European Network of
Transmission System Operators
for Electricity

EQUIPMENT RELIABILITY PROFILE SPECIFICATION

2022-02-16

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.

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Revision History

Version	Release	Date	Paragraph	Comments
0	1	2021-10-12		For CIM EG review. This profile replaces Available Remedial Action Profile. These new profiles includes also information on SIPS, GLSK, limits, area and overlapping zone.
1	0	2022-02-16		Approved by SOC.

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1 Introduction

The equipment reliability profile enables exchanges of additional information related to equipment as well as SIPS, limits, area and overlapping zone.

2 Application profile specification

2.1 Version information

The content is generated from UML model file CGMES30v25_501-20v01_HeaderMetaData-10v08_NC20v70.eap.

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

- Title: Equipment Reliability Vocabulary
- Keyword: ER
- Description: This vocabulary is describing the equipment reliability profile.
- Version IRI: http://entsoe.eu/ns/CIM/EquipmentReliability-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:5f727c5c-b49f-47be-b750-a00fefb7e806

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 NC profiles, NC 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 "NC". 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:NC:ER:AreaDispatchableUnit:hvdcInterconnection

In cases where the generating unit is dispatched behind HVDC interconnection (DCTieCorridor) in order to have an explicit modelling of the relationship between the generating unit and the HVDC interconnection, the following is recommended:

- The AreaDispatchableUnit shall refer to both DCTieCorridor and the GeneratingUnit (providing the dispatch capability).
- DCTieCorridor where the capability is provided trough.

- C:NC:ER:AreaDispatchableUnit:associations

  The AreaDispatchableUnit shall be associated with either GeneratingUnit, PowerElecronicsUnit or EnergyConsumer.

- C:NC:ER:EnergyComponent:associations

  The EnergyComponent shall be associated with either GeneratingUnit, PowerElecronicsUnit or EnergyConsumer.

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 applicable for this profile is included in the metadata and document header specification document.

The header vocabulary contains all attributes defined in IEC 61970-552. This is done only for the purpose of having one vocabulary for header and to ensure transition for data exchanges that are using IEC 61970-552:2016 header. This profile does not use IEC 61970-552:2016 header attributes and relies only on the extended attributes.

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:NC:ALL:wasAttributedTo:usage

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

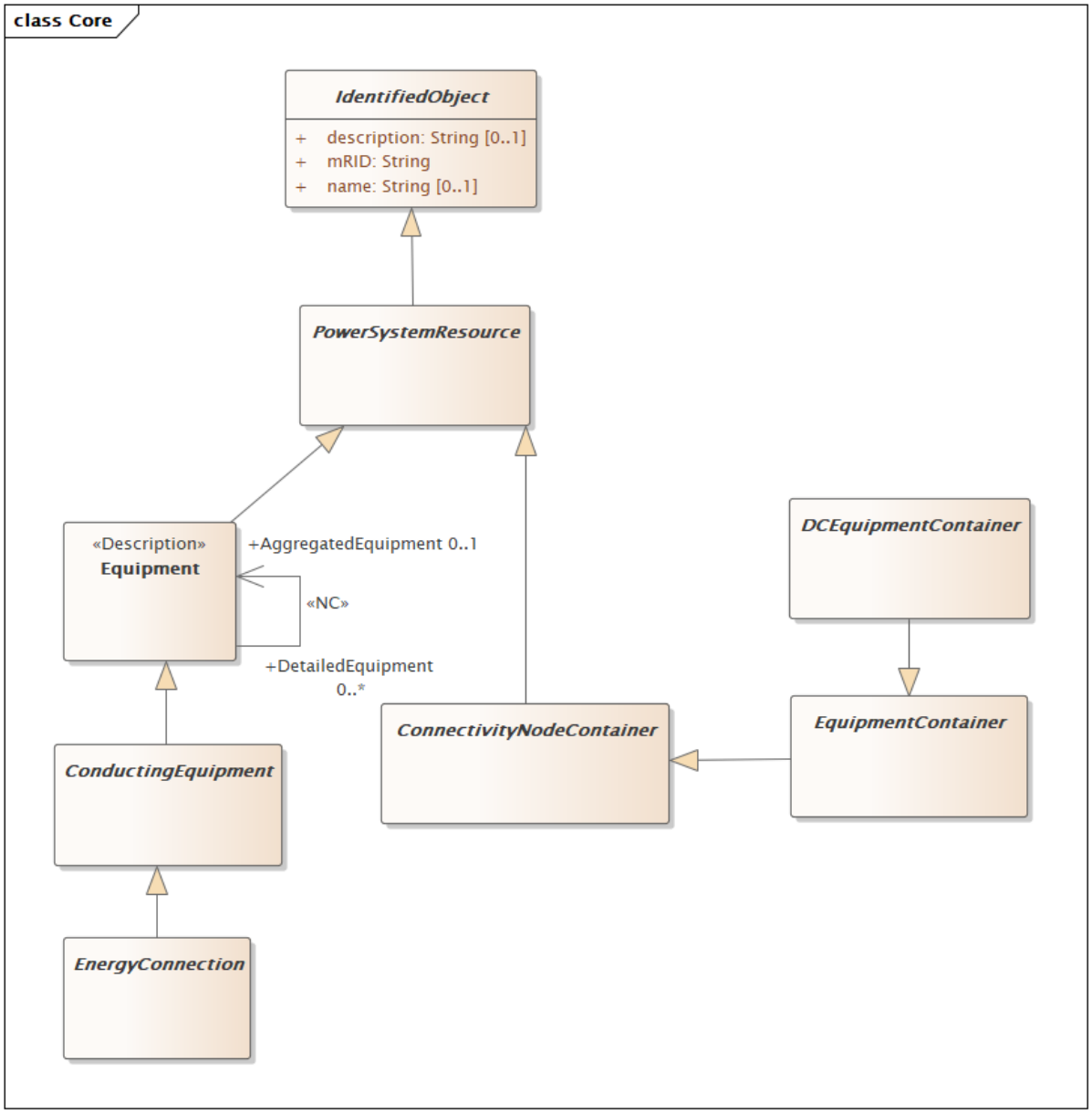
2.4.2 Reference metadata

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 it 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 equipment reliability profile.



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515 **Figure 1 – Class diagram EquipmentReliabilityProfile::Core**

516 Figure 1: The diagram shows classes from Base CIM used in the profile.

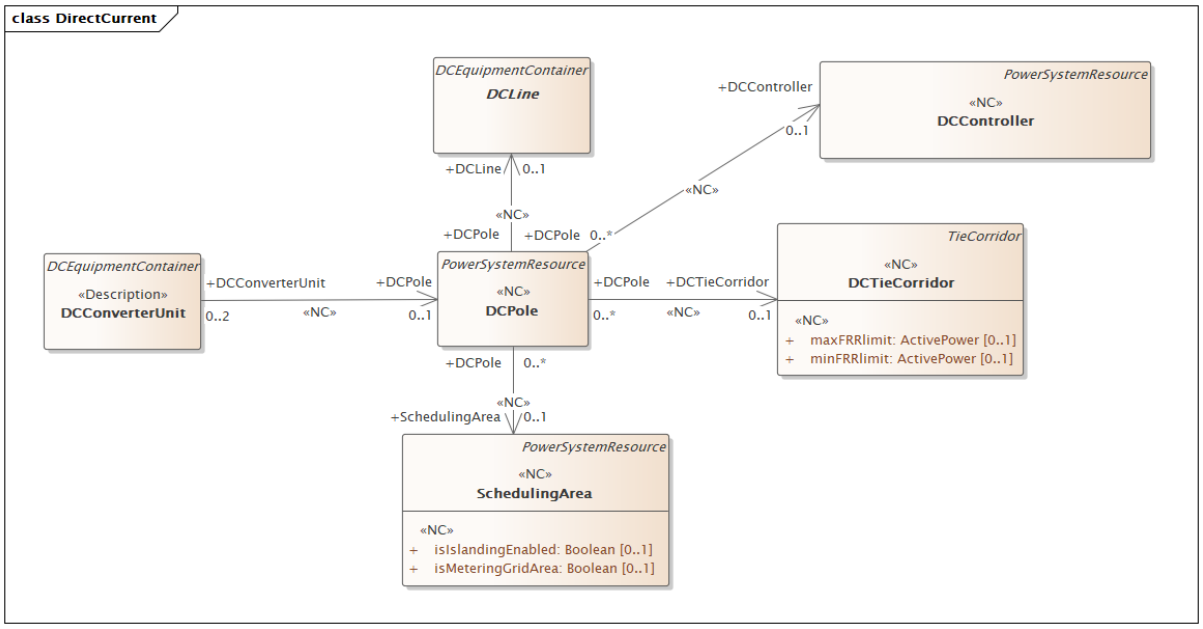


Figure 2 – Class diagram EquipmentReliabilityProfile::DirectCurrent

Figure 2: The diagram shows direct current related classes.

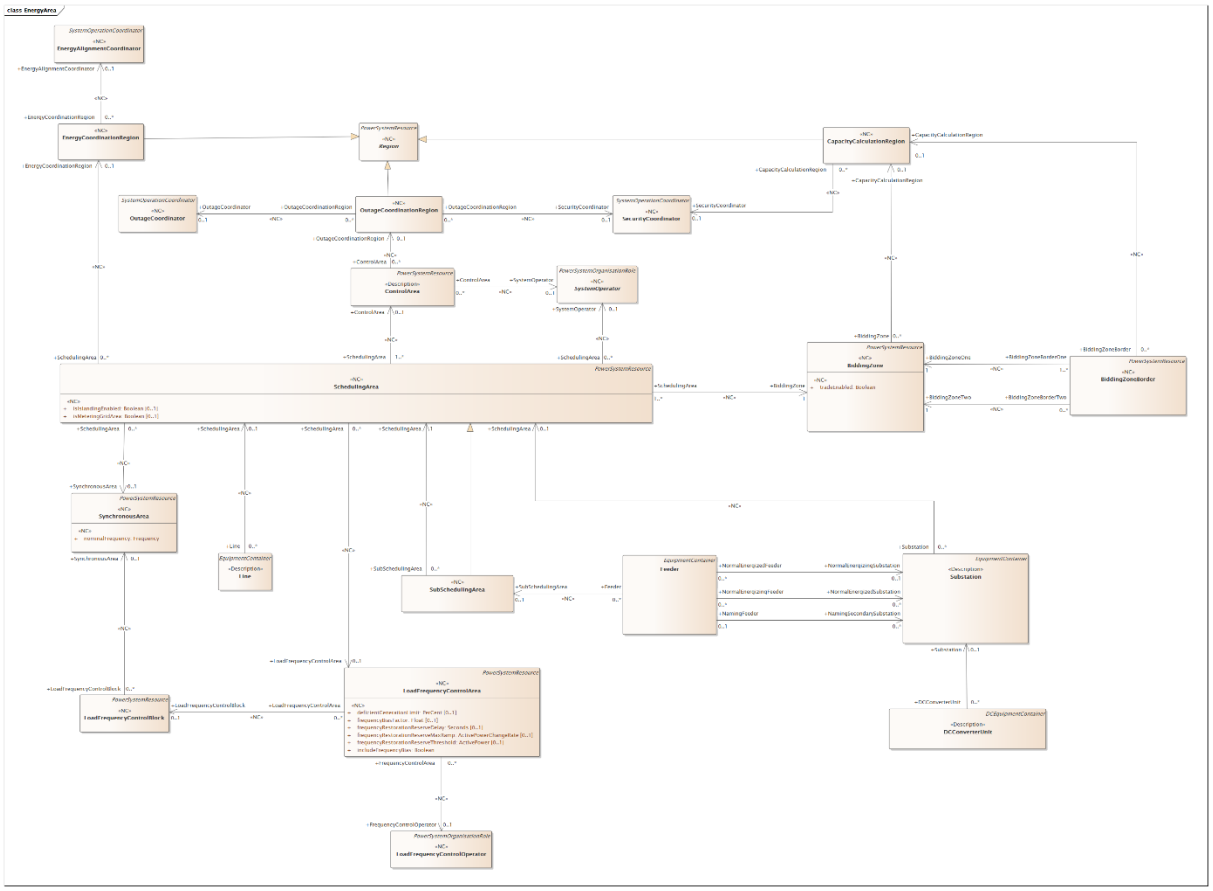


Figure 3 – Class diagram EquipmentReliabilityProfile::EnergyArea

Figure 3: The diagram shows energy area related classes.

