European Network of
Transmission System Operators
for Electricity

EQUIPMENT RELIABILITY PROFILE SPECIFICATION

2025-02-13

APPROVED DOCUMENT
VERSION 2.3.2

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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	Date	Paragraph	Comments
0.1.0	2021-10-12		For CIM EG review. This profile replaces Available Remedial Action Profile. These new profiles include also information on SIPS, GLSK, limits, area and overlapping zone.
1.0.0	2022-02-16		SOC approved
2.1.0	2022-09-21		SOC approved
2.2.0	2023-03-24		For review
2.2.0	2023-04-20		For ICTC approval.
2.3.0-alpha	2024-02-17		For internal review.
2.3.0-beta	2024-03-20		For CIM WG review.
2.3.0-gamma	2024-04-09		For StG Strategy review.
2.3.1-alpha	2024-09-07		For CIM WG review.
2.3.2-alpha	2025-01-04		ICTC Approval on 2025-02-13

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1 Introduction

The equipment reliability profile enables exchanges of additional information related to equipment as well as FACTS, limits, area and GLSK amongst others.

2 Application profile specification

2.1 Version information

The content is generated from UML model file CIM17-2_CGMES31v01_PROF-20v02_NC23v69_MS10v01_DES10v01.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: https://ap-voc.cim4.eu/EquipmentReliability/2.3
- Version info: 2.3.1
- Prior version: http://entsoe.eu/ns/CIM/EquipmentReliability-EU/2.2
- 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://CIM100_CGMES31v01_501-20v02_NC23v62_MM10v01.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:interconnection

In cases where the AreaDispatchingUnit is providing dispatch support for a control area outside its location it shall refer to TieCorridor that refers to ControlArea. Otherwise, the AreaDispatchingUnit shall refer to SchedulingArea.

- C:NC:ER:AreaDispatchableUnit:associations

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

- C:NC:ER:EnergyComponent:associations

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

- R:NC:ER:VoltageAngleLimit:AngleReferenceTerminal

Due to the nature of the exchange and requirements it is allowed that the association VoltageAngleLimit.AngleReferenceTerminal provides a dangling reference. This occurs when the referenced Terminal is in another MAS. Validation of this association is only performed when all dangling references are completed.

- R:NC:ALL:NA:serialization

The profiles are defined in the EnterpriseArchitect application and have multiple artifacts that describe them. The main artifacts are:

1) the EAP file (EnterpriseArchitect project file),
2) the profiles' specification document and
3) the application profiles (RDFS and SHACL).

Due to the complexity of the profiles, there are various cross profile associations that, from profiling and profile maintenance point of view, it is not practical to include the complete inheritance structure in all profiles. If this is done the documentation provided for all profiles would also include duplicated information on the description of classes defined in other profiles. The following cases are often observed in profiles:

  - Case 1: An association end refers to an abstract class
  - Case 2: An abstract class (stereotyped with "Description") has an association (direction to another class)
  - Case 3: An abstract class (not stereotyped with "Description") has an association (direction to another class)
  - Case 4: An abstract class has attributes and subclasses are not in the profile

In all cases, the datasets shall only include the subtypes of the abstract classes with the related properties (i.e. association or attributes) defined in the profile. The information is taken from either canonical model or the profiles where complete (expected) inheritance structure for the related abstract class is described. SHACL based constraints include constraints only for the concrete classes that are subtypes of the abstract class in the profile, and this can be used to inform which are the concrete classes expected in a dataset that conforms to this profile.

It should be taken into account that this approach deviates from MVAL5 (IEC 61970-600-1:2021), which creates multiple inheritance at serialization. For instance, with this more explicit exchange the serialization of the association between abstract class Equipment and abstract class Circuit for a PowerTransformer will be serialized as follows:

  - for association

<cim:PowerTransformer rdf:about="_c328f787-bc17-47ad-a59f-6ba7133340d0">

<nc:Equipment.Circut rdf:resource="#_9ced16ac-d076-4ef9-a241-a998a579e77b"/>

</cim:PowerTransformer>

- for attribute

<cim:ACLineSegment rdf:about="_04f681aa-6999-4fb3-9775-acaa5eb7ceff">

<cim:Equipment.inService>true</cim:Equipment.inService>

</cim:ACLineSegment>

The usage of rdf:ID or rdf:about depends on the stereotype of the class. rdf:about is used if the class has the stereotype “Description”.

An example of not allowed serialization, as the Equipment is an abstract class

<cim:Equipment rdf:about="_c328f787-bc17-47ad-a59f-6ba7133340d0">

<nc:Equipment.Circut rdf:resource="#_9ced16ac-d076-4ef9-a241-a998a579e77b"/>

</cim:Equipment>

- C:NC:ER:HydroPowerPlant:operatingMode

The SynchronousMachine.operatingMode of all SynchronousMachine objects part of a HydroPowerPlant shall be consistent.

- C:NC:ER:Circuit:associations

The Circuit shall be associated with either Equipment or Terminal.

- C:NC:ER:FunctionOutputVariable.PropertyReference:value

The value of the association end FunctionOutputVariable.PropertyReference shall be one of the values published in the skos:ConceptScheme https://energy.referencedata.eu/PropertyReference/.

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 or their URI (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.

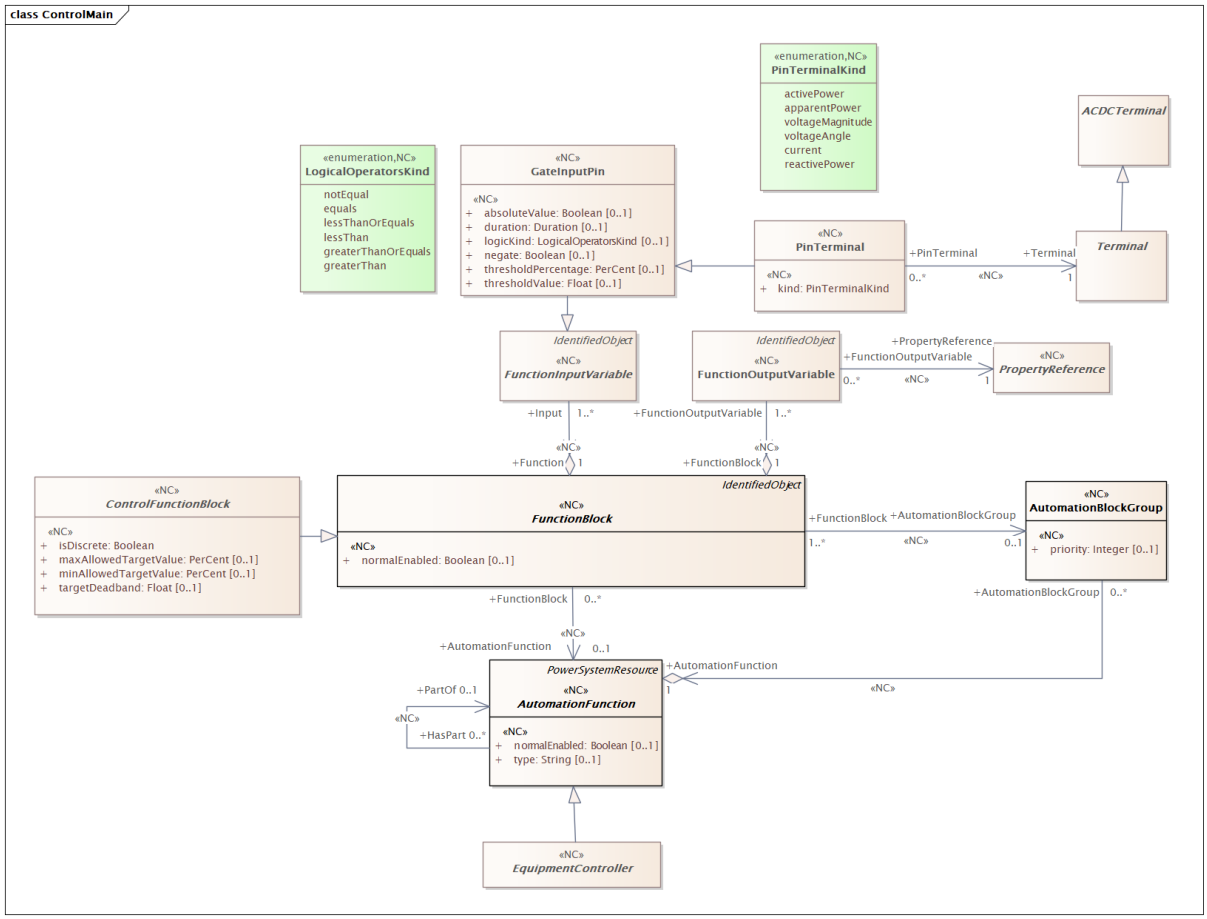


Figure 1 – Class diagram EquipmentReliabilityProfile::ControlMain

Figure 1: The diagram shows main structure of the control related classes.

