ACDCTerminal : IdentifiedObject
An AC electrical connection point to a piece of conducting equipment. Terminals are connected at physical connection points called connectivity nodes.
Table 1 shows all attributes of Terminal.

Table 1 – Attributes of VoltageAngleLimitProfile::Terminal

name	mult	type	description
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 2 shows all association ends of Terminal with other classes.

Table 2 – Association ends of VoltageAngleLimitProfile::Terminal with other classes

mult from	name	mult to	type	description
1..1	OperationalLimitSet	0..*	OperationalLimitSet	inherited from: ACDCTerminal

3.3 (abstract) ACDCTerminal

Inheritance path = IdentifiedObject

An electrical connection point (AC or DC) to a piece of conducting equipment. Terminals are connected at physical connection points called connectivity nodes.
Table 3 shows all attributes of ACDCTerminal.

Table 3 – Attributes of VoltageAngleLimitProfile::ACDCTerminal

name	mult	type	description
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 4 shows all association ends of ACDCTerminal with other classes.

Table 4 – Association ends of VoltageAngleLimitProfile::ACDCTerminal with other classes

mult from	name	mult to	type	description
1..1	OperationalLimitSet	0..*	OperationalLimitSet	The operational limit sets at the terminal.

3.4 (abstract) Equipment root class

The parts of a power system that are physical devices, electronic or mechanical.

3.5 (abstract) OperationalLimit

Inheritance path = IdentifiedObject
A value and normal value associated with a specific kind of limit.
The sub class value and normalValue attributes vary inversely to the associated OperationalLimitType.acceptableDuration (acceptableDuration for short).
If a particular piece of equipment has multiple operational limits of the same kind (apparent power, current, etc.), the limit with the greatest acceptableDuration shall have the smallest limit value and the limit with the smallest acceptableDuration shall have the largest limit value. Note: A large current can only be allowed to flow through a piece of equipment for a short duration without causing damage, but a lesser current can be allowed to flow for a longer duration.
Table 5 shows all attributes of OperationalLimit.

Table 5 – Attributes of VoltageAngleLimitProfile::OperationalLimit

name	mult	type	description
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 6 shows all association ends of OperationalLimit with other classes.

Table 6 – Association ends of VoltageAngleLimitProfile::OperationalLimit with other classes

mult from	name	mult to	type	description
1..*	OperationalLimitType	1..1	OperationalLimitType	The limit type associated with this limit.
1..*	OperationalLimitSet	1..1	OperationalLimitSet	The limit set to which the limit values belong.

3.6 OperationalLimitType

Inheritance path = IdentifiedObject
The operational meaning of a category of limits.
Table 7 shows all attributes of OperationalLimitType.

Table 7 – Attributes of VoltageAngleLimitProfile::OperationalLimitType

name	mult	type	description
direction	1..1	OperationalLimitDirectionKind	The direction of the limit.
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

3.7 (CSA) VoltageAngleLimit

Inheritance path = OperationalLimit : IdentifiedObject
The voltage angle limit for a two terminal ConductingEquipment. The association OperationalLimitSet.Terminal shall be instantiated for Terminal with sequenceNumber equal to 1.
Table 8 shows all attributes of VoltageAngleLimit.

Table 8 – Attributes of VoltageAngleLimitProfile::VoltageAngleLimit

name	mult	type	description
value	1..1	AngleDegrees	(CSA) The difference in angle degrees between Terminal with sequenceNumber equal to 1 and the Terminal referenced by the association VoltageAngleLimit.AngleReferenceTerminal. The value can be positive, negative or zero depending on the angle difference between the two terminals.
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 9 shows all association ends of VoltageAngleLimit with other classes.

Table 9 – Association ends of VoltageAngleLimitProfile::VoltageAngleLimit with other classes

mult from	name	mult to	type	description
0..*	AngleReferenceTerminal	1..1	Terminal	(CSA) The angele reference terminal for the voltage angel limit.
1..*	OperationalLimitType	1..1	OperationalLimitType	inherited from: OperationalLimit
1..*	OperationalLimitSet	1..1	OperationalLimitSet	inherited from: OperationalLimit

3.8 (md) Model root class

A Model is a collection of data describing instances, objects or entities, real or computed. In the context of CIM the semantics of the data is defined by profiles. Hence a model can contain equipment data, power flow initial values, power flow results etc.
The Model class describes the header content that is the same for the FullModel and the DifferenceModel. A Model is identified by an rdf:about attribute. The rdf:about attribute uniquely describes the model data and not the CIMXML document. A new rdf:about identification is

362 generated for created documents only when the model data has changed. A repeated creation
363 of documents from unchanged model data shall have the same rdf:about identification as
364 previous document generated from the same model data.
365 Table 10 shows all attributes of Model.