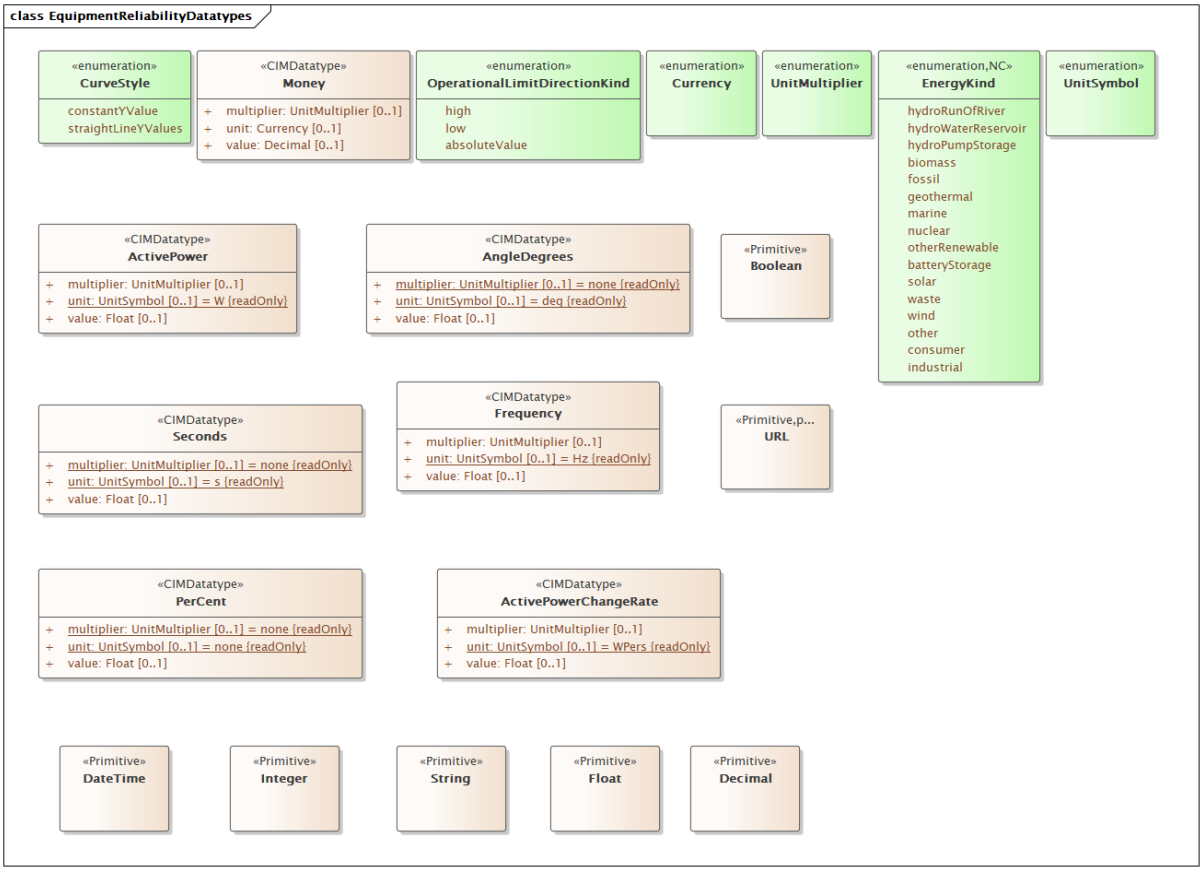
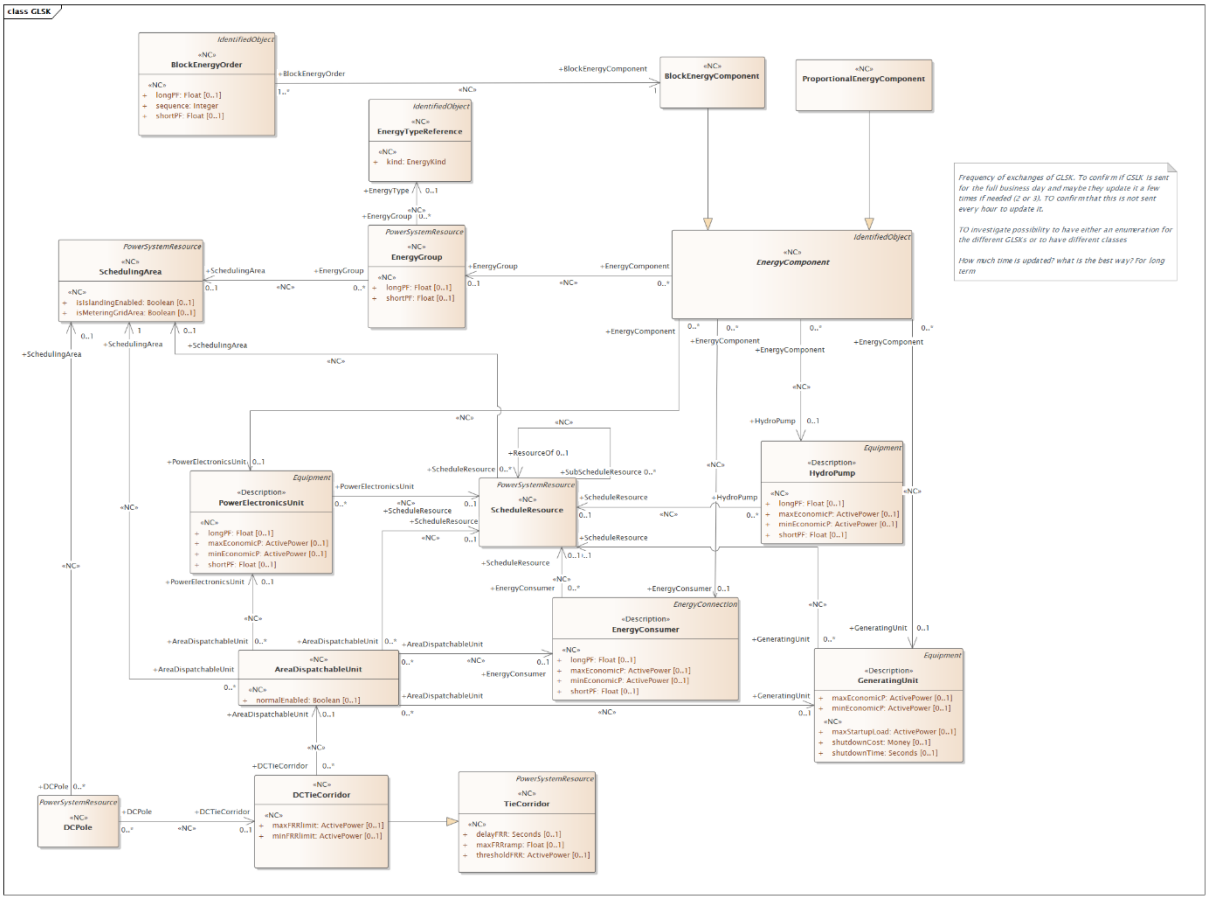


Figure 4 – Class diagram EquipmentReliabilityProfile::EquipmentReliabilityDatatypes

Figure 4: 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.



536

537 **Figure 5 – Class diagram EquipmentReliabilityProfile::GLSK**

538 Figure 5: The diagram shows generation and load shift keys related classes.

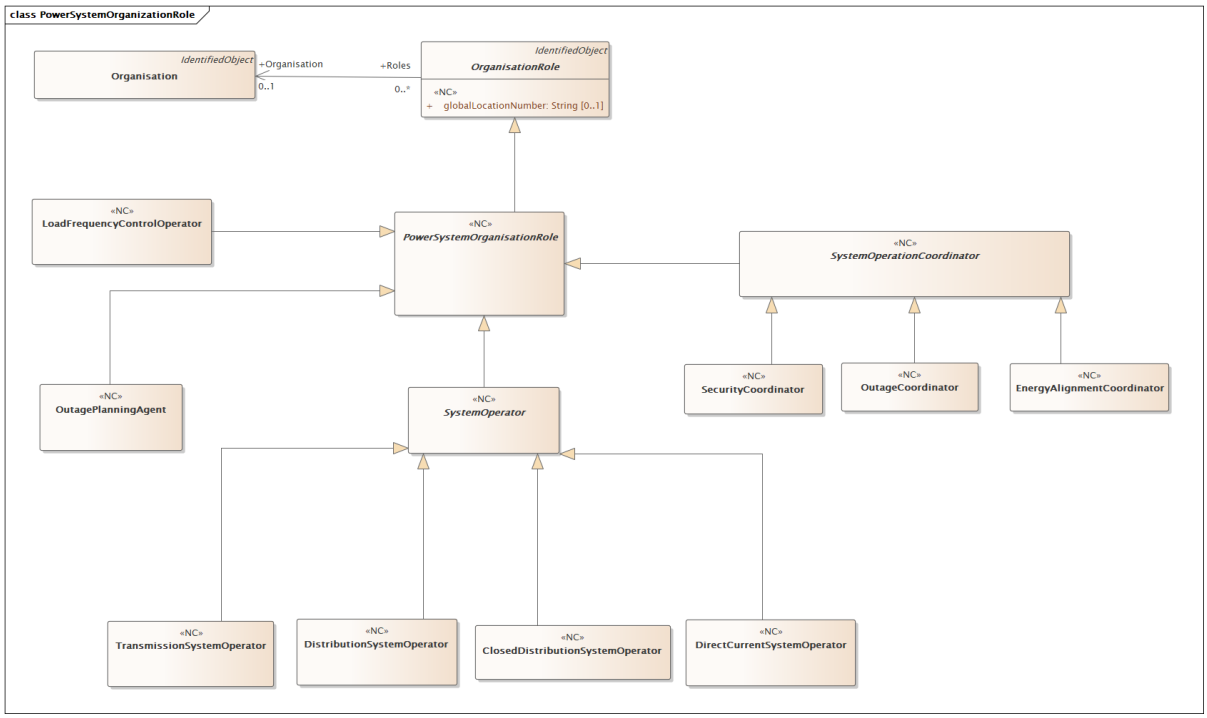


Figure 6 – Class diagram EquipmentReliabilityProfile::PowerSystemOrganizationRole

Figure 6: The diagram shows power system organisation role related classes.

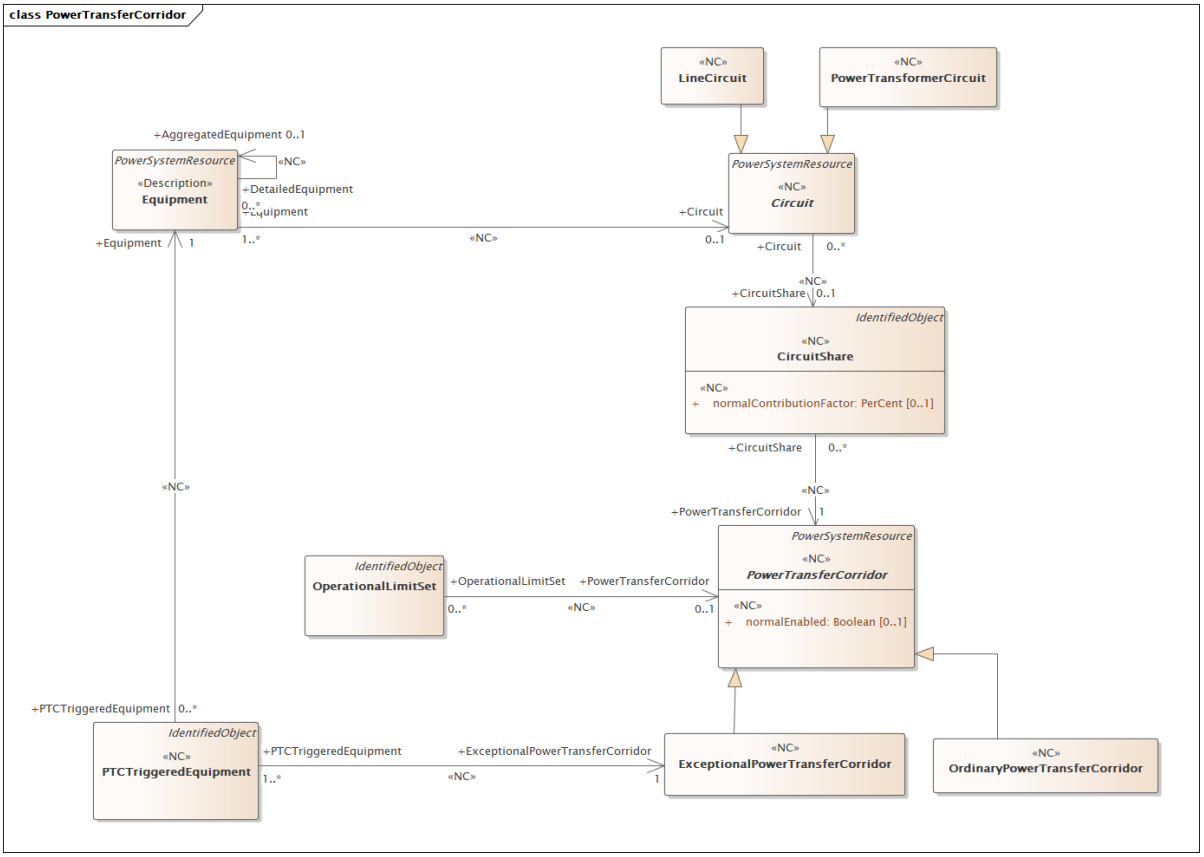


Figure 7 – Class diagram EquipmentReliabilityProfile::PowerTransferCorridor

Figure 7: The diagram shows power transfer corridor related classes.