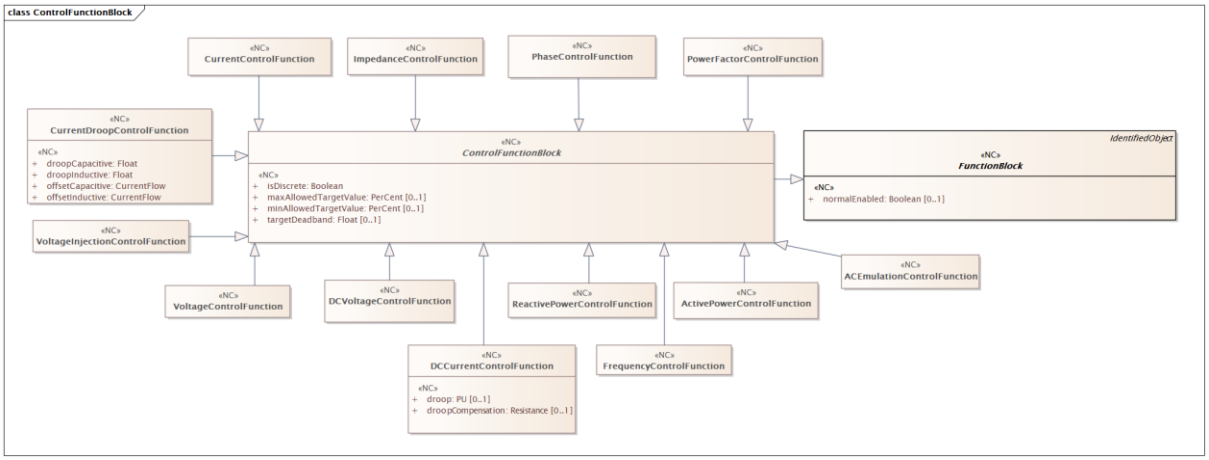


Figure 2 – Class diagram EquipmentReliabilityProfile::ControlFunctionBlock

Figure 2: The diagram shows control function block related classes.

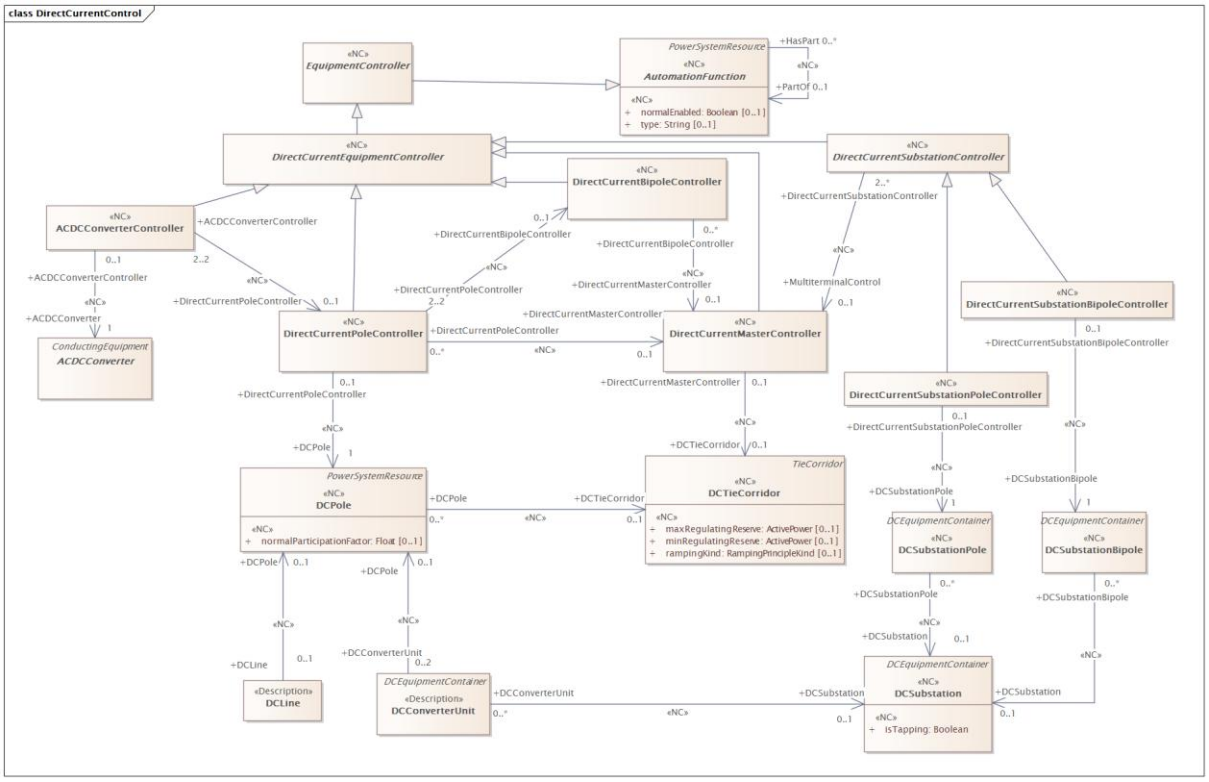
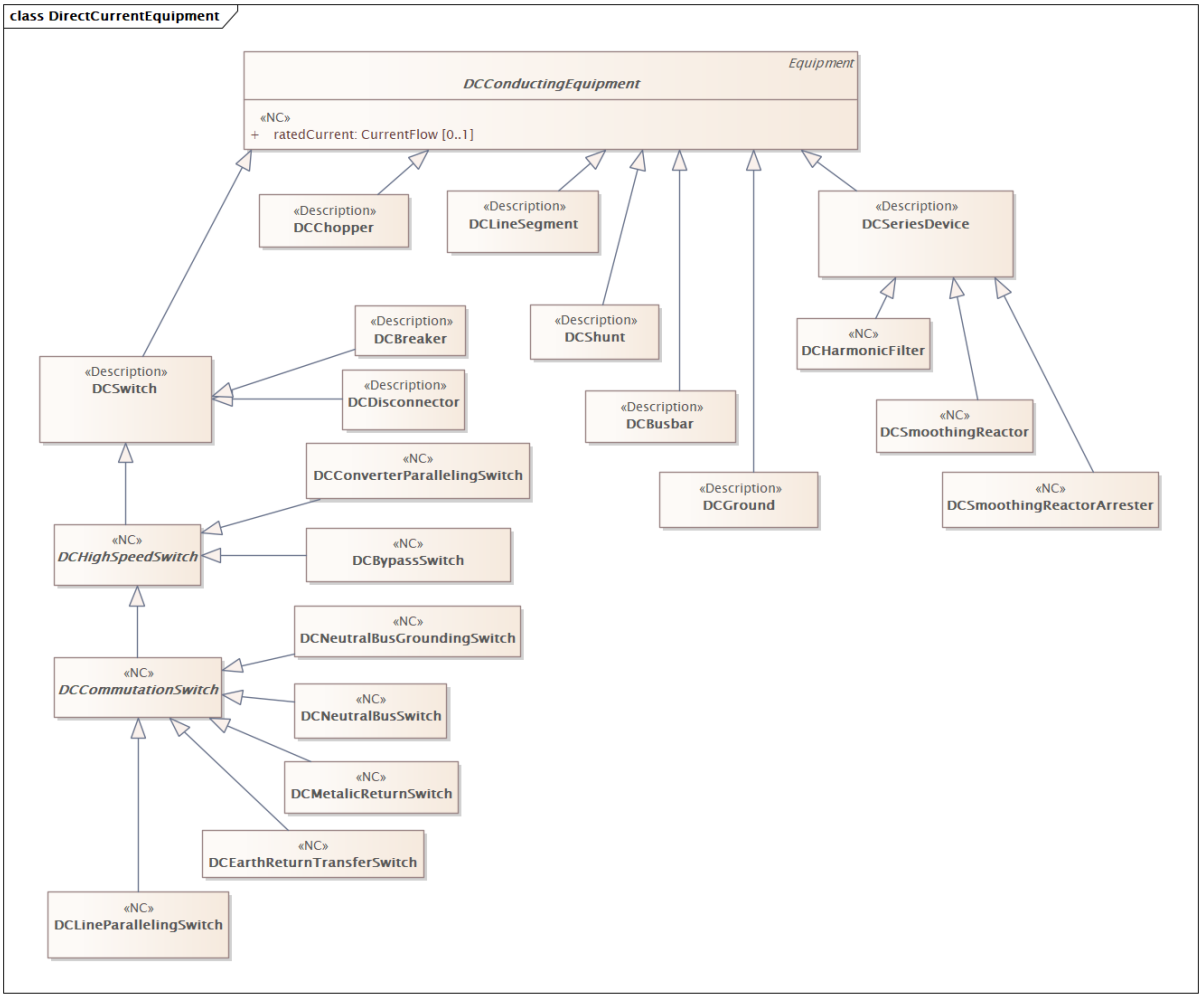


Figure 3 – Class diagram EquipmentReliabilityProfile::DirectCurrentControl

Figure 3: The diagram contains classes related to direct current control.