366 **Table 10 – Attributes of VoltageAngleLimitProfile::Model**

name	mult	type	description
version	1..1	Integer	(md) The version of the model. If the instance file is imported and exported with no change, the version number is kept the same. The version changes only if the content of the file changes. It is the same logic as for the header id. The version is the human readable id. [CIM context: It relates to the version of the document and not the version of the model which is serialized.].
status	0..1	IRI	(euvoc) Indicates the status of a skos:Concept or a skosxl:Label, or any resource related to controlled vocabulary management. [CIM context: The condition or position of an object with regard to its standing. (Validated, Primary, Backup etc.)].
keyword	1..1	StringFixedLanguage	(dcat) A keyword or tag describing a resource. [CIM context: The intended content type of the model, usually the profile keyword. Used to identify what profiles and content is expected in the document, e.g., Equipment, Boundary, SSH, AE, etc. The same keyword is used for different versions of same profile. It can be also used to identify different content based on the same profile. For instance, as the equipment profile can be used for both boundary data and equipment not related to boundary, the keyword is different to indicate that boundary data is exchanged. In order to avoid ambiguity the property is not exchanged in cases where the document contains multiple profiles referenced by dct:conformsTo.].
accessRights	0..1	IRI	(dct) Information about who access the resource or an indication of its security status.Access Rights may include information regarding access or restrictions based on privacy, security, or other policies. [CIM context: Reference to the confidentiality level that shall be applied when handling this model.].
conformsTo	1..n	StringIRI	(dct) An established standard to which the described resource conforms. [CIM context: An IRI describing the profile that governs this model. It uniquely identifies the profile and its version. Multiple instances of the property describe all standards or specifications to which the model and the document representing this model conform to. A document would normally conform to profile definitions, the constraints that relate to the profile and/or the set of business specific constrains. A reference to a machine- readable

name	mult	type	description
			constraints or specification indicates that the document was tested against these constraints and it conforms to them.].
identifier	1..1	StringIRI	(dct) An unambiguous reference to the resource within a given context. Recommended practice is to identify the resource by means of a string conforming to an identification system. Examples include International Standard Book Number (ISBN), Digital Object Identifier (DOI), and Uniform Resource Name (URN). Persistent identifiers should be provided as HTTP URIs. [CIM context: A unique identifier of the model which is serialised in the document where the header is located. The identifier is persistent for a given version of the model and shall change when the model changes. If a model is serialized as complete (full) model or as difference model exchange the identifier shall be the same. The identifier shall not be used as an identifier of the document which can be different for a given version of a model.].
license	0..1	String	(dct) A legal document giving official permission to do something with the resource. Recommended practice is to identify the license document with a URI. If this is not possible or feasible, a literal value that identifies the license may be provided. [CIM context: Reference to the license under which the data is made available. If no license holder is defined, then the original data provider holds the license.].
generatedAtTime	1..1	DateTime	(prov) Generation is the completion of production of a new entity by an activity. This entity did not exist before generation and becomes available for usage after this generation. [CIM context: The date and time when the model was serialized in the document where the header is located. The format is an extended format according to the ISO 8601-2005. European exchanges shall refer to UTC.].
atLocation	0..1	IRI	(prov) A location can be an identifiable geographic place (ISO 19112), but it can also be a non-geographic place such as a directory, row, or column. As such, there are numerous ways in which location can be expressed, such as by a coordinate, address, landmark, and so forth. [CIM context: Reference to a region or a domain for which this model is provided.].
wasInfluencedBy	1..n	IRI	(prov) Influence is the capacity of an entity, activity, or agent to have an effect on the character, development, or behavior of another by means of usage, start, end, generation, invalidation, communication, derivation, attribution, association, or delegation. [CIM context: A reference to the model on which the model serialised in this document depends on. The references are maintained by the producer of the model. Minimum requirements for the

name	mult	type	description
			dependency are specified and can be restricted within a business process as long as they do not contradict requirements by standards. For instance, IEC 61970-600-1 defines minimum requirements for the profiles defined in that standard.].
wasAttributedTo	1..1	IRI	(prov) Attribution is the ascribing of an entity to an agent. [CIM context: Reference to the agent (or service provider) from which the model originates.].
wasRevisionOf	0..1	IRI	(prov) A revision is a derivation for which the resulting entity is a revised version of some original. The implication here is that the resulting entity contains substantial content from the original. Revision is a particular case of derivation. [CIM context: When a model is updated the resulting model supersedes the models that were used as basis for the update. Hence this is a reference to the model which are superseded by this model. A model can supersede 1 or more models, e.g. a difference model or a full model supersede multiple models (difference or full). In this case, multiple properties are included in the header. The referenced document(s) is (are) identified by the URN/MRID/UUID in the FullModel rdf:about attribute when full model(s) is (are) referenced and by the URN/MRID/UUID in the DifferenceModel rdf:about attribute when difference model(s) is (are) referenced.].
inXSDDateTimeStamp	0..1	DateTimeStamp	(time) Position of an instant, expressed using xsd:dateTimeStamp, in which the time-zone field is mandatory. [CIM context: The date and time that this model represents, i.e. for which the model is (or was) valid. If used in relation with hasXSDDuration it indicates the beginning of the validity period. It is indicating either an instant (in cases where the model is only valid for a point in time) or the start time of a period. If not provided the model is considered valid for any time stamp. The format is an extended format according to the ISO 8601-2005. European exchanges shall refer to UTC.].
hasXSDDuration	0..1	Duration	(time) Extent of a temporal entity, expressed using xsd:duration. [CIM context: The duration of the validity period of the model that it is serialized in the document where the header is located. It is only used in relation to the inXSDDateTimeStamp property which indicates the beginning of the validity period of the model. The end of the validity period is derived from both inXSDDateTimeStamp and hasXSDDuration.].
processType	1..1	IRI	(eumd) The exact business nature. Reference to Business Process configurations.
creator	1..1	StringIRI	(dct) An entity responsible for making the resource.