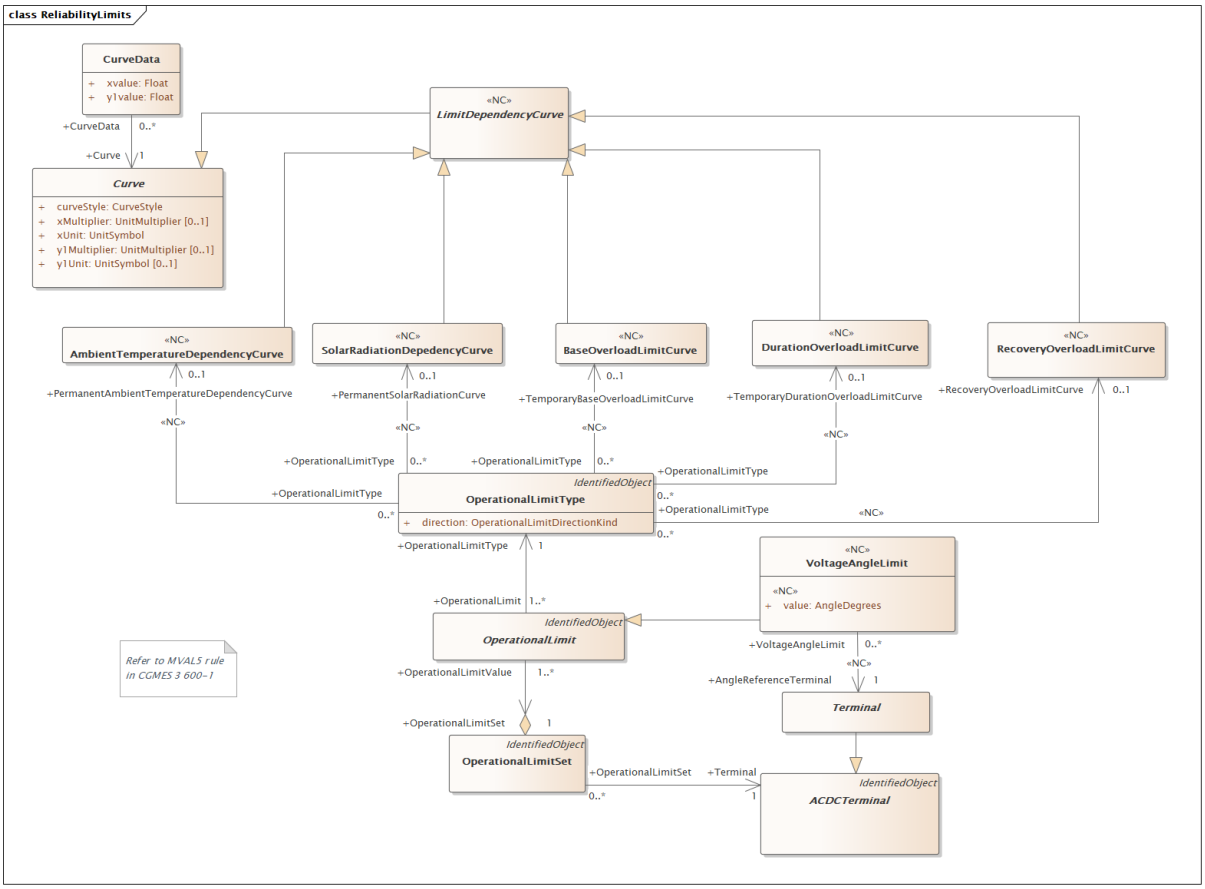


Figure 8 – Class diagram EquipmentReliabilityProfile::ReliabilityLimits

Figure 8: The diagram contains main classes related to the reliability limits.

3.2 (abstract) ConductingEquipment

Inheritance path = Equipment : PowerSystemResource : IdentifiedObject

The parts of the AC power system that are designed to carry current or that are conductively connected through terminals.

Table 1 shows all attributes of ConductingEquipment.

Table 1 – Attributes of EquipmentReliabilityProfile::ConductingEquipment

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 ConductingEquipment with other classes.

Table 2 – Association ends of EquipmentReliabilityProfile::ConductingEquipment with other classes

mult from	name	mult to	type	description
1..*	Circuit	0..1	Circuit	(NC) inherited from: Equipment

mult from	name	mult to	type	description
0..*	AggregatedEquipment	0..1	Equipment	(NC) inherited from: Equipment

3.3 (NC) DCController

Inheritance path = PowerSystemResource : IdentifiedObject

Table 3 shows all attributes of DCController.

Table 3 – Attributes of EquipmentReliabilityProfile::DCController

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

3.4 (abstract) EnergyConnection

Inheritance path = ConductingEquipment : Equipment : PowerSystemResource : IdentifiedObject

A connection of energy generation or consumption on the power system model.

Table 4 shows all attributes of EnergyConnection.

Table 4 – Attributes of EquipmentReliabilityProfile::EnergyConnection

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 5 shows all association ends of EnergyConnection with other classes.

Table 5 – Association ends of EquipmentReliabilityProfile::EnergyConnection with other classes

mult from	name	mult to	type	description
1..*	Circuit	0..1	Circuit	(NC) inherited from: Equipment
0..*	AggregatedEquipment	0..1	Equipment	(NC) inherited from: Equipment

3.5 (Description) HydroPump

Inheritance path = Equipment : PowerSystemResource : IdentifiedObject

A synchronous motor-driven pump, typically associated with a pumped storage plant.

Table 6 shows all attributes of HydroPump.

Table 6 – Attributes of EquipmentReliabilityProfile::HydroPump

name	mult	type	description
longPF	0..1	Float	(NC) Hydro pump long term economic participation factor.
maxEconomicP	0..1	ActivePower	(NC) Maximum high economic active power limit, that should not exceed the maximum operating active power limit.

name	mult	type	description
minEconomicP	0..1	ActivePower	(NC) Low economic active power limit that shall be greater than or equal to the minimum operating active power limit.
shortPF	0..1	Float	(NC) Hydro pump short term economic participation factor.
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 7 shows all association ends of HydroPump with other classes.

Table 7 – Association ends of EquipmentReliabilityProfile::HydroPump with other classes

mult from	name	mult to	type	description
0..*	ScheduleResource	0..1	ScheduleResource	(NC) The schedule resource that has this hydro pump.
1..*	Circuit	0..1	Circuit	(NC) inherited from: Equipment
0..*	AggregatedEquipment	0..1	Equipment	(NC) inherited from: Equipment

3.6 (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 8 shows all attributes of ACDCTerminal.

Table 8 – Attributes of EquipmentReliabilityProfile::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

3.7 (NC) AmbientTemperatureDependencyCurve

Inheritance path = LimitDependencyCurve : Curve

A curve or functional relationship between the ambient temperature independent variable (X-axis) and relative temperature dependent (Y-axis) variables.

Table 9 shows all attributes of AmbientTemperatureDependencyCurve.

Table 9 – Attributes of EquipmentReliabilityProfile::AmbientTemperatureDependencyCurve

name	mult	type	description
curveStyle	1..1	CurveStyle	inherited from: Curve
xMultiplier	0..1	UnitMultiplier	inherited from: Curve
xUnit	1..1	UnitSymbol	inherited from: Curve
y1Multiplier	0..1	UnitMultiplier	inherited from: Curve
y1Unit	0..1	UnitSymbol	inherited from: Curve

3.8 (NC) AreaDispatchableUnit root class

Allocates a given producing or consuming unit, including direct current corridor and collection of units, to a given control area (through the scheduling area) for supporting the control of the given area through dispatch instruction.
Table 10 shows all attributes of AreaDispatchableUnit.

Table 10 – Attributes of EquipmentReliabilityProfile::AreaDispatchableUnit

name	mult	type	description
normalEnabled	0..1	Boolean	(NC) Identifies if the unit is normally enabled to accept a dispatch instruction. If true, the unit is enabled to accept a dispatch instruction. If false, the unit has the capability, but it is not enabled to receive a dispatch instruction.

Table 11 shows all association ends of AreaDispatchableUnit with other classes.

Table 11 – Association ends of EquipmentReliabilityProfile::AreaDispatchableUnit with other classes

mult from	name	mult to	type	description
0..*	EnergyConsumer	0..1	EnergyConsumer	(NC) The energy consumer that belongs to this area dispatchable unit.
0..*	GeneratingUnit	0..1	GeneratingUnit	(NC) The generating unit that belongs to area dispatchable unit.
0..*	PowerElectronicsUnit	0..1	PowerElectronicsUnit	(NC) The power electronics unit that belongs to this area dispatchable unit.
0..*	ScheduleResource	0..1	ScheduleResource	(NC) The resource which is mFRR for the EnergySchedulingArea to which the AreaDispatchableUnit is connected. Note that this can be different than the area for the energy schedule.
0..*	SchedulingArea	1..1	SchedulingArea	(NC) The scheduling area that has this area dispatchable unit.

3.9 (NC) BaseOverloadLimitCurve

Inheritance path = LimitDependencyCurve : Curve
A curve or functional relationship between
- the relative loading - current loading over permanent loading (PATL) independent variable (X-axis), and
- temporary overloading (TATL) limiting dependent (Y-axis) variables.
Table 12 shows all attributes of BaseOverloadLimitCurve.

Table 12 – Attributes of EquipmentReliabilityProfile::BaseOverloadLimitCurve

name	mult	type	description
curveStyle	1..1	CurveStyle	inherited from: Curve
xMultiplier	0..1	UnitMultiplier	inherited from: Curve
xUnit	1..1	UnitSymbol	inherited from: Curve
y1Multiplier	0..1	UnitMultiplier	inherited from: Curve
y1Unit	0..1	UnitSymbol	inherited from: Curve

3.10 (NC) BiddingZone

Inheritance path = PowerSystemResource : IdentifiedObject

A bidding zone is a market-based method for handling power transmission congestion. It consists of scheduling areas that include the relevant production (supply) and consumption (demand) to form an electrical area with the same market price without capacity allocation. Table 13 shows all attributes of BiddingZone.

Table 13 – Attributes of EquipmentReliabilityProfile::BiddingZone

name	mult	type	description
tradeEnabled	1..1	Boolean	(NC) Identifies the mechanism for determining the energy price for a given bidding zone. If true, the bid and the offer is expected to be provided for the bidding zone to create the market price. If false, other mechanism determines the price of energy for a given bidding zone, e.g. virtual bidding zone.
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 BiddingZone with other classes.

Table 14 – Association ends of EquipmentReliabilityProfile::BiddingZone with other classes

mult from	name	mult to	type	description
0..*	CapacityCalculationRegion	0..1	CapacityCalculationRegion	(NC) The capacity calculation region related to this bidding zone.

3.11 (NC) BiddingZoneBorder

Inheritance path = PowerSystemResource : IdentifiedObject
Defines the aggregated connection capacity between two Bidding Zones.
Table 15 shows all attributes of BiddingZoneBorder.

Table 15 – Attributes of EquipmentReliabilityProfile::BiddingZoneBorder

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 16 shows all association ends of BiddingZoneBorder with other classes.

Table 16 – Association ends of EquipmentReliabilityProfile::BiddingZoneBorder with other classes

mult from	name	mult to	type	description
0..*	BiddingZoneTwo	1..1	BiddingZone	(NC) The bidding zone for the secondary side.
1..*	BiddingZoneOne	1..1	BiddingZone	(NC) The bidding zone for the primary side.
0..*	CapacityCalculationRegion	0..1	CapacityCalculationRegion	(NC) The capacity calculation region for which the capacity is derived from.

3.12 (NC) BlockEnergyComponent

Inheritance path = EnergyComponent : IdentifiedObject

The energy group active power are distributed, according to block dispatch order given by an active block dispatch instruction, between the energy component in a given energy group.

Table 17 shows all attributes of BlockEnergyComponent.

Table 17 – Attributes of EquipmentReliabilityProfile::BlockEnergyComponent

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 18 shows all association ends of BlockEnergyComponent with other classes.

Table 18 – Association ends of EquipmentReliabilityProfile::BlockEnergyComponent with other classes

mult from	name	mult to	type	description
0..*	HydroPump	0..1	HydroPump	(NC) inherited from: EnergyComponent
0..*	EnergyGroup	0..1	EnergyGroup	(NC) inherited from: EnergyComponent
0..*	PowerElectronicsUnit	0..1	PowerElectronicsUnit	(NC) inherited from: EnergyComponent
0..*	EnergyConsumer	0..1	EnergyConsumer	(NC) inherited from: EnergyComponent
0..*	GeneratingUnit	0..1	GeneratingUnit	(NC) inherited from: EnergyComponent

3.13 (NC) BlockEnergyOrder

Inheritance path = IdentifiedObject

The order given by a block dispatch instruction that are distributing the energy over the energy components.