1088

1089 **Figure 4 – Class diagram EquipmentReliabilityProfile::DirectCurrentEquipment**

1090 Figure 4: The diagram shows the DC equipment model.

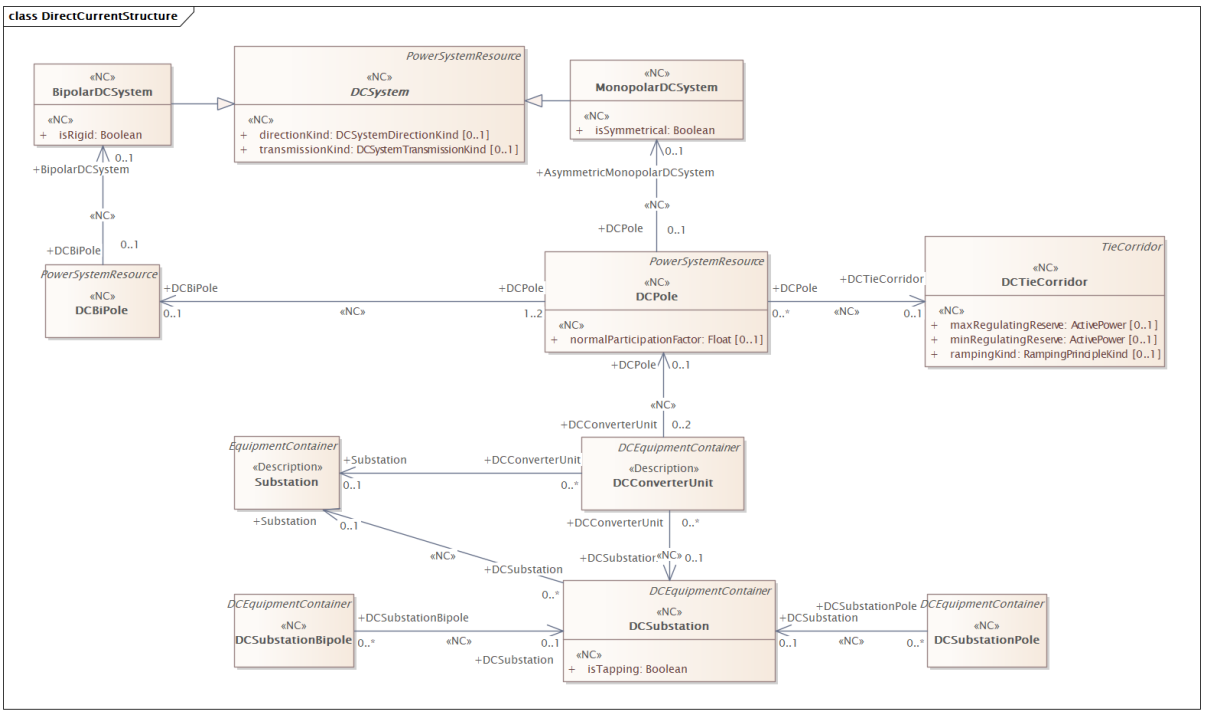


Figure 5 – Class diagram EquipmentReliabilityProfile::DirectCurrentStructure

Figure 5: The diagram contains classes related to direct current structure.

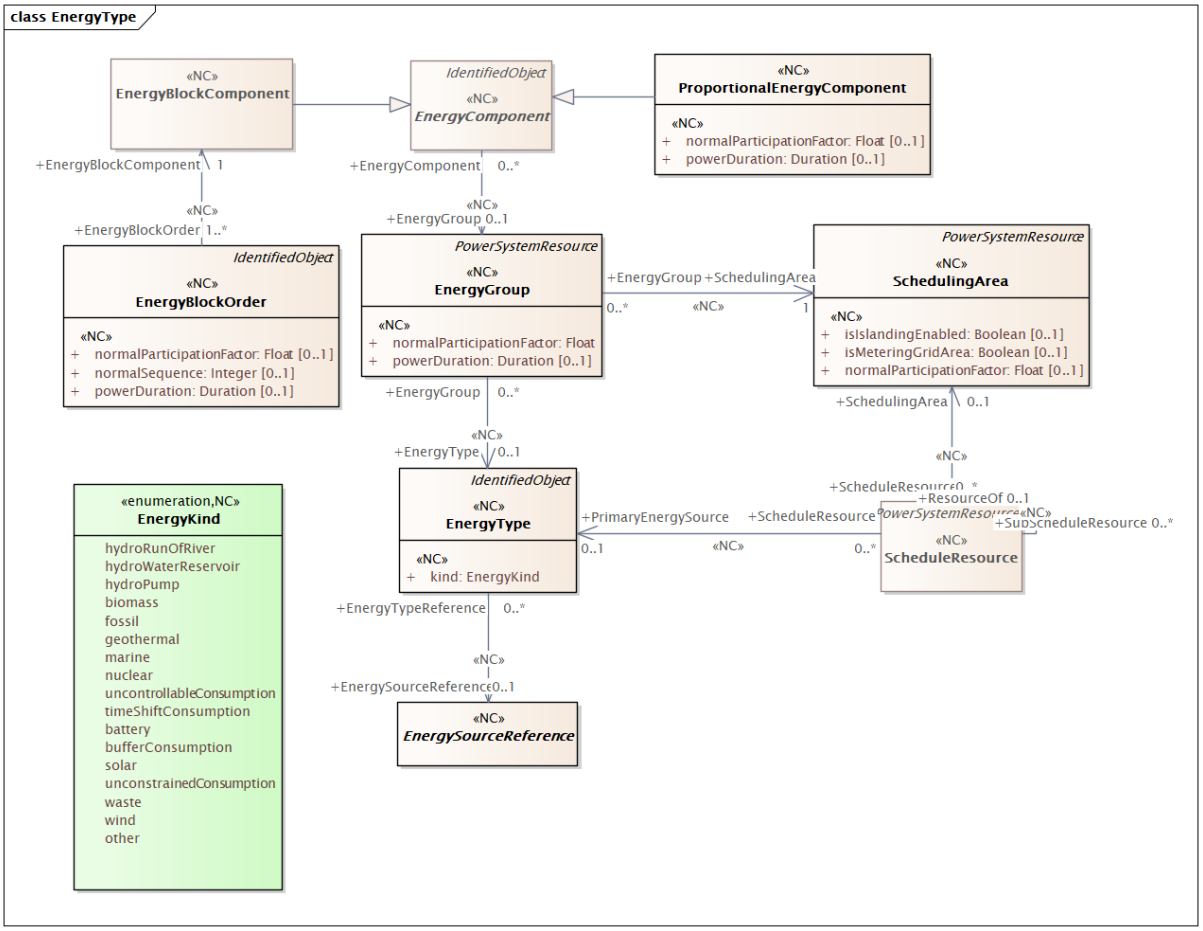


Figure 6 – Class diagram EquipmentReliabilityProfile::EnergyType

Figure 6:

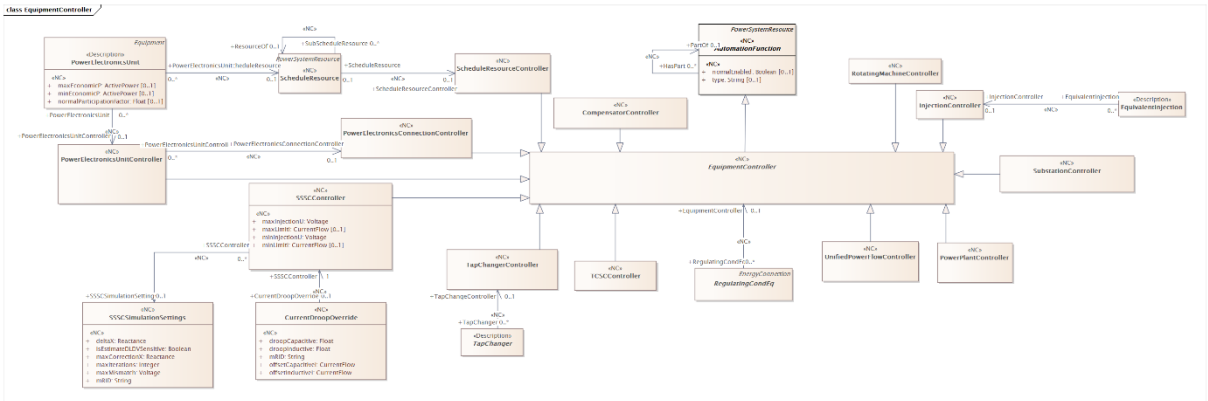


Figure 7 – Class diagram EquipmentReliabilityProfile::EquipmentController

Figure 7: The diagram shows equipment controller related classes.