name	mult	type	description
			Recommended practice is to identify the creator with a URI. If this is not possible or feasible, a literal value that identifies the creator may be provided. [CIM context: The name of the agent (Modeling Authority) from which the model originates].
serviceLocation	0..1	IRI	(eumd) Reference to a service location (region or a domain).

3.9 (md) FullModel

Inheritance path = Model

It represents the full model header and its contents is described by the Model class.

Table 11 shows all attributes of FullModel.

Table 11 – Attributes of VoltageAngleLimitProfile::FullModel

name	mult	type	description
version	1..1	Integer	(md) inherited from: Model
status	0..1	IRI	(euvoc) inherited from: Model
keyword	1..1	StringFixedLanguage	(dcat) inherited from: Model
accessRights	0..1	IRI	(dct) inherited from: Model
conformsTo	1..n	StringIRI	(dct) inherited from: Model
identifier	1..1	StringIRI	(dct) inherited from: Model
license	0..1	String	(dct) inherited from: Model
generatedAtTime	1..1	DateTime	(prov) inherited from: Model
atLocation	0..1	IRI	(prov) inherited from: Model
wasInfluencedBy	1..n	IRI	(prov) inherited from: Model
wasAttributedTo	1..1	IRI	(prov) inherited from: Model
wasRevisionOf	0..1	IRI	(prov) inherited from: Model
inXSDDateTimeStamp	0..1	DateTimeStamp	(time) inherited from: Model
hasXSDDuration	0..1	Duration	(time) inherited from: Model
processType	1..1	IRI	(eumd) inherited from: Model
creator	1..1	StringIRI	(dct) inherited from: Model
serviceLocation	0..1	IRI	(eumd) inherited from: Model

3.10 (abstract) IdentifiedObject root class

This is a root class to provide common identification for all classes needing identification and naming attributes.

Table 12 shows all attributes of IdentifiedObject.

Table 12 – Attributes of VoltageAngleLimitProfile::IdentifiedObject

name	mult	type	description
description	0..1	String	The description is a free human readable text describing or naming the object. It may be non unique and may not correlate to a naming hierarchy.

name	mult	type	description
mRID	1..1	String	Master resource identifier issued by a model authority. The mRID is unique within an exchange context. Global uniqueness is easily achieved by using a UUID, as specified in RFC 4122, for the mRID. The use of UUID is strongly recommended. For CIMXML data files in RDF syntax conforming to IEC 61970-552, the mRID is mapped to rdf:ID or rdf:about attributes that identify CIM object elements.
name	0..1	String	The name is any free human readable and possibly non unique text naming the object.

3.11 OperationalLimitSet

Inheritance path = IdentifiedObject

A set of limits associated with equipment. Sets of limits might apply to a specific temperature, or season for example. A set of limits may contain different severities of limit levels that would apply to the same equipment. The set may contain limits of different types such as apparent power and current limits or high and low voltage limits that are logically applied together as a set.

Table 13 shows all attributes of OperationalLimitSet.

Table 13 – Attributes of VoltageAngleLimitProfile::OperationalLimitSet

name	mult	type	description
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 14 shows all association ends of OperationalLimitSet with other classes.

Table 14 – Association ends of VoltageAngleLimitProfile::OperationalLimitSet with other classes

mult from	name	mult to	type	description
0..*	Terminal	1..1	ACDCTerminal	The terminal where the operational limit set apply.
1..1	OperationalLimitValue	1..*	OperationalLimit	Values of equipment limits.
0..*	Equipment	0..1	Equipment	The equipment to which the limit set applies.

3.12 AngleDegrees datatype

Measurement of angle in degrees.

Table 15 shows all attributes of AngleDegrees.

Table 15 – Attributes of VoltageAngleLimitProfile::AngleDegrees

name	mult	type	description
value	0..1	Float	
unit	0..1	UnitSymbol	(const=deg)
multiplier	0..1	UnitMultiplier	(const=none)

3.13 Seconds datatype

Time, in seconds.
Table 16 shows all attributes of Seconds.

Table 16 – Attributes of VoltageAngleLimitProfile::Seconds

name	mult	type	description
value	0..1	Float	Time, in seconds
unit	0..1	UnitSymbol	(const=s)
multiplier	0..1	UnitMultiplier	(const=none)

3.14 Date primitive

Date as "yyyy-mm-dd", which conforms with ISO 8601. UTC time zone is specified as "yyyy-mm-ddZ". A local timezone relative UTC is specified as "yyyy-mm-dd(+/-)hh:mm".