Table 19 shows all attributes of BlockEnergyOrder.

Table 19 – Attributes of EquipmentReliabilityProfile::BlockEnergyOrder

name	mult	type	description
sequence	1..1	Integer	(NC) The sequence order for a given block dispatch instruction. The sequence number need to be unique for a given block dispatch instruction, e.g. two order in the same instruction cannot have the same sequence.
longPF	0..1	Float	(NC) Block order long term economic participation factor.
shortPF	0..1	Float	(NC) Block order short term economic participation factor.
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 20 shows all association ends of BlockEnergyOrder with other classes.

Table 20 – Association ends of EquipmentReliabilityProfile::BlockEnergyOrder with other classes

mult from	name	mult to	type	description
1..*	BlockEnergyComponent	1..1	BlockEnergyComponent	(NC) The block energy component that has this block energy order.

3.14 (NC) CapacityCalculationRegion

Inheritance path = Region : PowerSystemResource : IdentifiedObject

Capacity calculation region is a coherent part of the interconnected system that is used for calculating the transmission capacity for a bidding zone or between bidding zones.

Table 21 shows all attributes of CapacityCalculationRegion.

Table 21 – Attributes of EquipmentReliabilityProfile::CapacityCalculationRegion

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 22 shows all association ends of CapacityCalculationRegion with other classes.

Table 22 – Association ends of EquipmentReliabilityProfile::CapacityCalculationRegion with other classes

mult from	name	mult to	type	description
0..*	SecurityCoordinator	0..1	SecurityCoordinator	(NC) The security coordinator responsible for the capacity calculation region.

3.15 (abstract,NC) Circuit

Inheritance path = PowerSystemResource : IdentifiedObject

A circuit is a collection of equipment in a network graph that provide common stability limits. The relevant equipment is in general given by the identifying terminal. A software application that can do topology processing shall calculate the equipment belonging to the circuit, if there are no stability limits associated to it. In case of stability limits, the containment reflects the equipments that were used in the calculation/analysis.

Table 23 shows all attributes of Circuit.

Table 23 – Attributes of EquipmentReliabilityProfile::Circuit

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 24 shows all association ends of Circuit with other classes.

687 **Table 24 – Association ends of EquipmentReliabilityProfile::Circuit with other classes**

mult from	name	mult to	type	description
0..*	CircuitShare	0..1	CircuitShare	(NC) The share of this circuit.

688

689 ### 3.16 (NC) CircuitShare

690 Inheritance path = IdentifiedObject
691 Defines the share of the circuit which is part of this power transfer corridor.
692 Table 25 shows all attributes of CircuitShare.

693 **Table 25 – Attributes of EquipmentReliabilityProfile::CircuitShare**

name	mult	type	description
normalContributionFactor	0..1	PerCent	(NC) Normal contribution factor for the circuit which is part of a power transfer corridor.
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

694
695 Table 26 shows all association ends of CircuitShare with other classes.

696 **Table 26 – Association ends of EquipmentReliabilityProfile::CircuitShare with other**
697 **classes**

mult from	name	mult to	type	description
0..*	PowerTransferCorridor	1..1	PowerTransferCorridor	(NC) The power transfer corridor that has this circuit share.

698

699 ### 3.17 (NC) ClosedDistributionSystemOperator

700 Inheritance path = SystemOperator : PowerSystemOrganisationRole : OrganisationRole :
701 IdentifiedObject
702 A system operator which distributes electricity (or gas) within a geographically confined
703 industrial, commercial or shared services and does not supply household customers.
704 Table 27 shows all attributes of ClosedDistributionSystemOperator.

705 **Table 27 – Attributes of EquipmentReliabilityProfile::ClosedDistributionSystemOperator**

name	mult	type	description
globalLocationNumber	0..1	String	(NC) inherited from: OrganisationRole
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

706
707 Table 28 shows all association ends of ClosedDistributionSystemOperator with other classes.

708 **Table 28 – Association ends of**
709 **EquipmentReliabilityProfile::ClosedDistributionSystemOperator with other classes**

mult from	name	mult to	type	description
0..*	Organisation	0..1	Organisation	inherited from: OrganisationRole

3.18 (abstract) ConnectivityNodeContainer

Inheritance path = PowerSystemResource : IdentifiedObject
A base class for all objects that may contain connectivity nodes or topological nodes.
Table 29 shows all attributes of ConnectivityNodeContainer.

Table 29 – Attributes of EquipmentReliabilityProfile::ConnectivityNodeContainer

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

3.19 (Description) ControlArea

Inheritance path = PowerSystemResource : IdentifiedObject
A control area is a grouping of generating units and/or loads and a cutset of tie lines (as terminals) which may be used for a variety of purposes including automatic generation control, power flow solution area interchange control specification, and input to load forecasting. All generation and load within the area defined by the terminals on the border are considered in the area interchange control. Note that any number of overlapping control area specifications can be superimposed on the physical model. The following general principles apply to ControlArea:
1. The control area orientation for net interchange is positive for an import, negative for an export.
2. The control area net interchange is determined by summing flows in Terminals. The Terminals are identified by creating a set of TieFlow objects associated with a ControlArea object. Each TieFlow object identifies one Terminal.
3. In a single network model, a tie between two control areas must be modelled in both control area specifications, such that the two representations of the tie flow sum to zero.
4. The normal orientation of Terminal flow is positive for flow into the conducting equipment that owns the Terminal. (i.e. flow from a bus into a device is positive.) However, the orientation of each flow in the control area specification must align with the control area convention, i.e. import is positive. If the orientation of the Terminal flow referenced by a TieFlow is positive into the control area, then this is confirmed by setting TieFlow.positiveFlowIn flag TRUE. If not, the orientation must be reversed by setting the TieFlow.positiveFlowIn flag FALSE.
Table 30 shows all attributes of ControlArea.

Table 30 – Attributes of EquipmentReliabilityProfile::ControlArea

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 31 shows all association ends of ControlArea with other classes.

Table 31 – Association ends of EquipmentReliabilityProfile::ControlArea with other classes

mult from	name	mult to	type	description
0..*	OutageCoordinationRegion	0..1	OutageCoordinationRegion	(NC) The outage coordination region that has this control area.

mult from	name	mult to	type	description
0..*	SystemOperator	0..1	SystemOperator	(NC) The system operator that operates this control area.

3.20 (NC) 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 32 shows all attributes of VoltageAngleLimit.

Table 32 – Attributes of EquipmentReliabilityProfile::VoltageAngleLimit

name	mult	type	description
value	1..1	AngleDegrees	(NC) 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 33 shows all association ends of VoltageAngleLimit with other classes.

Table 33 – Association ends of EquipmentReliabilityProfile::VoltageAngleLimit with other classes

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

3.21 (abstract) Curve root class

A multi-purpose curve or functional relationship between an independent variable (X-axis) and dependent (Y-axis) variables.

Table 34 shows all attributes of Curve.

Table 34 – Attributes of EquipmentReliabilityProfile::Curve

name	mult	type	description
curveStyle	1..1	CurveStyle	The style or shape of the curve.
xMultiplier	0..1	UnitMultiplier	Multiplier for X-axis.
xUnit	1..1	UnitSymbol	The X-axis units of measure.
y1Multiplier	0..1	UnitMultiplier	Multiplier for Y1-axis.
y1Unit	0..1	UnitSymbol	The Y1-axis units of measure.

3.22 CurveData root class

Multi-purpose data points for defining a curve. The use of this generic class is discouraged if a more specific class can be used to specify the X and Y axis values along with their specific data types.
Table 35 shows all attributes of CurveData.

Table 35 – Attributes of EquipmentReliabilityProfile::CurveData

name	mult	type	description
xvalue	1..1	Float	The data value of the X-axis variable, depending on the X-axis units.
y1value	1..1	Float	The data value of the first Y-axis variable, depending on the Y-axis units.

Table 36 shows all association ends of CurveData with other classes.

Table 36 – Association ends of EquipmentReliabilityProfile::CurveData with other classes

mult from	name	mult to	type	description
0..*	Curve	1..1	Curve	The curve of this curve data point.

3.23 (Description) DCConverterUnit

Inheritance path = DCEquipmentContainer : EquipmentContainer : ConnectivityNodeContainer : PowerSystemResource : IdentifiedObject
Indivisible operative unit comprising all equipment between the point of common coupling on the AC side and the point of common coupling – DC side, essentially one or more converters, together with one or more converter transformers, converter control equipment, essential protective and switching devices and auxiliaries, if any, used for conversion.
Table 37 shows all attributes of DCConverterUnit.

Table 37 – Attributes of EquipmentReliabilityProfile::DCConverterUnit

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 38 shows all association ends of DCConverterUnit with other classes.

Table 38 – Association ends of EquipmentReliabilityProfile::DCConverterUnit with other classes

mult from	name	mult to	type	description
0..*	Substation	0..1	Substation	The containing substation of the DC converter unit.
0..2	DCPole	0..1	DCPole	(NC) The DC pole that has this DC converter unit.

3.24 (abstract) DCEquipmentContainer

Inheritance path = EquipmentContainer : ConnectivityNodeContainer : PowerSystemResource : IdentifiedObject

A modelling construct to provide a root class for containment of DC as well as AC equipment. The class differ from the EquipmentContaner for AC in that it may also contain DCNode-s. Hence it can contain both AC and DC equipment.
Table 39 shows all attributes of DCEquipmentContainer.

Table 39 – Attributes of EquipmentReliabilityProfile::DCEquipmentContainer

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

3.25 (abstract) DCLine

Inheritance path = DCEquipmentContainer : EquipmentContainer : ConnectivityNodeContainer : PowerSystemResource : IdentifiedObject
Overhead lines and/or cables connecting two or more HVDC substations.
Table 40 shows all attributes of DCLine.

Table 40 – Attributes of EquipmentReliabilityProfile::DCLine

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

3.26 (NC) DCPole

Inheritance path = PowerSystemResource : IdentifiedObject
The direct current (DC) pole is the circuit which includes converter units from both sides and the relevant direct current line. This forms the smallest unit of transmission control.
Table 41 shows all attributes of DCPole.

Table 41 – Attributes of EquipmentReliabilityProfile::DCPole

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 42 shows all association ends of DCPole with other classes.

Table 42 – Association ends of EquipmentReliabilityProfile::DCPole with other classes

mult from	name	mult to	type	description
0..*	DCController	0..1	DCController	(NC) This is the DCController for this Pole.
0..*	DCTieCorridor	0..1	DCTieCorridor	(NC) The DCTieCorridor that has this DC pole.
0..*	SchedulingArea	0..1	SchedulingArea	(NC) The scheduling area that has this DC pole.
0..1	DCLine	0..1	DCLine	(NC) The DC line that is related to this DC pole.

3.27 (NC) DCTieCorridor

Inheritance path = TieCorridor : PowerSystemResource : IdentifiedObject

A collection of one or more direct current poles that connect to different control areas together.

Table 43 shows all attributes of DCTieCorridor.

Table 43 – Attributes of EquipmentReliabilityProfile::DCTieCorridor

name	mult	type	description
maxFRRlimit	0..1	ActivePower	(NC) Maximum allocated effect for Frequency Restoration Reserve (FRR).
minFRRlimit	0..1	ActivePower	(NC) Minimum allocated effect for Frequency Restoration Reserve (FRR).
delayFRR	0..1	Seconds	(NC) inherited from: TieCorridor
maxFRRramp	0..1	Float	(NC) inherited from: TieCorridor
thresholdFRR	0..1	ActivePower	(NC) inherited from: TieCorridor
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 44 shows all association ends of DCTieCorridor with other classes.

Table 44 – Association ends of EquipmentReliabilityProfile::DCTieCorridor with other classes

mult from	name	mult to	type	description
0..*	AreaDispatchableUnit	0..1	AreaDispatchableUnit	(NC) The AreaDispatchableUnit for the DCTieCorridor.

3.28 (NC) DirectCurrentSystemOperator

Inheritance path = SystemOperator : PowerSystemOrganisationRole : OrganisationRole : IdentifiedObject

System operator of the direct current pole. There are typically one or two system operators that are operating either the control area at one side or the control areas at both sides of the direct current pole. In some cases it is operated by an independent operator from the connected control areas.

Table 45 shows all attributes of DirectCurrentSystemOperator.

Table 45 – Attributes of EquipmentReliabilityProfile::DirectCurrentSystemOperator

name	mult	type	description
globalLocationNumber	0..1	String	(NC) inherited from: OrganisationRole
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 46 shows all association ends of DirectCurrentSystemOperator with other classes.

Table 46 – Association ends of EquipmentReliabilityProfile::DirectCurrentSystemOperator with other classes

mult from	name	mult to	type	description
0..*	Organisation	0..1	Organisation	inherited from: OrganisationRole

3.29 (NC) DistributionSystemOperator

Inheritance path = SystemOperator : PowerSystemOrganisationRole : OrganisationRole : IdentifiedObject

A system operator that is responsible for operating of energy distribution network from transmission level down to low voltage levels including the connection to household.