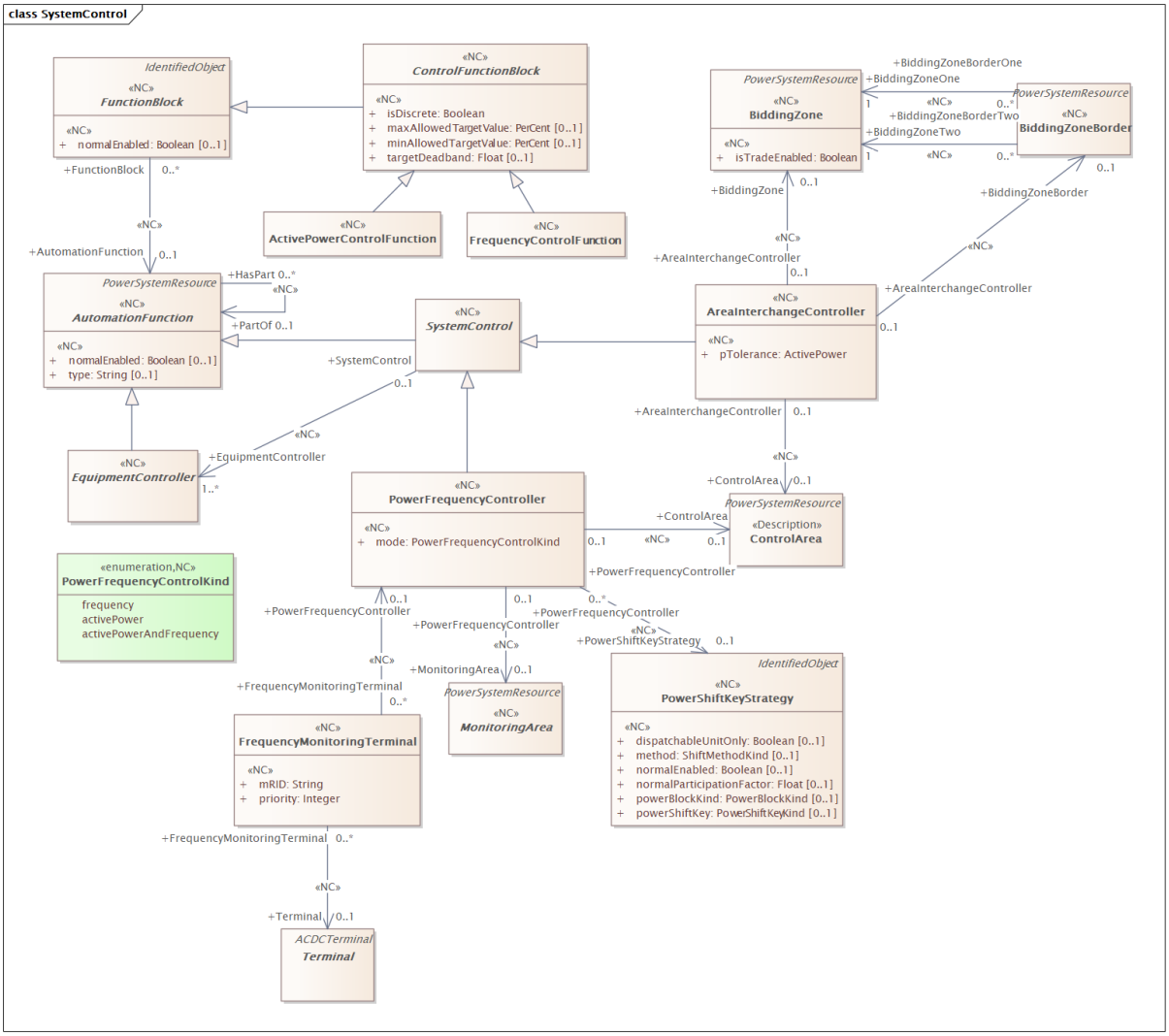


Figure 8 – Class diagram EquipmentReliabilityProfile::SystemControl

Figure 8: The diagram contains classes related to system control.

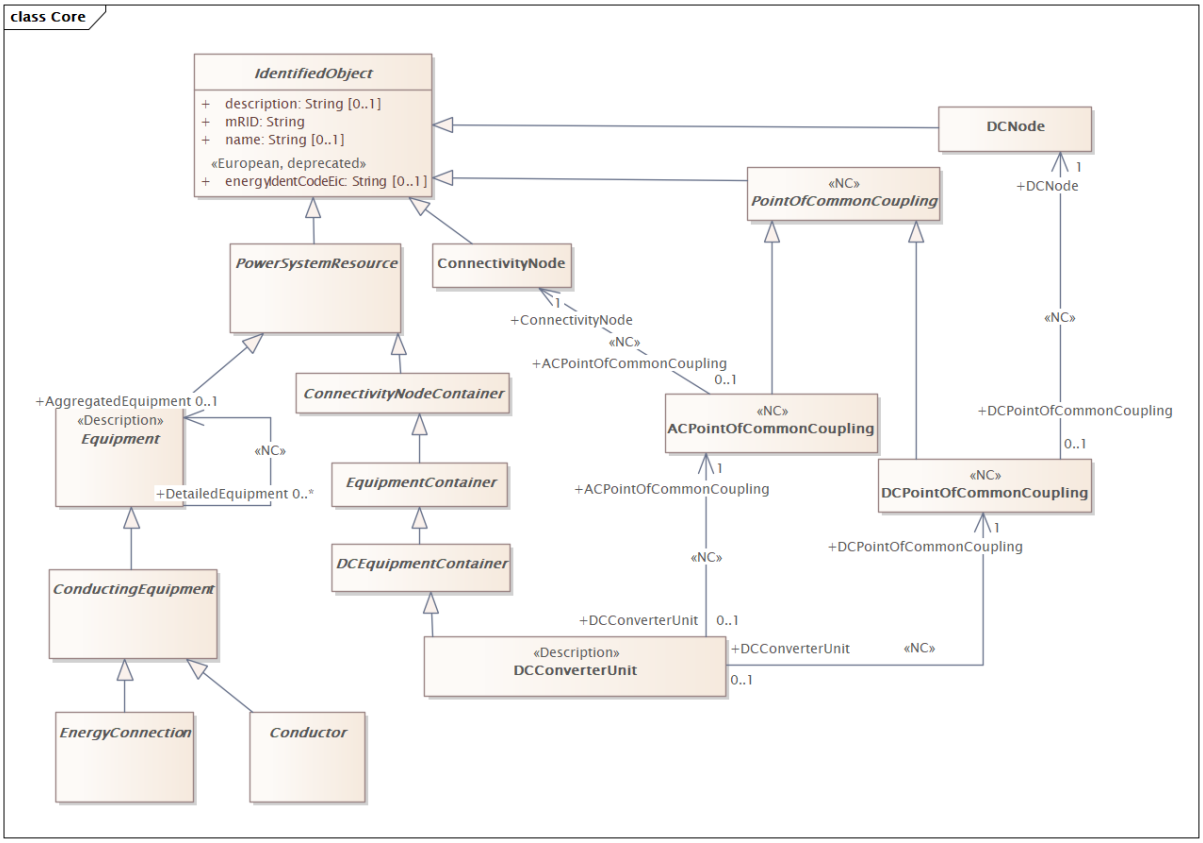
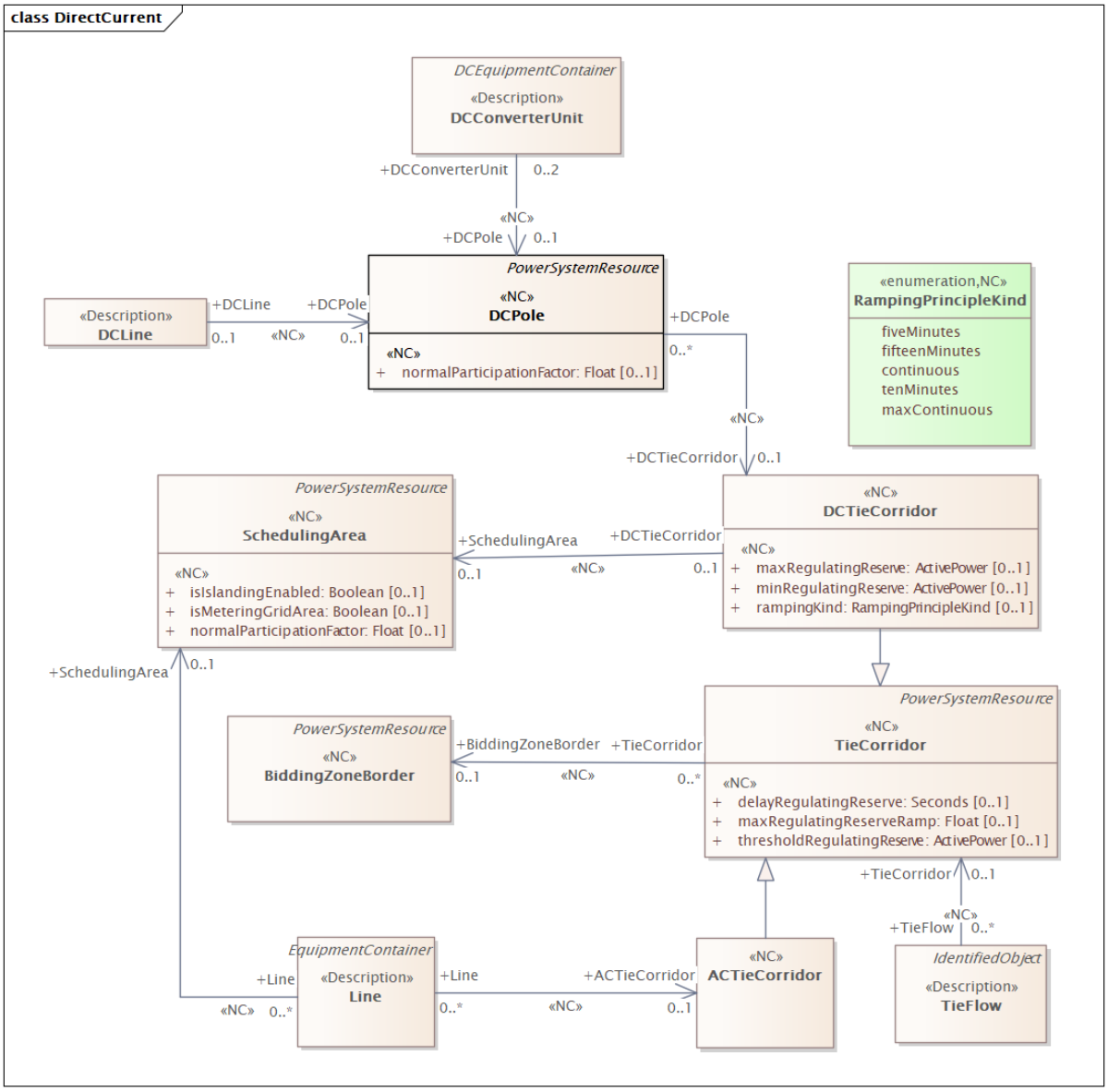