3.15 Boolean primitive

A type with the value space "true" and "false".

3.16 DateTime primitive

Date and time as "yyyy-mm-ddThh:mm:ss.sss", which conforms with ISO 8601. UTC time zone is specified as "yyyy-mm-ddThh:mm:ss.sssZ". A local timezone relative UTC is specified as "yyyy-mm-ddThh:mm:ss.sss-hh:mm". The second component (shown here as "ss.sss") could have any number of digits in its fractional part to allow any kind of precision beyond seconds.

3.17 (eumd) DateTimeStamp primitive

Position of an instant, expressed using xsd:dateTimeStamp, in which the time-zone field is mandatory.

3.18 Duration primitive

Duration as "PnYnMnDTnHnMnS" which conforms to ISO 8601, where nY expresses a number of years, nM a number of months, nD a number of days. The letter T separates the date expression from the time expression and, after it, nH identifies a number of hours, nM a number of minutes and nS a number of seconds. The number of seconds could be expressed as a decimal number, but all other numbers are integers.

3.19 Float primitive

A floating point number. The range is unspecified and not limited.

3.20 (profcim) IRI primitive

An IRI (Internationalized Resource Identifier) within an RDF graph is a Unicode string that conforms to the syntax defined in RFC 3987.
The primitive is serialized as rdf:resource in RDFXML.
IRIs in the RDF abstract syntax must be absolute, and may contain a fragment identifier.
IRI equality: Two IRIs are equal if and only if they are equivalent under Simple String Comparison according to section 5.1 of [RFC3987]. Further normalization must not be performed when comparing IRIs for equality.
IRIs are a generalization of URIs [RFC3986] that permits a wider range of Unicode characters. Every absolute URI and URL is an IRI, but not every IRI is an URI. When IRIs are used in operations that are only defined for URIs, they must first be converted according to the mapping defined in section 3.1 of [RFC3987]. A notable example is retrieval over the HTTP protocol. The mapping involves UTF-8 encoding of non-ASCII characters, %-encoding of octets not allowed in URIs, and Punycode-encoding of domain names.

3.21 String primitive

A string consisting of a sequence of characters. The character encoding is UTF-8. The string length is unspecified and unlimited.

3.22 (profcim) StringFixedLanguage primitive

A string consisting of a sequence of characters. The character encoding is UTF-8. The string length is unspecified and unlimited.
The primitive is serialized as literal without language support.

3.23 (profcim) StringIRI primitive

An IRI (Internationalized Resource Identifier) within an RDF graph is a Unicode string that conforms to the syntax defined in RFC 3987.
The primitive is serialized as literal without language support.
IRIs in the RDF abstract syntax must be absolute, and may contain a fragment identifier.
IRI equality: Two IRIs are equal if and only if they are equivalent under Simple String Comparison according to section 5.1 of [RFC3987]. Further normalization must not be performed when comparing IRIs for equality.
IRIs are a generalization of URIs [RFC3986] that permits a wider range of Unicode characters. Every absolute URI and URL is an IRI, but not every IRI is an URI. When IRIs are used in operations that are only defined for URIs, they must first be converted according to the mapping defined in section 3.1 of [RFC3987]. A notable example is retrieval over the HTTP protocol. The mapping involves UTF-8 encoding of non-ASCII characters, %-encoding of octets not allowed in URIs, and Punycode-encoding of domain names.

3.24 (profcim) URL primitive

A Uniform Resource Locator (URL), colloquially termed a web address, is a reference to a web resource that specifies its location on a computer network and a mechanism for retrieving it. A URL is a specific type of Uniform Resource Identifier (URI), although many people use the two terms interchangeably.URLs occur most commonly to reference web pages (http), but are also used for file transfer (ftp), email (mailto), database access (JDBC), and many other applications.

3.25 OperationalLimitDirectionKind enumeration

The direction attribute describes the side of a limit that is a violation.
Table 17 shows all literals of OperationalLimitDirectionKind.

Table 17 – Literals of VoltageAngleLimitProfile::OperationalLimitDirectionKind

literal	value	description
high		High means that a monitored value above the limit value is a violation. If applied to a terminal flow, the positive direction is into the terminal.
low		Low means a monitored value below the limit is a violation. If applied to a terminal flow, the positive direction is into the terminal.
absoluteValue		An absoluteValue limit means that a monitored absolute value above the limit value is a violation.