Table 47 shows all attributes of DistributionSystemOperator.

Table 47 – Attributes of EquipmentReliabilityProfile::DistributionSystemOperator

name	mult	type	description
globalLocationNumber	0..1	String	(NC) inherited from: OrganisationRole
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 48 shows all association ends of DistributionSystemOperator with other classes.

Table 48 – Association ends of EquipmentReliabilityProfile::DistributionSystemOperator with other classes

mult from	name	mult to	type	description
0..*	Organisation	0..1	Organisation	inherited from: OrganisationRole

3.30 (NC) DurationOverloadLimitCurve

Inheritance path = LimitDependencyCurve : Curve

A curve or functional relationship between
- the overload duration independent variable (X-axis), and
- temporary overloading (TATL) limiting dependent (Y-axis) variables.

Table 49 shows all attributes of DurationOverloadLimitCurve.

Table 49 – Attributes of EquipmentReliabilityProfile::DurationOverloadLimitCurve

name	mult	type	description
curveStyle	1..1	CurveStyle	inherited from: Curve
xMultiplier	0..1	UnitMultiplier	inherited from: Curve
xUnit	1..1	UnitSymbol	inherited from: Curve
y1Multiplier	0..1	UnitMultiplier	inherited from: Curve
y1Unit	0..1	UnitSymbol	inherited from: Curve

3.31 (Description) Equipment

Inheritance path = PowerSystemResource : IdentifiedObject

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

Table 50 shows all attributes of Equipment.

Table 50 – Attributes of EquipmentReliabilityProfile::Equipment

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 51 shows all association ends of Equipment with other classes.

Table 51 – Association ends of EquipmentReliabilityProfile::Equipment with other classes

mult from	name	mult to	type	description
1..*	Circuit	0..1	Circuit	(NC) The circuit that containts its member equipment.
0..*	AggregatedEquipment	0..1	Equipment	(NC) A proxy model of the detailed equipment.

3.32 (NC) EnergyAlignmentCoordinator

Inheritance path = SystemOperationCoordinator : PowerSystemOrganisationRole : OrganisationRole : IdentifiedObject

A role that is responsible for alignment of forecast and schedule energy to a given energy coordination region.

Table 52 shows all attributes of EnergyAlignmentCoordinator.

Table 52 – Attributes of EquipmentReliabilityProfile::EnergyAlignmentCoordinator

name	mult	type	description
globalLocationNumber	0..1	String	(NC) inherited from: OrganisationRole
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 53 shows all association ends of EnergyAlignmentCoordinator with other classes.

Table 53 – Association ends of EquipmentReliabilityProfile::EnergyAlignmentCoordinator with other classes

mult from	name	mult to	type	description
0..*	Organisation	0..1	Organisation	inherited from: OrganisationRole

3.33 (abstract,NC) EnergyComponent

Inheritance path = IdentifiedObject

The energy component that a given conducting equipment active power is including.

Table 54 shows all attributes of EnergyComponent.

Table 54 – Attributes of EquipmentReliabilityProfile::EnergyComponent

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

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

Table 55 shows all association ends of EnergyComponent with other classes.

Table 55 – Association ends of EquipmentReliabilityProfile::EnergyComponent with other classes

mult from	name	mult to	type	description
0..*	HydroPump	0..1	HydroPump	(NC) The hydro pump that relates to this energy component.
0..*	EnergyGroup	0..1	EnergyGroup	(NC) The energy group that has this energy component.
0..*	PowerElectronicsUnit	0..1	PowerElectronicsUnit	(NC) The power electronics unit that relates to this energy component.
0..*	EnergyConsumer	0..1	EnergyConsumer	(NC) The energy consumer that relates to this energy component.
0..*	GeneratingUnit	0..1	GeneratingUnit	(NC) The generating unit that is part of this energy component.

3.34 (Description) EnergyConsumer

Inheritance path = EnergyConnection : ConductingEquipment : Equipment : PowerSystemResource : IdentifiedObject

Generic user of energy - a point of consumption on the power system model.

EnergyConsumer.pfixed, .qfixed, .pfixedPct and .qfixedPct have meaning only if there is no LoadResponseCharacteristic associated with EnergyConsumer or if LoadResponseCharacteristic.exponentModel is set to False.

Table 56 shows all attributes of EnergyConsumer.

Table 56 – Attributes of EquipmentReliabilityProfile::EnergyConsumer

name	mult	type	description
longPF	0..1	Float	(NC) Energy consumer long term economic participation factor.
maxEconomicP	0..1	ActivePower	(NC) Maximum high economic active power limit, that should not exceed the maximum operating active power limit.
minEconomicP	0..1	ActivePower	(NC) Low economic active power limit that shall be greater than or equal to the minimum operating active power limit.
shortPF	0..1	Float	(NC) Energy consumer short term economic participation factor.
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 57 shows all association ends of EnergyConsumer with other classes.

902 **Table 57 – Association ends of EquipmentReliabilityProfile::EnergyConsumer with other classes**
903

mult from	name	mult to	type	description
0..*	ScheduleResource	0..1	ScheduleResource	(NC) The schedule resource that has this energy consumer.
1..*	Circuit	0..1	Circuit	(NC) inherited from: Equipment
0..*	AggregatedEquipment	0..1	Equipment	(NC) inherited from: Equipment

904

905 ### 3.35 (NC) EnergyCoordinationRegion

906 Inheritance path = Region : PowerSystemResource : IdentifiedObject
907 A region that has a common organisation or a service that is responsible for alignment of
908 forecast and scheduling of energy.
909 Table 58 shows all attributes of EnergyCoordinationRegion.

910 **Table 58 – Attributes of EquipmentReliabilityProfile::EnergyCoordinationRegion**

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

911
912 Table 59 shows all association ends of EnergyCoordinationRegion with other classes.

913 **Table 59 – Association ends of EquipmentReliabilityProfile::EnergyCoordinationRegion**
914 **with other classes**

mult from	name	mult to	type	description
0..*	EnergyAlignmentCoordinator	0..1	EnergyAlignmentCoordinator	(NC) The energy alignment coordinator that operates this energy coordination region.

915

916 ### 3.36 (NC) EnergyGroup

917 Inheritance path = PowerSystemResource : IdentifiedObject
918 A group of energy consumers and/or energy producers used for forecasting and/or scheduling
919 slack distribution and area interchange control.
920 Table 60 shows all attributes of EnergyGroup.

921 **Table 60 – Attributes of EquipmentReliabilityProfile::EnergyGroup**

name	mult	type	description
longPF	0..1	Float	(NC) Energy group long term economic participation factor.
shortPF	0..1	Float	(NC) Energy group short term economic participation factor.
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

922
923 Table 61 shows all association ends of EnergyGroup with other classes.

924 **Table 61 – Association ends of EquipmentReliabilityProfile::EnergyGroup with other**
925 **classes**

mult from	name	mult to	type	description
0..*	EnergyType	0..1	EnergyTypeReference	(NC) The energy type that the energy group are defined by.
0..*	SchedulingArea	0..1	SchedulingArea	(NC) The scheduling area that has this energy group.

926

927 ### 3.37 (NC) EnergyTypeReference

928 Inheritance path = IdentifiedObject
929 A energy type reference call to standardized the type of energy for do declaration of energy
930 and for forecast and schedule allocation. This is a class that is used as instance reference.
931 Table 62 shows all attributes of EnergyTypeReference.

932 **Table 62 – Attributes of EquipmentReliabilityProfile::EnergyTypeReference**

name	mult	type	description
kind	1..1	EnergyKind	(NC) The kind of energy type.
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

933

934 ### 3.38 (abstract) EquipmentContainer

935 Inheritance path = ConnectivityNodeContainer : PowerSystemResource : IdentifiedObject
936 A modelling construct to provide a root class for containing equipment.
937 Table 63 shows all attributes of EquipmentContainer.

938 **Table 63 – Attributes of EquipmentReliabilityProfile::EquipmentContainer**

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

939

940 ### 3.39 (NC) ExceptionalPowerTransferCorridor

941 Inheritance path = PowerTransferCorridor : PowerSystemResource : IdentifiedObject
942 Potential power transfer corridor that can be triggered by equipment which changes its in
943 service status or it is operating in an island.
944 Table 64 shows all attributes of ExceptionalPowerTransferCorridor.

945 **Table 64 – Attributes of EquipmentReliabilityProfile::ExceptionalPowerTransferCorridor**

name	mult	type	description
normalEnabled	0..1	Boolean	(NC) inherited from: PowerTransferCorridor
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

946

3.40 Feeder

Inheritance path = EquipmentContainer : ConnectivityNodeContainer : PowerSystemResource : IdentifiedObject

A collection of equipment for organizational purposes, used for grouping distribution resources. The organization a feeder does not necessarily reflect connectivity or current operation state.

Table 65 shows all attributes of Feeder.

Table 65 – Attributes of EquipmentReliabilityProfile::Feeder

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 66 shows all association ends of Feeder with other classes.

Table 66 – Association ends of EquipmentReliabilityProfile::Feeder with other classes

mult from	name	mult to	type	description
0..*	SubSchedulingArea	0..1	SubSchedulingArea	(NC) The subscheduling area that has this feeder.
0..*	NormalEnergizedSubstation	0..*	Substation	The substations that are normally energized by the feeder.
0..1	NamingSecondarySubstation	0..*	Substation	The secondary substations that are normally energized from the feeder. Used for naming purposes. Should be consistent with the other associations for energizing terminal specification and the feeder energization specification.
0..*	NormalEnergizingSubstation	0..1	Substation	The substation that nominally energizes the feeder. Also used for naming purposes.

3.41 (Description) GeneratingUnit

Inheritance path = Equipment : PowerSystemResource : IdentifiedObject

A single or set of synchronous machines for converting mechanical power into alternating-current power. For example, individual machines within a set may be defined for scheduling purposes while a single control signal is derived for the set. In this case there would be a GeneratingUnit for each member of the set and an additional GeneratingUnit corresponding to the set.

Table 67 shows all attributes of GeneratingUnit.

Table 67 – Attributes of EquipmentReliabilityProfile::GeneratingUnit

name	mult	type	description
shutdownTime	0..1	Seconds	(NC) Time it takes to shutdown the unit.
shutdownCost	0..1	Money	(NC) The shutdown cost incurred for each shutdown of the GeneratingUnit.
maxStartupLoad	0..1	ActivePower	(NC) Maximum consumption by the generating unit as part of the startup process.
maxEconomicP	0..1	ActivePower	Maximum high economic active power limit, that should not exceed the maximum operating active power limit.

name	mult	type	description
minEconomicP	0..1	ActivePower	Low economic active power limit that shall be greater than or equal to the minimum operating active power limit.
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 68 shows all association ends of GeneratingUnit with other classes.

Table 68 – Association ends of EquipmentReliabilityProfile::GeneratingUnit with other classes

mult from	name	mult to	type	description
0..*	ScheduleResource	0..1	ScheduleResource	(NC) The schedule resource that has this generating unit.
1..*	Circuit	0..1	Circuit	(NC) inherited from: Equipment
0..*	AggregatedEquipment	0..1	Equipment	(NC) inherited from: Equipment

3.42 (abstract) IdentifiedObject root class

This is a root class to provide common identification for all classes needing identification and naming attributes.
Table 69 shows all attributes of IdentifiedObject.

Table 69 – Attributes of EquipmentReliabilityProfile::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.
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.

3.43 (abstract,NC) LimitDependencyCurve

Inheritance path = Curve
A curve or functional relationship between an independent variable (X-axis) and limiting dependent (Y-axis) variables.
Table 70 shows all attributes of LimitDependencyCurve.

Table 70 – Attributes of EquipmentReliabilityProfile::LimitDependencyCurve

name	mult	type	description
curveStyle	1..1	CurveStyle	inherited from: Curve

name	mult	type	description
xMultiplier	0..1	UnitMultiplier	inherited from: Curve
xUnit	1..1	UnitSymbol	inherited from: Curve
y1Multiplier	0..1	UnitMultiplier	inherited from: Curve
y1Unit	0..1	UnitSymbol	inherited from: Curve

3.44 (Description) Line

Inheritance path = EquipmentContainer : ConnectivityNodeContainer : PowerSystemResource : IdentifiedObject

Contains equipment beyond a substation belonging to a power transmission line.

Table 71 shows all attributes of Line.

Table 71 – Attributes of EquipmentReliabilityProfile::Line

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 72 shows all association ends of Line with other classes.

Table 72 – Association ends of EquipmentReliabilityProfile::Line with other classes

mult from	name	mult to	type	description
0..*	SchedulingArea	0..1	SchedulingArea	(NC) The scheduling area that has this line.

3.45 (NC) LineCircuit

Inheritance path = Circuit : PowerSystemResource : IdentifiedObject

A line circuit is a circuit that has at least one ACLineSegment and may or may not include related switching and/or auxiliary equipment.

Table 73 shows all attributes of LineCircuit.