Figure 9 – Class diagram EquipmentReliabilityProfile::Core

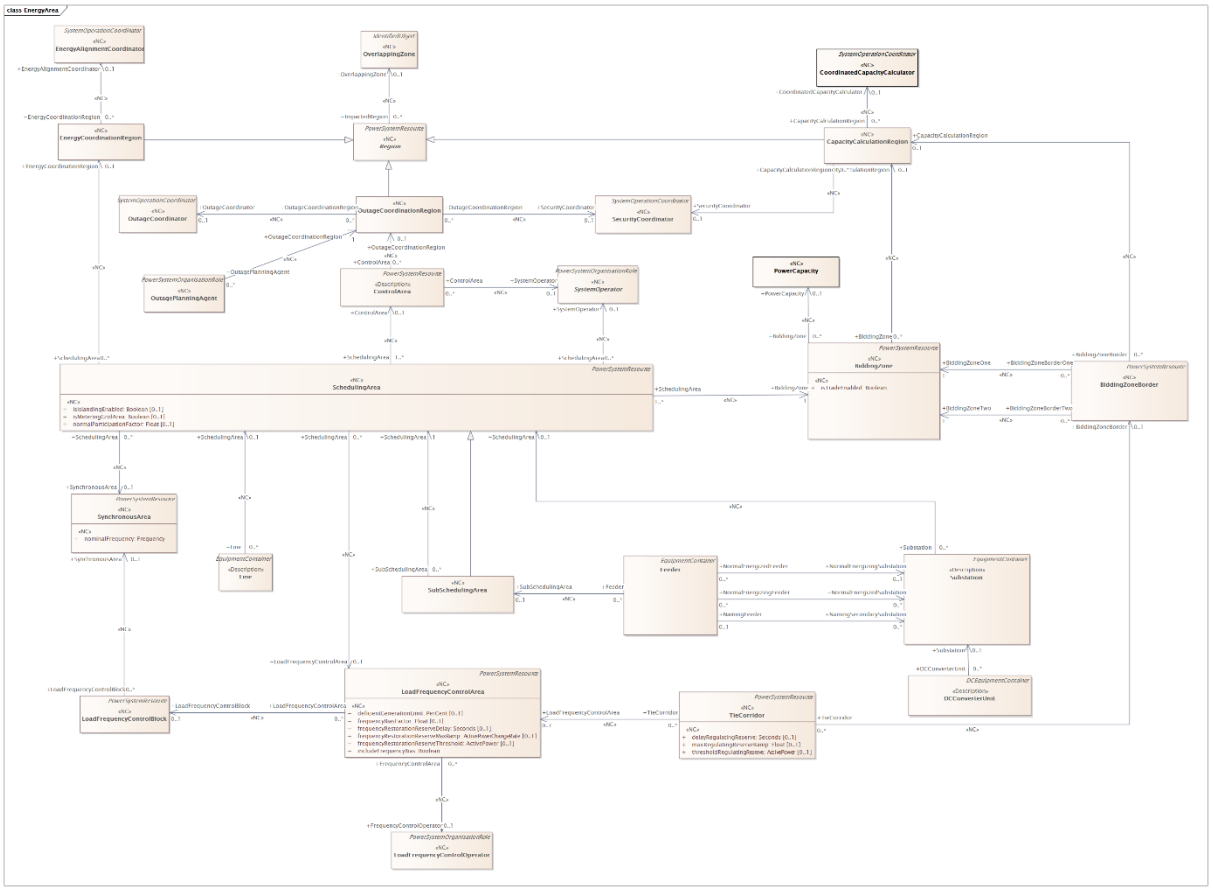
Figure 9: The diagram shows classes from Base CIM used in the profile.



1106

1107 **Figure 10 – Class diagram EquipmentReliabilityProfile::DirectCurrent**

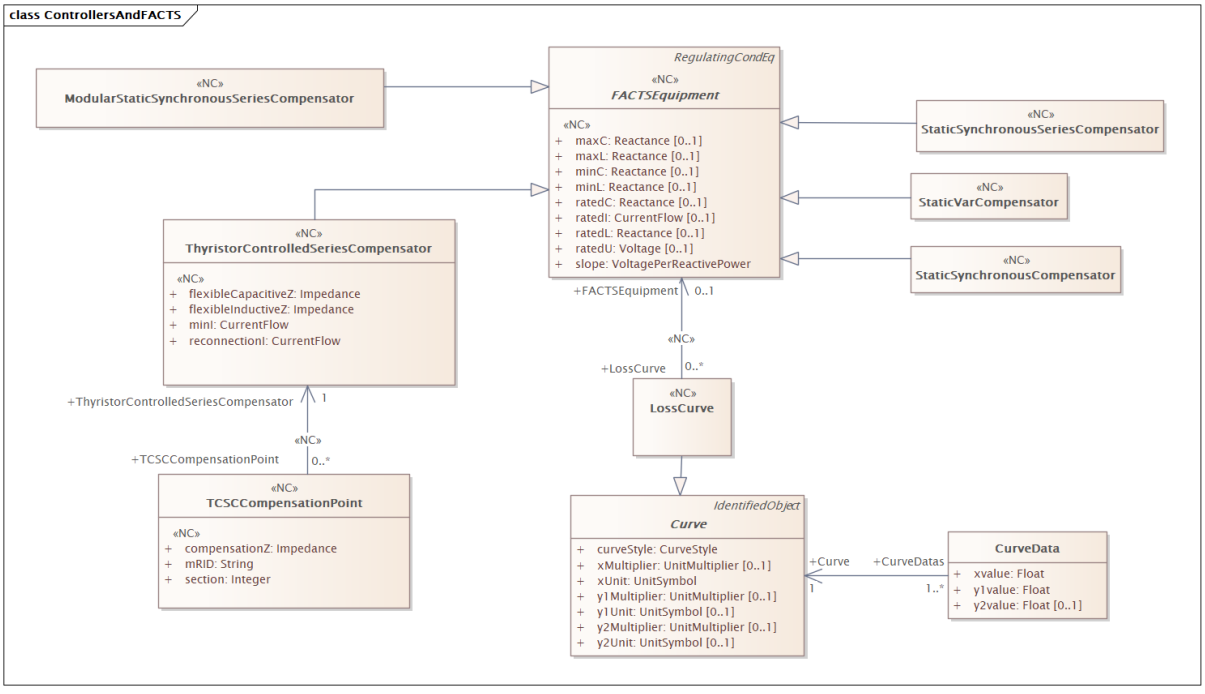
1108 Figure 10: The diagram shows direct current related classes.