3.26 UnitMultiplier enumeration

The unit multipliers defined for the CIM. When applied to unit symbols, the unit symbol is treated as a derived unit. Regardless of the contents of the unit symbol text, the unit symbol shall be treated as if it were a single-character unit symbol. Unit symbols should not contain multipliers, and it should be left to the multiplier to define the multiple for an entire data type.
For example, if a unit symbol is "m2Pers" and the multiplier is "k", then the value is k(m**2/s), and the multiplier applies to the entire final value, not to any individual part of the value. This can be conceptualized by substituting a derived unit symbol for the unit type. If one imagines that the symbol "Þ" represents the derived unit "m2Pers", then applying the multiplier "k" can be conceptualized simply as "kÞ".
For example, the SI unit for mass is "kg" and not "g". If the unit symbol is defined as "kg", then the multiplier is applied to "kg" as a whole and does not replace the "k" in front of the "g". In

this case, the multiplier of "m" would be used with the unit symbol of "kg" to represent one gram. As a text string, this violates the instructions in IEC 80000-1. However, because the unit symbol in CIM is treated as a derived unit instead of as an SI unit, it makes more sense to conceptualize the "kg" as if it were replaced by one of the proposed replacements for the SI mass symbol. If one imagines that the "kg" were replaced by a symbol "Þ", then it is easier to conceptualize the multiplier "m" as creating the proper unit "mÞ", and not the forbidden unit "mkg".
Table 18 shows all literals of UnitMultiplier.

Table 18 – Literals of VoltageAngleLimitProfile::UnitMultiplier

literal	value	description
y	-24	Yocto 10**-24.
z	-21	Zepto 10**-21.
a	-18	Atto 10**-18.
f	-15	Femto 10**-15.
p	-12	Pico 10**-12.
n	-9	Nano 10**-9.
micro	-6	Micro 10**-6.
m	-3	Milli 10**-3.
c	-2	Centi 10**-2.
d	-1	Deci 10**-1.
none	0	No multiplier or equivalently multiply by 1.
da	1	Deca 10**1.
h	2	Hecto 10**2.
k	3	Kilo 10**3.
M	6	Mega 10**6.
G	9	Giga 10**9.
T	12	Tera 10**12.
P	15	Peta 10**15.
E	18	Exa 10**18.
Z	21	Zetta 10**21.
Y	24	Yotta 10**24.

3.27 UnitSymbol enumeration

The derived units defined for usage in the CIM. In some cases, the derived unit is equal to an SI unit. Whenever possible, the standard derived symbol is used instead of the formula for the derived unit. For example, the unit symbol Farad is defined as "F" instead of "CPerV". In cases where a standard symbol does not exist for a derived unit, the formula for the unit is used as the unit symbol. For example, density does not have a standard symbol and so it is represented as "kgPerm3". With the exception of the "kg", which is an SI unit, the unit symbols do not contain multipliers and therefore represent the base derived unit to which a multiplier can be applied as a whole.
Every unit symbol is treated as an unparseable text as if it were a single-letter symbol. The meaning of each unit symbol is defined by the accompanying descriptive text and not by the text contents of the unit symbol.
To allow the widest possible range of serializations without requiring special character handling, several substitutions are made which deviate from the format described in IEC 80000-1. The division symbol "/" is replaced by the letters "Per". Exponents are written in plain text after the unit as "m3" instead of being formatted as "m" with a superscript of 3 or introducing a symbol

as in "m^3". The degree symbol "°" is replaced with the letters "deg". Any clarification of the meaning for a substitution is included in the description for the unit symbol.
Non-SI units are included in list of unit symbols to allow sources of data to be correctly labelled with their non-SI units (for example, a GPS sensor that is reporting numbers that represent feet instead of meters). This allows software to use the unit symbol information correctly convert and scale the raw data of those sources into SI-based units.
The integer values are used for harmonization with IEC 61850.
Table 19 shows all literals of UnitSymbol.

Table 19 – Literals of VoltageAngleLimitProfile::UnitSymbol

literal	value	description
none	0	Dimension less quantity, e.g. count, per unit, etc.
m	2	Length in metres.
kg	3	Mass in kilograms. Note: multiplier “k” is included in this unit symbol for compatibility with IEC 61850-7-3.
s	4	Time in seconds.
A	5	Current in amperes.
K	6	Temperature in kelvins.
mol	7	Amount of substance in moles.
cd	8	Luminous intensity in candelas.
deg	9	Plane angle in degrees.
rad	10	Plane angle in radians (m/m).
sr	11	Solid angle in steradians (m2/m2).
Gy	21	Absorbed dose in grays (J/kg).
Bq	22	Radioactivity in becquerels (1/s).
degC	23	Relative temperature in degrees Celsius. In the SI unit system the symbol is °C. Electric charge is measured in coulomb that has the unit symbol C. To distinguish degree Celsius from coulomb the symbol used in the UML is degC. The reason for not using °C is that the special character ° is difficult to manage in software.
Sv	24	Dose equivalent in sieverts (J/kg).
F	25	Electric capacitance in farads (C/V).
C	26	Electric charge in coulombs (A·s).
S	27	Conductance in siemens.
H	28	Electric inductance in henrys (Wb/A).
V	29	Electric potential in volts (W/A).
ohm	30	Electric resistance in ohms (V/A).
J	31	Energy in joules (N·m = C·V = W·s).
N	32	Force in newtons (kg·m/s²).
Hz	33	Frequency in hertz (1/s).
lx	34	Illuminance in lux (lm/m²).
lm	35	Luminous flux in lumens (cd·sr).
Wb	36	Magnetic flux in webers (V·s).
T	37	Magnetic flux density in teslas (Wb/m2).