Table 73 – Attributes of EquipmentReliabilityProfile::LineCircuit

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 74 shows all association ends of LineCircuit with other classes.

Table 74 – Association ends of EquipmentReliabilityProfile::LineCircuit with other classes

mult from	name	mult to	type	description
0..*	CircuitShare	0..1	CircuitShare	(NC) inherited from: Circuit

3.46 (NC) LoadFrequencyControlArea

Inheritance path = PowerSystemResource : IdentifiedObject

A part of a synchronous area or an entire synchronous area, physically demarcated by points of measurement at interconnectors to other load frequency control (LFC) areas, operated by one or more TSOs fulfilling the obligations of load-frequency control.
Table 75 shows all attributes of LoadFrequencyControlArea.

Table 75 – Attributes of EquipmentReliabilityProfile::LoadFrequencyControlArea

name	mult	type	description
deficientGenerationLimit	0..1	PerCent	(NC) Percentage of average dispatch target plus average regulation used to calculate Deficient Generation Limit. Analyst enterable online. Defaulted to 96 in the model if null, negative, or greater than 100.
frequencyBiasFactor	0..1	Float	(NC) Manually entered frequency bias in MW/0.1 Hz. Equal to FBIAS_OPA if manual entry of frequency bias is selected, otherwise it contains the most recent manually entered value of frequency bias. Modifiable online.
includeFrequencyBias	1..1	Boolean	(NC) True means the frequency bias of the OPA is taken into consideration in the frequency bias computation.
frequencyRestorationReserveDelay	0..1	Seconds	(NC) FRR delay expressed in seconds. Must be a multiple of AGC's cycle duration. Must be strictly positive.
frequencyRestorationReserveMaxRamp	0..1	ActivePowerChangeRate	(NC) Maximum authorized ramp for both FRR dispatching and ramp to zero.
frequencyRestorationReserveThreshold	0..1	ActivePower	(NC) Authorized threshold for both FRR dispatching and ramp to zero.
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 76 shows all association ends of LoadFrequencyControlArea with other classes.

Table 76 – Association ends of EquipmentReliabilityProfile::LoadFrequencyControlArea with other classes

mult from	name	mult to	type	description
0..*	LoadFrequencyControlBlock	0..1	LoadFrequencyControlBlock	(NC) The load frequency control block that has this load frequency control area.
0..*	FrequencyControlOperator	0..1	LoadFrequencyControlOperator	(NC) The frequency control operator that operates this frequency control area.

3.47 (NC) LoadFrequencyControlBlock

Inheritance path = PowerSystemResource : IdentifiedObject
A part of a synchronous area or an entire synchronous area, physically demarcated by points of measurement at interconnectors to other load frequency control (LFC) blocks, consisting of one or more LFC areas, operated by one or more TSOs fulfilling the obligations of load-frequency control.
Table 77 shows all attributes of LoadFrequencyControlBlock.

Table 77 – Attributes of EquipmentReliabilityProfile::LoadFrequencyControlBlock

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

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

Table 78 shows all association ends of LoadFrequencyControlBlock with other classes.

Table 78 – Association ends of EquipmentReliabilityProfile::LoadFrequencyControlBlock with other classes

mult from	name	mult to	type	description
0..*	SynchronousArea	0..1	SynchronousArea	(NC) The synchronous area that has this load frequency control block.

3.48 (NC) LoadFrequencyControlOperator

Inheritance path = PowerSystemOrganisationRole : OrganisationRole : IdentifiedObject
A role that is responsible for operational security by operating the load frequency control (LFC) mechanism.
Table 79 shows all attributes of LoadFrequencyControlOperator.

Table 79 – Attributes of EquipmentReliabilityProfile::LoadFrequencyControlOperator

name	mult	type	description
globalLocationNumber	0..1	String	(NC) inherited from: OrganisationRole
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 80 shows all association ends of LoadFrequencyControlOperator with other classes.

Table 80 – Association ends of EquipmentReliabilityProfile::LoadFrequencyControlOperator with other classes

mult from	name	mult to	type	description
0..*	Organisation	0..1	Organisation	inherited from: OrganisationRole

3.49 (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 81 shows all attributes of OperationalLimit.

Table 81 – Attributes of EquipmentReliabilityProfile::OperationalLimit

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

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

Table 82 shows all association ends of OperationalLimit with other classes.

Table 82 – Association ends of EquipmentReliabilityProfile::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.

3.50 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 83 shows all attributes of OperationalLimitSet.

Table 83 – Attributes of EquipmentReliabilityProfile::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 84 shows all association ends of OperationalLimitSet with other classes.

Table 84 – Association ends of EquipmentReliabilityProfile::OperationalLimitSet with other classes

mult from	name	mult to	type	description
0..*	Terminal	1..1	ACDCTerminal	The terminal where the operational limit set apply.
0..*	PowerTransferCorridor	0..1	PowerTransferCorridor	(NC) The power transfer corridor that has this operational limit set.

3.51 OperationalLimitType

Inheritance path = IdentifiedObject

The operational meaning of a category of limits.

Table 85 shows all attributes of OperationalLimitType.

Table 85 – Attributes of EquipmentReliabilityProfile::OperationalLimitType

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

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

Table 86 shows all association ends of OperationalLimitType with other classes.

Table 86 – Association ends of EquipmentReliabilityProfile::OperationalLimitType with other classes

mult from	name	mult to	type	description
0..*	PermanentAmbientTemperatureDependencyCurve	0..1	AmbientTemperatureDependencyCurve	(NC) The permanent ambient temperature dependency curve for this operational limit type.
0..*	TemporaryBaseOverloadLimitCurve	0..1	BaseOverloadLimitCurve	(NC) The temporary base overload limit curve for this operational limit type.
0..*	TemporaryDurationOverloadLimitCurve	0..1	DurationOverloadLimitCurve	(NC) The temporary duration overload limit curve for this operational limit type.
0..*	PermanentSolarRadiationCurve	0..1	SolarRadiationDepedencyCurve	(NC) The permanent solar radiation curve for this operational limit type.
0..*	RecoveryOverloadLimitCurve	0..1	RecoveryOverloadLimitCurve	(NC) This is the curve which provides the recovery time information for this limit type.

3.52 (NC) OrdinaryPowerTransferCorridor

Inheritance path = PowerTransferCorridor : PowerSystemResource : IdentifiedObject
Power transfer corridor defined for normal operating network.
Table 87 shows all attributes of OrdinaryPowerTransferCorridor.

Table 87 – Attributes of EquipmentReliabilityProfile::OrdinaryPowerTransferCorridor

name	mult	type	description
normalEnabled	0..1	Boolean	(NC) inherited from: PowerTransferCorridor
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

3.53 Organisation

Inheritance path = IdentifiedObject
Organisation that might have roles as utility, contractor, supplier, manufacturer, customer, etc.
Table 88 shows all attributes of Organisation.

Table 88 – Attributes of EquipmentReliabilityProfile::Organisation

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

3.54 (abstract) OrganisationRole

Inheritance path = IdentifiedObject

Identifies a way in which an organisation may participate in the utility enterprise (e.g., customer, manufacturer, etc).
Table 89 shows all attributes of OrganisationRole.

Table 89 – Attributes of EquipmentReliabilityProfile::OrganisationRole

name	mult	type	description
globalLocationNumber	0..1	String	(NC) The Global Location Number (GLN) is part of the GS1 systems of standards. GLN is a 13-digit number structured that include GS1 Company Prefix, Location Reference (N1-N12) and Check Digit (N13). GS1 is a neutral, not-for-profit, international organisation that develops and maintains standards for supply and demand chains across multiple sectors.
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 90 shows all association ends of OrganisationRole with other classes.

Table 90 – Association ends of EquipmentReliabilityProfile::OrganisationRole with other classes

mult from	name	mult to	type	description
0..*	Organisation	0..1	Organisation	Organisation having this role.

3.55 (NC) OutageCoordinationRegion

Inheritance path = Region : PowerSystemResource : IdentifiedObject
A region that has a common organisation or service that is responsible for planning and coordinate outage and its impact on grid operation.
Table 91 shows all attributes of OutageCoordinationRegion.

Table 91 – Attributes of EquipmentReliabilityProfile::OutageCoordinationRegion

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 92 shows all association ends of OutageCoordinationRegion with other classes.

Table 92 – Association ends of EquipmentReliabilityProfile::OutageCoordinationRegion with other classes

mult from	name	mult to	type	description
0..*	SecurityCoordinator	0..1	SecurityCoordinator	(NC) The security coordinator that is responsible for this outage coordination region.
0..*	OutageCoordinator	0..1	OutageCoordinator	(NC) The outage coordinator responsible for this outage coordination region.

3.56 (NC) OutageCoordinator

Inheritance path = SystemOperationCoordinator : PowerSystemOrganisationRole : OrganisationRole : IdentifiedObject
A role that coordinates the planned availability status of relevant power system equipment to meet the need by the asset owner or operator and the security of the power system.
Table 93 shows all attributes of OutageCoordinator.

Table 93 – Attributes of EquipmentReliabilityProfile::OutageCoordinator

name	mult	type	description
globalLocationNumber	0..1	String	(NC) inherited from: OrganisationRole
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 94 shows all association ends of OutageCoordinator with other classes.

Table 94 – Association ends of EquipmentReliabilityProfile::OutageCoordinator with other classes

mult from	name	mult to	type	description
0..*	Organisation	0..1	Organisation	inherited from: OrganisationRole

3.57 (NC) OutagePlanningAgent

Inheritance path = PowerSystemOrganisationRole : OrganisationRole : IdentifiedObject
An entity with the task of planning the availability status of a relevant power generating module, a relevant demand facility or a relevant grid element.
Table 95 shows all attributes of OutagePlanningAgent.

Table 95 – Attributes of EquipmentReliabilityProfile::OutagePlanningAgent

name	mult	type	description
globalLocationNumber	0..1	String	(NC) inherited from: OrganisationRole
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 96 shows all association ends of OutagePlanningAgent with other classes.

Table 96 – Association ends of EquipmentReliabilityProfile::OutagePlanningAgent with other classes

mult from	name	mult to	type	description
0..*	Organisation	0..1	Organisation	inherited from: OrganisationRole

3.58 (Description) PowerElectronicsUnit

Inheritance path = Equipment : PowerSystemResource : IdentifiedObject
A generating unit or battery or aggregation that connects to the AC network using power electronics rather than rotating machines.
Table 97 shows all attributes of PowerElectronicsUnit.

Table 97 – Attributes of EquipmentReliabilityProfile::PowerElectronicsUnit

name	mult	type	description
longPF	0..1	Float	(NC) Power electronics unit long term economic participation factor.
maxEconomicP	0..1	ActivePower	(NC) Maximum high economic active power limit, that should not exceed the maximum operating active power limit.
minEconomicP	0..1	ActivePower	(NC) Low economic active power limit that shall be greater than or equal to the minimum operating active power limit.
shortPF	0..1	Float	(NC) Power electronics unit short term economic participation factor.
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 98 shows all association ends of PowerElectronicsUnit with other classes.

Table 98 – Association ends of EquipmentReliabilityProfile::PowerElectronicsUnit with other classes

mult from	name	mult to	type	description
0..*	ScheduleResource	0..1	ScheduleResource	(NC) The schedule resource that has this power electronics unit.
1..*	Circuit	0..1	Circuit	(NC) inherited from: Equipment
0..*	AggregatedEquipment	0..1	Equipment	(NC) inherited from: Equipment

3.59 (abstract,NC) PowerSystemOrganisationRole

Inheritance path = OrganisationRole : IdentifiedObject

A role that is responsible for the functional operational of a power system resource.

Table 99 shows all attributes of PowerSystemOrganisationRole.

Table 99 – Attributes of EquipmentReliabilityProfile::PowerSystemOrganisationRole

name	mult	type	description
globalLocationNumber	0..1	String	(NC) inherited from: OrganisationRole
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 100 shows all association ends of PowerSystemOrganisationRole with other classes.

Table 100 – Association ends of EquipmentReliabilityProfile::PowerSystemOrganisationRole with other classes

mult from	name	mult to	type	description
0..*	Organisation	0..1	Organisation	inherited from: OrganisationRole

3.60 (abstract) PowerSystemResource

Inheritance path = IdentifiedObject

A power system resource (PSR) can be an item of equipment such as a switch, an equipment container containing many individual items of equipment such as a substation, or an organisational entity such as sub-control area. Power system resources can have measurements associated.
Table 101 shows all attributes of PowerSystemResource.

Table 101 – Attributes of EquipmentReliabilityProfile::PowerSystemResource

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

3.61 (abstract,NC) PowerTransferCorridor

Inheritance path = PowerSystemResource : IdentifiedObject
A power transfer corridor is defined as a set of circuits (transmission lines or transformers) separating two portions of the power system, or a subset of circuits exposed to a substantial portion of the transmission exchange between two parts of the system.
Table 102 shows all attributes of PowerTransferCorridor.