1109

1110 **Figure 11 – Class diagram EquipmentReliabilityProfile::EnergyArea**

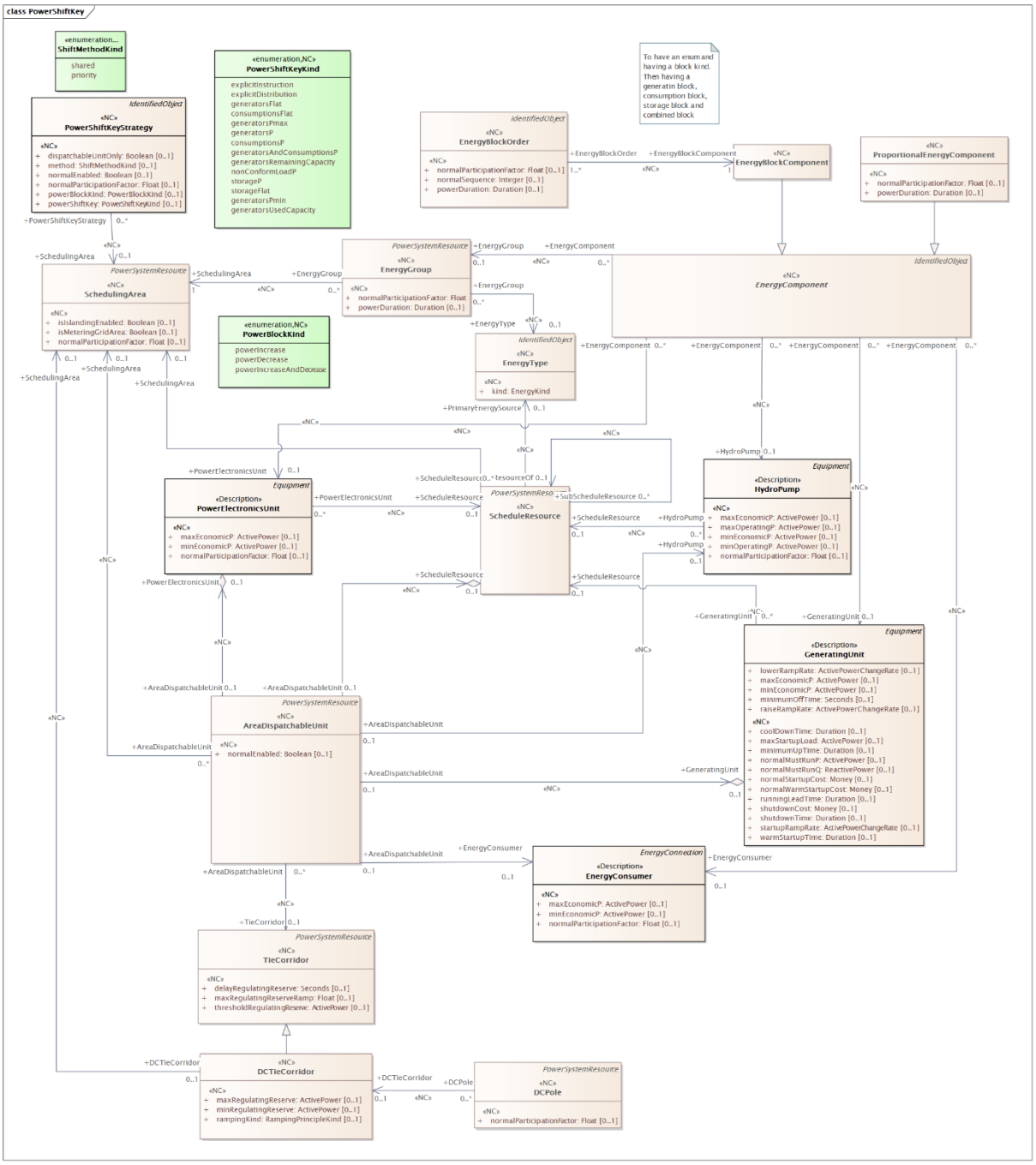
1111 Figure 11:



1112

1113 **Figure 12 – Class diagram EquipmentReliabilityProfile::ControllersAndFACTS**

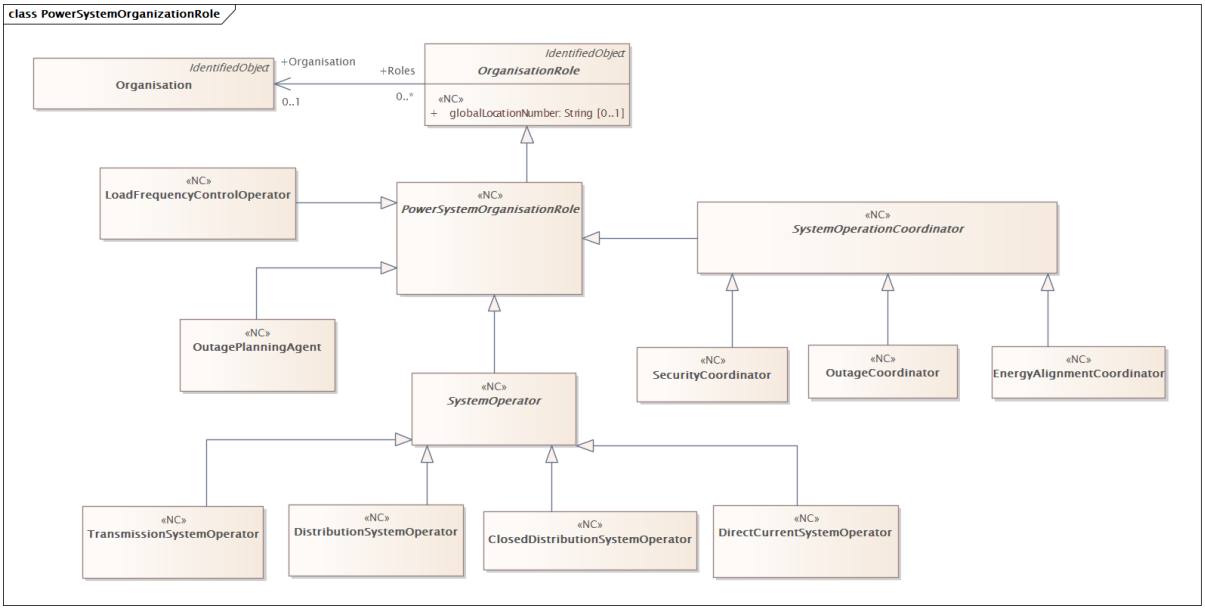
1114 Figure 12: The diagram shows Controllers and FACTS related classes.



1115

1116 **Figure 13 – Class diagram EquipmentReliabilityProfile::PowerShiftKey**

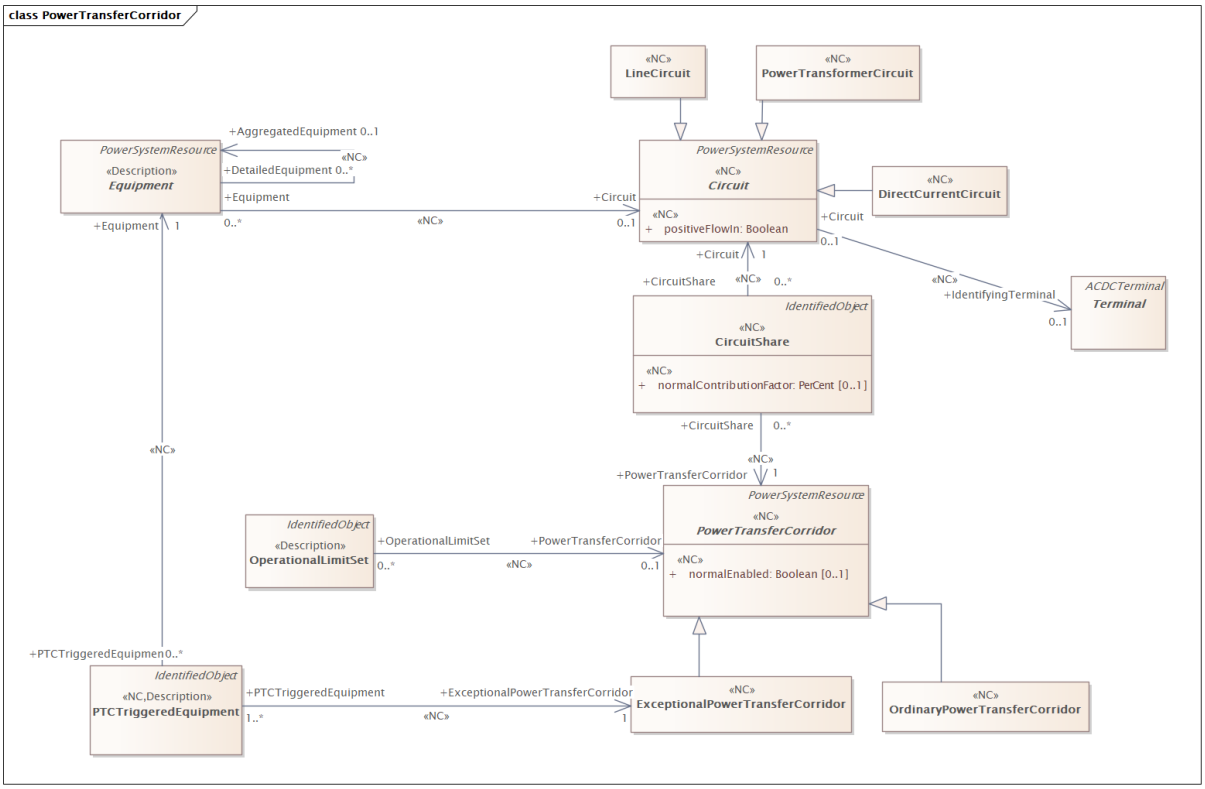
1117 Figure 13: The diagram shows generation and load shift keys related classes.