literal	value	description
W	38	Real power in watts (J/s). Electrical power may have real and reactive components. The real portion of electrical power (I^2R or VIcos(phi)), is expressed in Watts. See also apparent power and reactive power.
Pa	39	Pressure in pascals (N/m^2). Note: the absolute or relative measurement of pressure is implied with this entry. See below for more explicit forms.
m2	41	Area in square metres (m^2).
m3	42	Volume in cubic metres (m^3).
mPers	43	Velocity in metres per second (m/s).
mPers2	44	Acceleration in metres per second squared (m/s^2).
m3Pers	45	Volumetric flow rate in cubic metres per second (m^3/s).
mPerm3	46	Fuel efficiency in metres per cubic metres (m/m^3).
kgm	47	Moment of mass in kilogram metres (kg·m) (first moment of mass). Note: multiplier “k” is included in this unit symbol for compatibility with IEC 61850-7-3.
kgPerm3	48	Density in kilogram/cubic metres (kg/m^3). Note: multiplier “k” is included in this unit symbol for compatibility with IEC 61850-7-3.
m2Pers	49	Viscosity in square metres / second (m^2/s).
WPermK	50	Thermal conductivity in watt/metres kelvin.
JPerK	51	Heat capacity in joules/kelvin.
ppm	52	Concentration in parts per million.
rotPers	53	Rotations per second (1/s). See also Hz (1/s).
radPers	54	Angular velocity in radians per second (rad/s).
WPerm2	55	Heat flux density, irradiance, watts per square metre.
JPerm2	56	Insulation energy density, joules per square metre or watt second per square metre.
SPerm	57	Conductance per length (F/m).
KPers	58	Temperature change rate in kelvins per second.
PaPers	59	Pressure change rate in pascals per second.
JPerkgK	60	Specific heat capacity, specific entropy, joules per kilogram Kelvin.
VA	61	Apparent power in volt amperes. See also real power and reactive power.
VAr	63	Reactive power in volt amperes reactive. The “reactive” or “imaginary” component of electrical power (VIsin(phi)). (See also real power and apparent power). Note: Different meter designs use different methods to arrive at their results. Some meters may compute reactive power as an arithmetic value, while others compute the value vectorially. The data consumer should determine the method in use and the suitability of the measurement for the intended purpose.

literal	value	description
cosPhi	65	Power factor, dimensionless. Note 1: This definition of power factor only holds for balanced systems. See the alternative definition under code 153. Note 2 : Beware of differing sign conventions in use between the IEC and EEI. It is assumed that the data consumer understands the type of meter in use and the sign convention in use by the utility.
Vs	66	Volt seconds (Ws/A).
V2	67	Volt squared (W^2/A^2).
As	68	Ampere seconds (A·s).
A2	69	Amperes squared (A^2).
A2s	70	Ampere squared time in square amperes (A^2s).
VAh	71	Apparent energy in volt ampere hours.
Wh	72	Real energy in watt hours.
VArh	73	Reactive energy in volt ampere reactive hours.
VPerHz	74	Magnetic flux in volt per hertz.
HzPers	75	Rate of change of frequency in hertz per second.
character	76	Number of characters.
charPers	77	Data rate (baud) in characters per second.
kgm2	78	Moment of mass in kilogram square metres ($kg·m^2$) (Second moment of mass, commonly called the moment of inertia). Note: multiplier “k” is included in this unit symbol for compatibility with IEC 61850-7-3.
dB	79	Sound pressure level in decibels. Note: multiplier “d” is included in this unit symbol for compatibility with IEC 61850-7-3.
WPers	81	Ramp rate in watts per second.
lPers	82	Volumetric flow rate in litres per second.
dBm	83	Power level (logarithmic ratio of signal strength , Bel-mW), normalized to 1mW. Note: multiplier “d” is included in this unit symbol for compatibility with IEC 61850-7-3.
h	84	Time in hours, hour = 60 min = 3600 s.
min	85	Time in minutes, minute = 60 s.
Q	100	Quantity power, Q.
Qh	101	Quantity energy, Qh.
ohmm	102	Resistivity, ohm metres, (rho).
APerm	103	A/m, magnetic field strength, amperes per metre.
V2h	104	Volt-squared hour, volt-squared-hours.
A2h	105	Ampere-squared hour, ampere-squared hour.
Ah	106	Ampere-hours, ampere-hours.
count	111	Amount of substance, Counter value.
ft3	119	Volume, cubic feet.
m3Perh	125	Volumetric flow rate, cubic metres per hour.