Table 102 – Attributes of EquipmentReliabilityProfile::PowerTransferCorridor

name	mult	type	description
normalEnabled	0..1	Boolean	(NC) It is the normal enable/disable the monitoring/assessment of a power transfer corridor. True means that the monitoring of the power transfer corridor is assessed. False means the power transfer corridor is not assessed.
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

3.62 (NC) PowerTransformerCircuit

Inheritance path = Circuit : PowerSystemResource : IdentifiedObject
A power transformer circuit is a circuit that has at least one PowerTransformer and may or may not include related switching and/or auxiliary equipment.
Table 103 shows all attributes of PowerTransformerCircuit.

Table 103 – Attributes of EquipmentReliabilityProfile::PowerTransformerCircuit

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 104 shows all association ends of PowerTransformerCircuit with other classes.

Table 104 – Association ends of EquipmentReliabilityProfile::PowerTransformerCircuit with other classes

mult from	name	mult to	type	description
0..*	CircuitShare	0..1	CircuitShare	(NC) inherited from: Circuit

3.63 (NC) ProportionalEnergyComponent

Inheritance path = EnergyComponent : IdentifiedObject
The energy group active power are distributed proportionally between the energy component in a given energy group.
Table 105 shows all attributes of ProportionalEnergyComponent.

Table 105 – Attributes of EquipmentReliabilityProfile::ProportionalEnergyComponent

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 106 shows all association ends of ProportionalEnergyComponent with other classes.

Table 106 – Association ends of EquipmentReliabilityProfile::ProportionalEnergyComponent with other classes

mult from	name	mult to	type	description
0..*	HydroPump	0..1	HydroPump	(NC) inherited from: EnergyComponent
0..*	EnergyGroup	0..1	EnergyGroup	(NC) inherited from: EnergyComponent
0..*	PowerElectronicsUnit	0..1	PowerElectronicsUnit	(NC) inherited from: EnergyComponent
0..*	EnergyConsumer	0..1	EnergyConsumer	(NC) inherited from: EnergyComponent
0..*	GeneratingUnit	0..1	GeneratingUnit	(NC) inherited from: EnergyComponent

3.64 (NC) PTCTriggeredEquipment

Inheritance path = IdentifiedObject
Equipment that is operating in an island or it is out of service.
Table 107 shows all attributes of PTCTriggeredEquipment.

Table 107 – Attributes of EquipmentReliabilityProfile::PTCTriggeredEquipment

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 108 shows all association ends of PTCTriggeredEquipment with other classes.

Table 108 – Association ends of EquipmentReliabilityProfile::PTCTriggeredEquipment with other classes

mult from	name	mult to	type	description
0..*	Equipment	1..1	Equipment	(NC) The equipment which is part of power transfer corridor trigggering.
1..*	ExceptionalPowerTransferCorridor	1..1	ExceptionalPowerTransferCorridor	(NC) The power transfer corridor which is triggered by this equipment.

3.65 (NC) RecoveryOverloadLimitCurve

Inheritance path = LimitDependencyCurve : Curve
The relation between the recovery time and an overload limit.
Table 109 shows all attributes of RecoveryOverloadLimitCurve.

Table 109 – Attributes of EquipmentReliabilityProfile::RecoveryOverloadLimitCurve

name	mult	type	description
curveStyle	1..1	CurveStyle	inherited from: Curve
xMultiplier	0..1	UnitMultiplier	inherited from: Curve
xUnit	1..1	UnitSymbol	inherited from: Curve
y1Multiplier	0..1	UnitMultiplier	inherited from: Curve
y1Unit	0..1	UnitSymbol	inherited from: Curve

3.66 (abstract,NC) Region

Inheritance path = PowerSystemResource : IdentifiedObject
A region where the system operator belongs to.
Table 110 shows all attributes of Region.

Table 110 – Attributes of EquipmentReliabilityProfile::Region

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

3.67 (NC) ScheduleResource

Inheritance path = PowerSystemResource : IdentifiedObject
A schedule resource is a market-based method for handling participation of small units, particularly located on the lower voltage level that is controlled by a Distributed System Operator (DSO). It is a collection of units that can operate in the market by providing bids, offers and a resulting committed operational schedule for the collection.
Table 111 shows all attributes of ScheduleResource.

Table 111 – Attributes of EquipmentReliabilityProfile::ScheduleResource

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 112 shows all association ends of ScheduleResource with other classes.

Table 112 – Association ends of EquipmentReliabilityProfile::ScheduleResource with other classes

mult from	name	mult to	type	description
0..*	SchedulingArea	0..1	SchedulingArea	(NC) The scheduling area that has this schedule resource.
0..*	ResourceOf	0..1	ScheduleResource	(NC) The schedule resource that has this subschedule resource.

3.68 (NC) SchedulingArea

Inheritance path = PowerSystemResource : IdentifiedObject

An area where production and/or consumption of energy can be forecasted, scheduled and measured. The area is operated by only one system operator, typically a Transmission System Operator (TSO). The area can consist of a sub area, which has the same definition as the main area, but it can be operated by another system operator (typically Distributed System Operator (DSO) or a Closed Distributed System Operator (CDSO)). This includes microgrid concept. A substation is the smallest grouping that can be included in the area. The area size should be considered in terms of the possibility of accumulated reading (settlement metering) and the capability of operating as an island.

Table 113 shows all attributes of SchedulingArea.

Table 113 – Attributes of EquipmentReliabilityProfile::SchedulingArea

name	mult	type	description
isIslandingEnabled	0..1	Boolean	(NC) Identifies if the area can operate in island operation. If true, the area is enabled (capable) of operating as an electrical island. If false, the area does not have the capability or it is not enabled to operate as an electrical island.
isMeteringGridArea	0..1	Boolean	(NC) Identifies if the area is settlement metered for all import and export to the area. If true, the area is metered area. If false, it is not.
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 114 shows all association ends of SchedulingArea with other classes.

Table 114 – Association ends of EquipmentReliabilityProfile::SchedulingArea with other classes

mult from	name	mult to	type	description
0..*	EnergyCoordinationRegion	0..1	EnergyCoordinationRegion	(NC) The energy coordination region that has this scheduling area.
0..*	LoadFrequencyControlArea	0..1	LoadFrequencyControlArea	(NC) The load frequency control area which has this scheduling area.
0..*	SynchronousArea	0..1	SynchronousArea	(NC) The synchronous are that has this scheduling area.
0..*	SystemOperator	0..1	SystemOperator	(NC) The system operator for this scheduling area.
1..*	BiddingZone	1..1	BiddingZone	(NC) The bidding zone related to this schedulling area.
1..*	ControlArea	0..1	ControlArea	(NC) The control area for this scheduling area.

3.69 (NC) SecurityCoordinator

Inheritance path = SystemOperationCoordinator : PowerSystemOrganisationRole : OrganisationRole : IdentifiedObject

A role that coordinates the relevant remedial actions and their optimisation to ensure efficient use to achieve required operational security of the power system.

Table 115 shows all attributes of SecurityCoordinator.

Table 115 – Attributes of EquipmentReliabilityProfile::SecurityCoordinator

name	mult	type	description
globalLocationNumber	0..1	String	(NC) inherited from: OrganisationRole
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 116 shows all association ends of SecurityCoordinator with other classes.

Table 116 – Association ends of EquipmentReliabilityProfile::SecurityCoordinator with other classes

mult from	name	mult to	type	description
0..*	Organisation	0..1	Organisation	inherited from: OrganisationRole

3.70 (NC) SolarRadiationDepedencyCurve

Inheritance path = LimitDependencyCurve : Curve

A curve or functional relationship between
- the solar radiation independent variable (X-axis), and
- relative dependent (Y-axis) variables.

Table 117 shows all attributes of SolarRadiationDepedencyCurve.

Table 117 – Attributes of EquipmentReliabilityProfile::SolarRadiationDepedencyCurve

name	mult	type	description
curveStyle	1..1	CurveStyle	inherited from: Curve
xMultiplier	0..1	UnitMultiplier	inherited from: Curve
xUnit	1..1	UnitSymbol	inherited from: Curve
y1Multiplier	0..1	UnitMultiplier	inherited from: Curve
y1Unit	0..1	UnitSymbol	inherited from: Curve

3.71 (NC) SubSchedulingArea

Inheritance path = SchedulingArea : PowerSystemResource : IdentifiedObject

An area that is a specialisation of scheduling area that is a part of another scheduling area. Typically part of a Transmission System Operator (TSO) scheduling area which is typically operated by a Distributed System Operator (DSO) or a Close Distributed System Operator (CDSO). This includes microgrid concept. A sub scheduling area can contain other sub areas. A sub scheduling area leaf will form the smallest entity of any given energy area.

Table 118 shows all attributes of SubSchedulingArea.

Table 118 – Attributes of EquipmentReliabilityProfile::SubSchedulingArea

name	mult	type	description
isIslandingEnabled	0..1	Boolean	(NC) inherited from: SchedulingArea
isMeteringGridArea	0..1	Boolean	(NC) inherited from: SchedulingArea
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 119 shows all association ends of SubSchedulingArea with other classes.

Table 119 – Association ends of EquipmentReliabilityProfile::SubSchedulingArea with other classes

mult from	name	mult to	type	description
0..*	SchedulingArea	1..1	SchedulingArea	(NC) The scheduling area that has this subscheduling area.
0..*	EnergyCoordinationRegion	0..1	EnergyCoordinationRegion	(NC) inherited from: SchedulingArea
0..*	LoadFrequencyControlArea	0..1	LoadFrequencyControlArea	(NC) inherited from: SchedulingArea
0..*	SynchronousArea	0..1	SynchronousArea	(NC) inherited from: SchedulingArea
0..*	SystemOperator	0..1	SystemOperator	(NC) inherited from: SchedulingArea
1..*	BiddingZone	1..1	BiddingZone	(NC) inherited from: SchedulingArea
1..*	ControlArea	0..1	ControlArea	(NC) inherited from: SchedulingArea

3.72 (Description) Substation

Inheritance path = EquipmentContainer : ConnectivityNodeContainer : PowerSystemResource : IdentifiedObject

A collection of equipment for purposes other than generation or utilization, through which electric energy in bulk is passed for the purposes of switching or modifying its characteristics.

Table 120 shows all attributes of Substation.

Table 120 – Attributes of EquipmentReliabilityProfile::Substation

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 121 shows all association ends of Substation with other classes.

Table 121 – Association ends of EquipmentReliabilityProfile::Substation with other classes

mult from	name	mult to	type	description
0..*	SchedulingArea	0..1	SchedulingArea	(NC) The scheduling area that has this substation.

3.73 (NC) SynchronousArea

Inheritance path = PowerSystemResource : IdentifiedObject

A Synchronous Area is an electrical area covered by interconnect with a common System Frequency in a steady-state.

Table 122 shows all attributes of SynchronousArea.

Table 122 – Attributes of EquipmentReliabilityProfile::SynchronousArea

name	mult	type	description
nominalFrequency	1..1	Frequency	(NC) The nominal frequency for the Synchronous Area, e.g. 50 Hz for Europe.

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

3.74 (abstract,NC) SystemOperationCoordinator

Inheritance path = PowerSystemOrganisationRole : OrganisationRole : IdentifiedObject
A role that coordinates relevant information and impact in regards to operating the power system.
Table 123 shows all attributes of SystemOperationCoordinator.

Table 123 – Attributes of EquipmentReliabilityProfile::SystemOperationCoordinator

name	mult	type	description
globalLocationNumber	0..1	String	(NC) inherited from: OrganisationRole
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 124 shows all association ends of SystemOperationCoordinator with other classes.

Table 124 – Association ends of EquipmentReliabilityProfile::SystemOperationCoordinator with other classes

mult from	name	mult to	type	description
0..*	Organisation	0..1	Organisation	inherited from: OrganisationRole

3.75 (abstract,NC) SystemOperator

Inheritance path = PowerSystemOrganisationRole : OrganisationRole : IdentifiedObject
System operator.
Table 125 shows all attributes of SystemOperator.

Table 125 – Attributes of EquipmentReliabilityProfile::SystemOperator

name	mult	type	description
globalLocationNumber	0..1	String	(NC) inherited from: OrganisationRole
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 126 shows all association ends of SystemOperator with other classes.

Table 126 – Association ends of EquipmentReliabilityProfile::SystemOperator with other classes

mult from	name	mult to	type	description
0..*	Organisation	0..1	Organisation	inherited from: OrganisationRole

3.76 (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 127 shows all attributes of Terminal.

Table 127 – Attributes of EquipmentReliabilityProfile::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

3.77 (NC) TieCorridor

Inheritance path = PowerSystemResource : IdentifiedObject

A collection of one or more tie-line or direct current poles that connect two different control areas together.

Table 128 shows all attributes of TieCorridor.