1118

1119 **Figure 14 – Class diagram EquipmentReliabilityProfile::PowerSystemOrganizationRole**

1120 Figure 14: The diagram shows power system organisation role related classes.



1121

1122 **Figure 15 – Class diagram EquipmentReliabilityProfile::PowerTransferCorridor**

1123 Figure 15: The diagram shows power transfer corridor related classes.

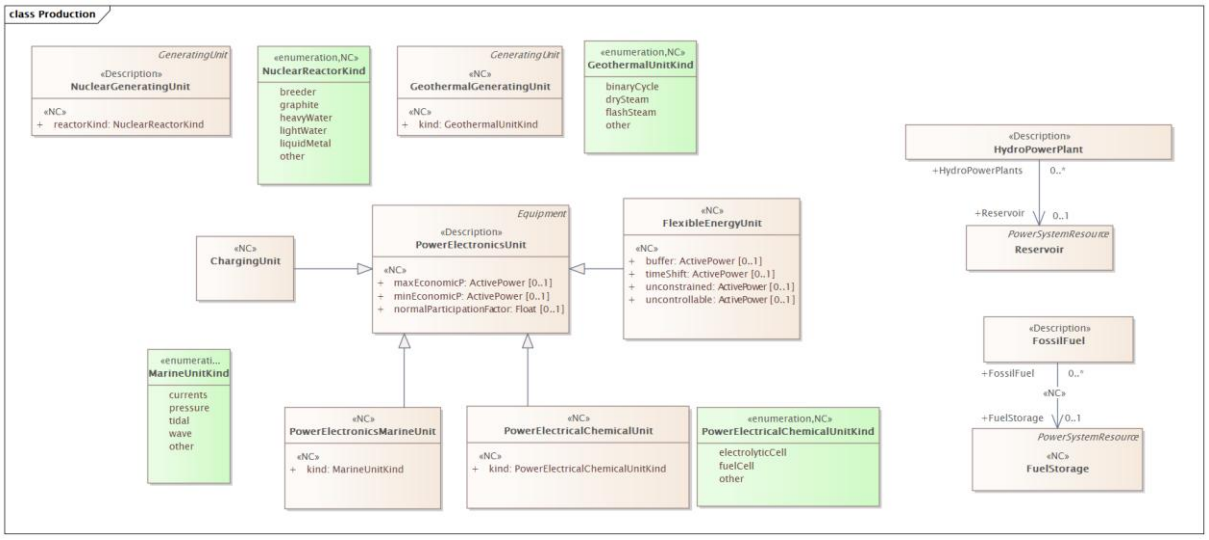


Figure 16 – Class diagram EquipmentReliabilityProfile::Production

Figure 16: The diagram shows production related classes.

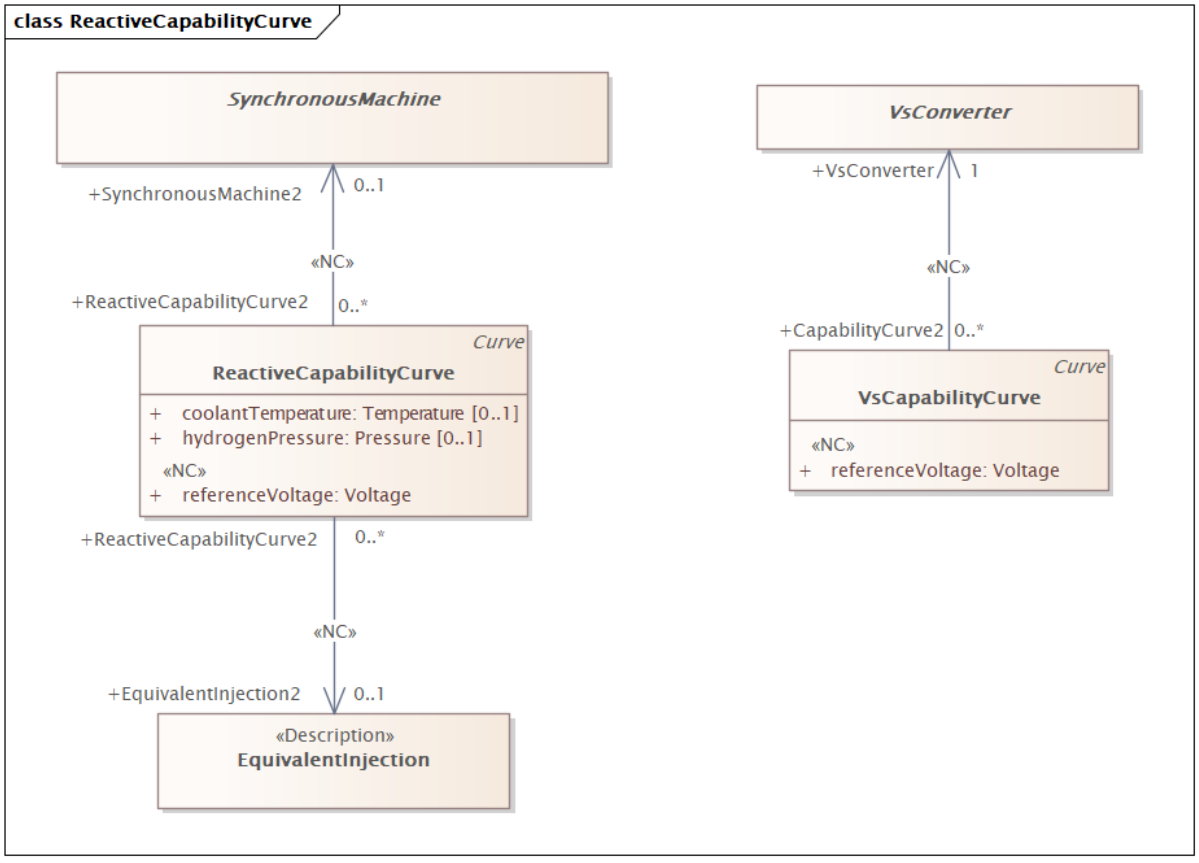


Figure 17 – Class diagram EquipmentReliabilityProfile::ReactiveCapabilityCurve

Figure 17: The diagram shows classes related to reactive capability curve.

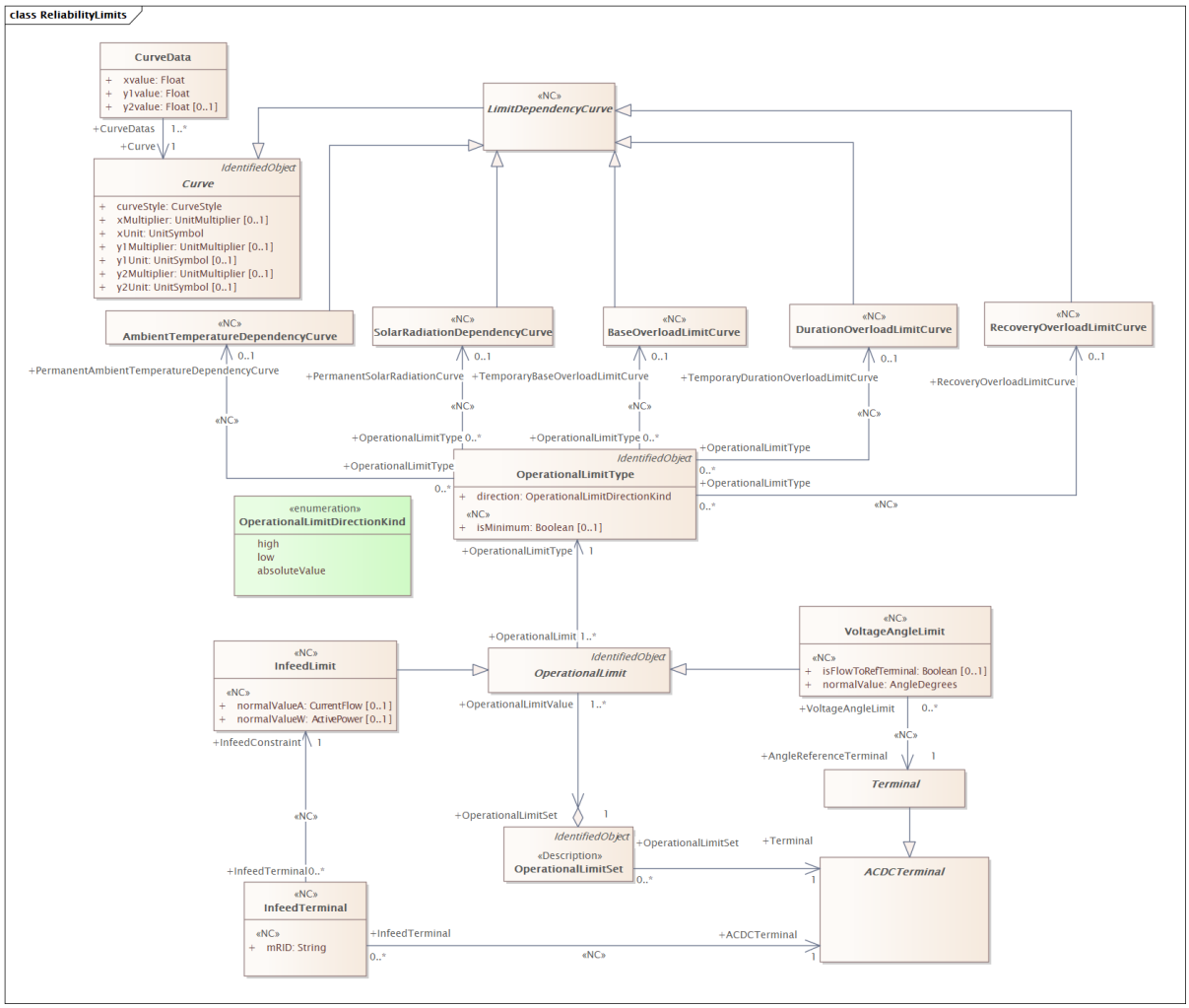


Figure 18 – Class diagram EquipmentReliabilityProfile::ReliabilityLimits

Figure 18: The diagram contains main classes related to the reliability limits.