literal	value	description
gal	128	Volume in gallons, US gallon (1 gal = 231 in3 = 128 fl ounce).
Btu	132	Energy, British Thermal Units.
l	134	Volume in litres, litre = dm3 = m3/1000.
lPerh	137	Volumetric flow rate, litres per hour.
lPerl	143	Concentration, The ratio of the volume of a solute divided by the volume of the solution. Note: Users may need use a prefix such a 'µ' to express a quantity such as 'µL/L'.
gPerg	144	Concentration, The ratio of the mass of a solute divided by the mass of the solution. Note: Users may need use a prefix such a 'µ' to express a quantity such as 'µg/g'.
molPerm3	145	Concentration, The amount of substance concentration, (c), the amount of solvent in moles divided by the volume of solution in m³.
molPermol	146	Concentration, Molar fraction, the ratio of the molar amount of a solute divided by the molar amount of the solution.
molPerkg	147	Concentration, Molality, the amount of solute in moles and the amount of solvent in kilograms.
sPers	149	Time, Ratio of time. Note: Users may need to supply a prefix such as 'µ' to show rates such as 'µs/s'.
HzPerHz	150	Frequency, rate of frequency change. Note: Users may need to supply a prefix such as 'm' to show rates such as 'mHz/Hz'.
VPerV	151	Voltage, ratio of voltages. Note: Users may need to supply a prefix such as 'm' to show rates such as 'mV/V'.
APerA	152	Current, ratio of amperages. Note: Users may need to supply a prefix such as 'm' to show rates such as 'mA/A'.
VPerVA	153	Power factor, PF, the ratio of the active power to the apparent power. Note: The sign convention used for power factor will differ between IEC meters and EEI (ANSI) meters. It is assumed that the data consumers understand the type of meter being used and agree on the sign convention in use at any given utility.
rev	154	Amount of rotation, revolutions.
kat	158	Catalytic activity, katal = mol / s.
JPerkg	165	Specific energy, Joules / kg.
m3Uncompensated	166	Volume, cubic metres, with the value uncompensated for weather effects.
m3Compensated	167	Volume, cubic metres, with the value compensated for weather effects.
WPerW	168	Signal Strength, ratio of power. Note: Users may need to supply a prefix such as 'm' to show rates such as 'mW/W'.
therm	169	Energy, therms.
onePerm	173	Wavenumber, reciprocal metres, (1/m).
m3Perkg	174	Specific volume, cubic metres per kilogram, v.

literal	value	description
Pas	175	Dynamic viscosity, pascal seconds.
Nm	176	Moment of force, newton metres.
NPerm	177	Surface tension, newton per metre.
radPers2	178	Angular acceleration, radians per second squared.
JPerm3	181	Energy density, joules per cubic metre.
VPerm	182	Electric field strength, volts per metre.
CPerm3	183	Electric charge density, coulombs per cubic metre.
CPerm2	184	Surface charge density, coulombs per square metre.
FPerm	185	Permittivity, farads per metre.
HPerm	186	Permeability, henrys per metre.
JPermol	187	Molar energy, joules per mole.
JPermolK	188	Molar entropy, molar heat capacity, joules per mole kelvin.
CPerkg	189	Exposure (x rays), coulombs per kilogram.
GyPers	190	Absorbed dose rate, grays per second.
WPersr	191	Radiant intensity, watts per steradian.
WPerm2sr	192	Radiance, watts per square metre steradian.
katPerm3	193	Catalytic activity concentration, katals per cubic metre.
d	195	Time in days, day = 24 h = 86400 s.
anglemin	196	Plane angle, minutes.
anglesec	197	Plane angle, seconds.
ha	198	Area, hectares.
tonne	199	Mass in tons, “tonne” or “metric ton” (1000 kg = 1 Mg).
bar	214	Pressure in bars, (1 bar = 100 kPa).
mmHg	215	Pressure, millimetres of mercury (1 mmHg is approximately 133.3 Pa).
M	217	Length, nautical miles (1 M = 1852 m).
kn	219	Speed, knots (1 kn = 1852/3600) m/s.
Mx	276	Magnetic flux, maxwells (1 Mx = 10-8 Wb).
G	277	Magnetic flux density, gausses (1 G = 10-4 T).
Oe	278	Magnetic field in oersteds, (1 Oe = (103/4p) A/m).
Vh	280	Volt-hour, Volt hours.
WPerA		Active power per current flow, watts per Ampere.
onePerHz		Reciprocal of frequency (1/Hz).
VPerVAr		Power factor, PF, the ratio of the active power to the apparent power. Note: The sign convention used for power factor will differ between IEC meters and EEI (ANSI) meters. It is assumed that the data consumers understand the type of meter being used and agree on the sign convention in use at any given utility.

literal	value	description
ohmPerm	86	Electric resistance per length in ohms per metre ((V/A)/m).
kgPerJ		Weight per energy in kilograms per joule (kg/J). Note: multiplier “k” is included in this unit symbol for compatibility with IEC 61850-7-3.
JPers		Energy rate in joules per second (J/s).

518

519

520

Annex A (informative): Sample data

A.1 General

This Annex is designed to illustrate the profile by using fragments of sample data. It is not meant to be a complete set of examples covering all possibilities of using the profile. Defining a complete set of test data is considered a separate activity to be performed for the purpose of setting up interoperability testing and conformity related to this profile.