Table 128 – Attributes of EquipmentReliabilityProfile::TieCorridor

name	mult	type	description
delayFRR	0..1	Seconds	(NC) A positive number that is a multiple of Automatic Generation Control (AGC) run cycles that describes the delay in adapting imbalance of the tie corridor.
maxFRRramp	0..1	Float	(NC) Maximum authorized ramp for both Frequency Reserve Restoration (FRR) dispatching and ramp to zero.
thresholdFRR	0..1	ActivePower	(NC) Frequency Reserve Restoration (FRR) coherency check threshold.
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

3.78 (NC) TransmissionSystemOperator

Inheritance path = SystemOperator : PowerSystemOrganisationRole : OrganisationRole : IdentifiedObject

A system operator role that is responsible for operating of an energy transmission network.

Table 129 shows all attributes of TransmissionSystemOperator.

Table 129 – Attributes of EquipmentReliabilityProfile::TransmissionSystemOperator

name	mult	type	description
globalLocationNumber	0..1	String	(NC) inherited from: OrganisationRole
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 130 shows all association ends of TransmissionSystemOperator with other classes.

Table 130 – Association ends of EquipmentReliabilityProfile::TransmissionSystemOperator with other classes

mult from	name	mult to	type	description
0..*	Organisation	0..1	Organisation	inherited from: OrganisationRole

3.79 CurveStyle enumeration

Style or shape of curve.
Table 131 shows all literals of CurveStyle.

Table 131 – Literals of EquipmentReliabilityProfile::CurveStyle

literal	value	description
constantYValue		The Y-axis values are assumed constant until the next curve point and prior to the first curve point.
straightLineYValues		The Y-axis values are assumed to be a straight line between values. Also known as linear interpolation.

3.80 OperationalLimitDirectionKind enumeration

The direction attribute describes the side of a limit that is a violation.
Table 132 shows all literals of OperationalLimitDirectionKind.

Table 132 – Literals of EquipmentReliabilityProfile::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.

3.81 Currency enumeration

Monetary currencies. ISO 4217 standard including 3-character currency code.
Table 133 shows all literals of Currency.

Table 133 – Literals of EquipmentReliabilityProfile::Currency

literal	value	description
AED	784	United Arab Emirates dirham.
AFN	971	Afghan afghani.
ALL	008	Albanian lek.
AMD	051	Armenian dram.
ANG	532	Netherlands Antillean guilder.
AOA	973	Angolan kwanza.
ARS	032	Argentine peso.

literal	value	description
AUD	036	Australian dollar.
AWG	533	Aruban florin.
AZN	944	Azerbaijani manat.
BAM	977	Bosnia and Herzegovina convertible mark.
BBD	052	Barbados dollar.
BDT	050	Bangladeshi taka.
BGN	975	Bulgarian lev.
BHD	048	Bahraini dinar.
BIF	108	Burundian franc.
BMD	060	Bermudian dollar (customarily known as Bermuda dollar).
BND	096	Brunei dollar.
BOB	068	Boliviano.
BOV	984	Bolivian Mvdol (funds code).
BRL	986	Brazilian real.
BSD	044	Bahamian dollar.
BTN	064	Bhutanese ngultrum.
BWP	072	Botswana pula.
BYR	974	Belarusian ruble.
BZD	084	Belize dollar.
CAD	124	Canadian dollar.
CDF	976	Congolese franc.
CHF	756	Swiss franc.
CLF	990	Unidad de Fomento (funds code), Chile.
CLP	152	Chilean peso.
CNY	156	Chinese yuan.
COP	170	Colombian peso.
COU	970	Unidad de Valor Real.
CRC	188	Costa Rican colon.
CUC	931	Cuban convertible peso.
CUP	192	Cuban peso.
CVE	132	Cape Verde escudo.
CZK	203	Czech koruna.
DJF	262	Djiboutian franc.
DKK	208	Danish krone.
DOP	214	Dominican peso.
DZD	012	Algerian dinar.
EEK	233	Estonian kroon.
EGP	818	Egyptian pound.
ERN	232	Eritrean nakfa.
ETB	230	Ethiopian birr.

literal	value	description
EUR	978	Euro.
FJD	242	Fiji dollar.
FKP	238	Falkland Islands pound.
GBP	826	Pound sterling.
GEL	981	Georgian lari.
GHS	936	Ghanaian cedi.
GIP	929	Gibraltar pound.
GMD	270	Gambian dalasi.
GNF	324	Guinean franc.
GTQ	320	Guatemalan quetzal.
GYD	328	Guyanese dollar.
HKD	344	Hong Kong dollar.
HNL	340	Honduran lempira.
HRK	191	Croatian kuna.
HTG	332	Haitian gourde.
HUF	348	Hungarian forint.
IDR	360	Indonesian rupiah.
ILS	376	Israeli new sheqel.
INR	356	Indian rupee.
IQD	368	Iraqi dinar.
IRR	364	Iranian rial.
ISK	352	Icelandic króna.
JMD	388	Jamaican dollar.
JOD	400	Jordanian dinar.
JPY	392	Japanese yen.
KES	404	Kenyan shilling.
KGS	417	Kyrgyzstani som.
KHR	116	Cambodian riel.
KMF	174	Comoro franc.
KPW	408	North Korean won.
KRW	410	South Korean won.
KWD	414	Kuwaiti dinar.
KYD	136	Cayman Islands dollar.
KZT	398	Kazakhstani tenge.
LAK	418	Lao kip.
LBP	422	Lebanese pound.
LKR	144	Sri Lanka rupee.
LRD	430	Liberian dollar.
LSL	426	Lesotho loti.
LTL	440	Lithuanian litas.
LVL	428	Latvian lats.

literal	value	description
LYD	434	Libyan dinar.
MAD	504	Moroccan dirham.
MDL	498	Moldovan leu.
MGA	969	Malagasy ariary.
MKD	807	Macedonian denar.
MMK	104	Myanma kyat.
MNT	496	Mongolian tugrik.
MOP	446	Macanese pataca.
MRO	478	Mauritanian ouguiya.
MUR	480	Mauritian rupee.
MVR	462	Maldivian rufiyaa.
MWK	454	Malawian kwacha.
MXN	484	Mexican peso.
MYR	458	Malaysian ringgit.
MZN	943	Mozambican metical.
NAD	516	Namibian dollar.
NGN	566	Nigerian naira.
NIO	558	Cordoba oro.
NOK	578	Norwegian krone.
NPR	524	Nepalese rupee.
NZD	554	New Zealand dollar.
OMR	512	Omani rial.
PAB	590	Panamanian balboa.
PEN	604	Peruvian nuevo sol.
PGK	598	Papua New Guinean kina.
PHP	608	Philippine peso.
PKR	586	Pakistani rupee.
PLN	985	Polish zloty.
PYG	600	Paraguayan guaraní.
QAR	634	Qatari rial.
RON	946	Romanian new leu.
RSD	941	Serbian dinar.
RUB	643	Russian rouble.
RWF	646	Rwandan franc.
SAR	682	Saudi riyal.
SBD	090	Solomon Islands dollar.
SCR	690	Seychelles rupee.
SDG	938	Sudanese pound.
SEK	752	Swedish krona/kronor.
SGD	702	Singapore dollar.
SHP	654	Saint Helena pound.

literal	value	description
SLL	694	Sierra Leonean leone.
SOS	706	Somali shilling.
SRD	968	Surinamese dollar.
STD	678	São Tomé and Príncipe dobra.
SYP	760	Syrian pound.
SZL	748	Lilangeni.
THB	764	Thai baht.
TJS	972	Tajikistani somoni.
TMT	934	Turkmenistani manat.
TND	788	Tunisian dinar.
TOP	776	Tongan pa'anga.
TRY	949	Turkish lira.
TTD	780	Trinidad and Tobago dollar.
TWD	901	New Taiwan dollar.
TZS	834	Tanzanian shilling.
UAH	980	Ukrainian hryvnia.
UGX	800	Ugandan shilling.
USD	840	United States dollar.
UYU	858	Uruguayan peso.
UZS	860	Uzbekistan som.
VEF	937	Venezuelan bolívar fuerte.
VND	704	Vietnamese Dong.
VUV	548	Vanuatu vatu.
WST	882	Samoan tala.
XAF	950	CFA franc BEAC.
XCD	951	East Caribbean dollar.
XOF	952	CFA Franc BCEAO.
XPF	953	CFP franc.
YER	886	Yemeni rial.
ZAR	710	South African rand.
ZMK	894	Zambian kwacha.
ZWL	932	Zimbabwe dollar.

3.82 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 134 shows all literals of UnitMultiplier.

Table 134 – Literals of EquipmentReliabilityProfile::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.

3.83 (NC) EnergyKind enumeration

Energy group given by the needed categorization given by energy origination directive.
Table 135 shows all literals of EnergyKind.

Table 135 – Literals of EquipmentReliabilityProfile::EnergyKind

literal	value	description
hydroRunOfRiver		Hydro run of river.
hydroWaterReservoir		Hydro water reservoir.
hydroPumpStorage		Hydro pump storage.
biomass		Biomass.
fossil		Fossil.

literal	value	description
geothermal		Geothermal.
marine		Marine.
nuclear		Nuclear.
otherRenewable		Other renewable.
batteryStorage		Battery storage.
solar		Solar.
waste		Waste.
wind		Wind.
other		Other.
consumer		Consumer.
industrial		Industrial.

3.84 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 136 shows all literals of UnitSymbol.

Table 136 – Literals of EquipmentReliabilityProfile::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.

literal	value	description
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).
W	38	Real power in watts (J/s). Electrical power may have real and reactive components. The real portion of electrical power (I²R or VIcos(phi)), is expressed in Watts. See also apparent power and reactive power.
Pa	39	Pressure in pascals (N/m²). 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 (m²).
m3	42	Volume in cubic metres (m³).
mPers	43	Velocity in metres per second (m/s).
mPers2	44	Acceleration in metres per second squared (m/s²).
m3Pers	45	Volumetric flow rate in cubic metres per second (m³/s).
mPerm3	46	Fuel efficiency in metres per cubic metres (m/m³).
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.

literal	value	description
kgPerm3	48	Density in kilogram/cubic metres (kg/m³). Note: multiplier “k” is included in this unit symbol for compatibility with IEC 61850-7-3.
m2Pers	49	Viscosity in square metres / second (m²/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.
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 (W²/A²).
As	68	Ampere seconds (A·s).
A2	69	Amperes squared (A²).
A2s	70	Ampere squared time in square amperes (A²s).
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.

literal	value	description
character	76	Number of characters.
charPers	77	Data rate (baud) in characters per second.
kgm2	78	Moment of mass in kilogram square metres (kg·m²) (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.
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.

literal	value	description
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.
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.

literal	value	description
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.
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).

3.85 ActivePower datatype

Product of RMS value of the voltage and the RMS value of the in-phase component of the current.

Table 137 shows all attributes of ActivePower.

Table 137 – Attributes of EquipmentReliabilityProfile::ActivePower

name	mult	type	description
multiplier	0..1	UnitMultiplier	
unit	0..1	UnitSymbol	(const=W)
value	0..1	Float	

3.86 AngleDegrees datatype

Measurement of angle in degrees.
Table 138 shows all attributes of AngleDegrees.

Table 138 – Attributes of EquipmentReliabilityProfile::AngleDegrees

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

3.87 Money datatype

Amount of money.
Table 139 shows all attributes of Money.

Table 139 – Attributes of EquipmentReliabilityProfile::Money

name	mult	type	description
multiplier	0..1	UnitMultiplier	
unit	0..1	Currency	
value	0..1	Decimal	

3.88 Seconds datatype

Time, in seconds.
Table 140 shows all attributes of Seconds.

Table 140 – Attributes of EquipmentReliabilityProfile::Seconds

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

3.89 Frequency datatype

Cycles per second.
Table 141 shows all attributes of Frequency.

Table 141 – Attributes of EquipmentReliabilityProfile::Frequency

name	mult	type	description
value	0..1	Float	
unit	0..1	UnitSymbol	(const=Hz)
multiplier	0..1	UnitMultiplier	

3.90 PerCent datatype

Percentage on a defined base. For example, specify as 100 to indicate at the defined base.
Table 142 shows all attributes of PerCent.

Table 142 – Attributes of EquipmentReliabilityProfile::PerCent

name	mult	type	description
value	0..1	Float	Normally 0 to 100 on a defined base.
unit	0..1	UnitSymbol	(const=none)
multiplier	0..1	UnitMultiplier	(const=none)

3.91 ActivePowerChangeRate datatype

Rate of change of active power per time.
Table 143 shows all attributes of ActivePowerChangeRate.

Table 143 – Attributes of EquipmentReliabilityProfile::ActivePowerChangeRate

name	mult	type	description
multiplier	0..1	UnitMultiplier	
unit	0..1	UnitSymbol	(const=WPers)
value	0..1	Float	

3.92 Boolean primitive

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

3.93 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.

3.94 Integer primitive

An integer number. The range is unspecified and not limited.

3.95 String primitive

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

3.96 Float primitive

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

3.97 Decimal primitive

Decimal is the base-10 notational system for representing real numbers.

3.98 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".

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 Sample instance data

Intentionally left blank. Sample data will be produced at later stage.