A.2 Header

```
<!--Header -->
  <md:FullModel rdf:about="urn:uuid:d2630bd5-9578-4fab-9647-13991c692d07"><!-- ID of the Full Model in RDF-->
    <!-- ID of the Full Model in Data Model-->
    <dct:identifier>urn:uuid:d2630bd5-9578-4fab-9647-13991c692d07</dct:identifier> <!--This is an example for mRID of the header -->
    <!-- creation time of the Document  -->
    <prov:generatedAtTime>2021-01-28T17:01:03Z</prov:generatedAtTime>
    <!-- Version of the Document -->
    <md:version>1</md:version>
    <!-- Validity/scenario period / delivery day [Optional]-->
    <time:inXSDDateTimeStamp>2021-11-25T17:00:00Z</time:inXSDDateTimeStamp>
    <time:hasXSDDuration>P1Y</time:hasXSDDuration>
    <!-- Description -->
    <dct:description>This is an example of assessed element</dct:description>
    <!-- Profile, Schema or Specification -->
    <dct:conformsTo>http://entsoe.eu/ns/CIM/VoltageAngleLimit-EU/1.0</dct:conformsTo>
    <dct:conformsTo> http://entsoe.eu/ns/CIM/VoltageAngleLimit-EU/constraints/1.0</dct:conformsTo> <!--This is an example how to refer to SHACL constraints -->
    <!-- Message Type -->
    <dcat:keyword>PaneModel</dcat:keyword>
    <!-- Model Dependency-->
    <prov:wasInfluencedBy rdf:resource="urn:uuid:f0063d01-1dac-46f0-91a4-2b7479991173" />
    <!—Model revision -->
    <prov:wasRevisionOf rdf:resource="urn:uuid:8341cd19-779b-4a84-bafb-06b8bb56f767" />
    <!-- Modeling Authority -->
    <prov:wasAttributedTo rdf:resource="urn:eic:10X1001A1001A094"/>
    <!-- Modeling Region -->
    <prov:atLocation rdf:resource="urn:eic:10YBE----------2"/>
    <!-- Status -->
```

```
... <euvoc:status rdf:resource="http://entsoe.eu/StatusType#Validated"/>
    <!-- License -->
... <dct:license>http://publications.europa.eu/resource/authority/licence/EUPL_1_2</dct:license>
    <!-- Process Type -->
    <eumd:processType rdf:resource="urn:entsoe.eu:ProcessTypeList#CSA"/>
    <!-- Type -->
....<dct:type>dataset</dct:type>
    <!-- Modelling Authority of the originator of the model -->
    <dct:creator>urn:eic:10X1001A1001A094</dct:creator>
    <!-- Confidentaliaty for Security Plan -->
    <dct:accessRights rdf:resource="http://entsoe.eu/MVS/2016/Confidentialyt/OPDE_Secret"/>
    <!—Service Location -->
.... <eumd:serviceLocation rdf:resource="urn:eic:10Y1001A1001A94A" />
  </md:FullModel>
```

A.3 Voltage angle limit

```
  <csa:VoltageAngleLimit rdf:ID="_d603e057-2cf8-49f2-8b6e-15d652d57818">
    <cim:IdentifiedObject.name>VAL1</cim:IdentifiedObject.name>
    <cim:IdentifiedObject.mRID>d603e057-2cf8-49f2-8b6e-15d652d57818</cim:IdentifiedObject.mRID>
    <csa:VoltageAngleLimit.value>30</csa:VoltageAngleLimit.value>
    <cim:OperationalLimit.OperationalLimitSet rdf:resource="#_5f348fe6-c8f3-4b2c-a1eb-fcc1ee45ab6a" />
     <cim:OperationalLimit.OperationalLimitType rdf:resource="#_9175d145-a12b-401e-bc22-42d24d3617a3" />
     <cim:VoltageAngleLimit.AngleReferenceTerminal rdf:resource="#_c4954052-8181-4ed6-a6ec-27a7d3752af6” />
  </csa:VoltageAngleLimit>

  <cim:OperationalLimitSet rdf:ID="_5f348fe6-c8f3-4b2c-a1eb-fcc1ee45ab6a">
    <cim:IdentifiedObject.name>Limits 1</cim:IdentifiedObject.name>
    <cim:OperationalLimitSet.Terminal rdf:resource="#_f9f29835-8a31-4310-9780-b1ad26f3cbb0" />
    <cim:IdentifiedObject.mRID>5f348fe6-c8f3-4b2c-a1eb-fcc1ee45ab6a</cim:IdentifiedObject.mRID>
  </cim:OperationalLimitSet>

  <cim:OperationalLimitType rdf:ID="_9175d145-a12b-401e-bc22-42d24d3617a3">
    <cim:IdentifiedObject.name>Type 1</cim:IdentifiedObject.name>
```

```
591         <cim:OperationalLimitType.direction
592     rdf:resource="http://iec.ch/TC57/CIM100#OperationalLimitDirectionKind.high" />
593         <cim:IdentifiedObject.mRID>9175d145-a12b-401e-bc22-42d24d3617a3</cim:IdentifiedObject.mRID>
594       </cim:OperationalLimitType>
595
596
597
```