3.2 (NC) OrdinaryPowerTransferCorridor

Inheritance path = PowerTransferCorridor : PowerSystemResource : IdentifiedObject
Power transfer corridor defined for normal operating network.
Table 1 shows all attributes of OrdinaryPowerTransferCorridor.

Table 1 – Attributes of EquipmentReliabilityProfile::OrdinaryPowerTransferCorridor

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

3.3 Organisation

Inheritance path = IdentifiedObject

Organisation that might have roles as utility, contractor, supplier, manufacturer, customer, etc. Table 2 shows all attributes of Organisation.

Table 2 – Attributes of EquipmentReliabilityProfile::Organisation

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

3.4 (abstract) OrganisationRole

Inheritance path = IdentifiedObject
Identifies a way in which an organisation may participate in the utility enterprise (e.g., customer, manufacturer, etc).
Table 3 shows all attributes of OrganisationRole.

Table 3 – 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.
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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

Table 4 – Association ends of EquipmentReliabilityProfile::OrganisationRole with other classes

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

3.5 (NC) OutageCoordinationRegion

Inheritance path = Region : PowerSystemResource : IdentifiedObject
A region that has a common organisation or service responsible for outage planning and coordination and its impact on grid operation.
Table 5 shows all attributes of OutageCoordinationRegion.

Table 5 – Attributes of EquipmentReliabilityProfile::OutageCoordinationRegion

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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

Table 6 – Association ends of EquipmentReliabilityProfile::OutageCoordinationRegion with other classes

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

3.6 (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 7 shows all attributes of OutageCoordinator.

Table 7 – Attributes of EquipmentReliabilityProfile::OutageCoordinator

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

Table 8 shows all association ends of OutageCoordinator with other classes.

Table 8 – Association ends of EquipmentReliabilityProfile::OutageCoordinator with other classes

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

3.7 (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 9 shows all attributes of OutagePlanningAgent.

Table 9 – Attributes of EquipmentReliabilityProfile::OutagePlanningAgent

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

Table 10 shows all association ends of OutagePlanningAgent with other classes.

Table 10 – Association ends of EquipmentReliabilityProfile::OutagePlanningAgent with other classes

mult from	name	mult to	type	description
0..*	OutageCoordinationRegion	1..1	OutageCoordinationRegion	(NC) Outage coordination region that this agent has outage planning responsible.
0..*	Organisation	0..1	Organisation	inherited from: OrganisationRole

3.8 (NC) PinTerminal

Inheritance path = GateInputPin : FunctionInputVariable : IdentifiedObject

Input pin associated with a Terminal. It is used for comparison.

Table 11 shows all attributes of PinTerminal.

Table 11 – Attributes of EquipmentReliabilityProfile::PinTerminal

name	mult	type	description
kind	1..1	PinTerminalKind	(NC) The kind of quantity which is used as an input value.
absoluteValue	0..1	Boolean	(NC) inherited from: GateInputPin
logicKind	0..1	LogicalOperatorsKind	(NC) inherited from: GateInputPin
duration	0..1	Duration	(NC) inherited from: GateInputPin
negate	0..1	Boolean	(NC) inherited from: GateInputPin
thresholdPercentage	0..1	PerCent	(NC) inherited from: GateInputPin
thresholdValue	0..1	Float	(NC) inherited from: GateInputPin
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 12 shows all association ends of PinTerminal with other classes.

Table 12 – Association ends of EquipmentReliabilityProfile::PinTerminal with other classes

mult from	name	mult to	type	description
0..*	Terminal	1..1	Terminal	(NC) The Terminal that is used in the input pin.
1..*	Function	1..1	FunctionBlock	(NC) inherited from: FunctionInputVariable

3.9 (NC) PowerElectricalChemicalUnit

Inheritance path = PowerElectronicsUnit : Equipment : PowerSystemResource : IdentifiedObject

A unit capable of either generating electrical energy from chemical reactions or using electrical energy to cause chemical reactions.

Table 13 shows all attributes of PowerElectricalChemicalUnit.

Table 13 – Attributes of EquipmentReliabilityProfile::PowerElectricalChemicalUnit

name	mult	type	description
kind	1..1	PowerElectricalChemicalUnitKind	(NC) Kind of power electrical chemical unit.
normalParticipationFactor	0..1	Float	(NC) inherited from: PowerElectronicsUnit
maxEconomicP	0..1	ActivePower	(NC) inherited from: PowerElectronicsUnit
minEconomicP	0..1	ActivePower	(NC) inherited from: PowerElectronicsUnit
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
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 PowerElectricalChemicalUnit with other classes.

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

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

3.10 (NC) PowerElectronicsMarineUnit

Inheritance path = PowerElectronicsUnit : Equipment : PowerSystemResource : IdentifiedObject

A unit that capture energy from marine sources, e.g. waves, for generating electrical power.

Table 15 shows all attributes of PowerElectronicsMarineUnit.

1217 **Table 15 – Attributes of EquipmentReliabilityProfile::PowerElectronicsMarineUnit**

name	mult	type	description
kind	1..1	MarineUnitKind	(NC) Kind of marine unit.
normalParticipationFactor	0..1	Float	(NC) inherited from: PowerElectronicsUnit
maxEconomicP	0..1	ActivePower	(NC) inherited from: PowerElectronicsUnit
minEconomicP	0..1	ActivePower	(NC) inherited from: PowerElectronicsUnit
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

1218
1219 Table 16 shows all association ends of PowerElectronicsMarineUnit with other classes.

1220 **Table 16 – Association ends of**
1221 **EquipmentReliabilityProfile::PowerElectronicsMarineUnit with other classes**

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

1222

1223 ## 3.11 (Description) PowerElectronicsUnit

1224 Inheritance path = Equipment : PowerSystemResource : IdentifiedObject
1225 A generating unit or battery or aggregation that connects to the AC network using power
1226 electronics rather than rotating machines.
1227 Table 17 shows all attributes of PowerElectronicsUnit.

1228 **Table 17 – Attributes of EquipmentReliabilityProfile::PowerElectronicsUnit**

name	mult	type	description
normalParticipationFactor	0..1	Float	(NC) Participation factor describing the entity part of the active power provided by a collection of entities (e.g. an active power forecast to a collection of entities is divided to each of the member entity according to the participation factor). Must be a positive value. In the case of a sharing strategy, the distribution is following entities value (V) equals aggregated value (T) divided by sum of participation factors (PF), i.e. V=T/sum(PF). In the case of priority strategy, the item with the lowest number gets allocated energy first.
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.

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
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 PowerElectronicsUnit with other classes.

Table 18 – 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.
0..*	PowerElectronicsUnitController	0..1	PowerElectronicsUnitController	(NC) Power electronics unit controller for this power electronics unit.
0..*	Circuit	0..1	Circuit	(NC) inherited from: Equipment
0..*	AggregatedEquipment	0..1	Equipment	(NC) inherited from: Equipment

3.12 (NC) PowerFactorControlFunction

Inheritance path = ControlFunctionBlock : FunctionBlock : IdentifiedObject

Power factor control function is a function block that calculates the operating point of the controlled equipment to achieve the target power factor.

Table 19 shows all attributes of PowerFactorControlFunction.

Table 19 – Attributes of EquipmentReliabilityProfile::PowerFactorControlFunction

name	mult	type	description
isDiscrete	1..1	Boolean	(NC) inherited from: ControlFunctionBlock
targetDeadband	0..1	Float	(NC) inherited from: ControlFunctionBlock
maxAllowedTargetValue	0..1	PerCent	(NC) inherited from: ControlFunctionBlock
minAllowedTargetValue	0..1	PerCent	(NC) inherited from: ControlFunctionBlock
normalEnabled	0..1	Boolean	(NC) inherited from: FunctionBlock
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
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 PowerFactorControlFunction with other classes.

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

mult from	name	mult to	type	description
0..*	AutomationFunction	0..1	AutomationFunction	(NC) inherited from: FunctionBlock
1..*	AutomationBlockGroup	0..1	AutomationBlockGroup	(NC) inherited from: FunctionBlock

3.13 (abstract,NC) PowerSystemOrganisationRole

Inheritance path = OrganisationRole : IdentifiedObject

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

Table 21 shows all attributes of PowerSystemOrganisationRole.

Table 21 – Attributes of EquipmentReliabilityProfile::PowerSystemOrganisationRole

name	mult	type	description
globalLocationNumber	0..1	String	(NC) inherited from: OrganisationRole
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
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 PowerSystemOrganisationRole with other classes.

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

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

3.14 (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 23 shows all attributes of PowerSystemResource.

Table 23 – Attributes of EquipmentReliabilityProfile::PowerSystemResource

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

3.15 (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 24 shows all attributes of PowerTransferCorridor.

Table 24 – 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

name	mult	type	description
			power transfer corridor is assessed. False means the power transfer corridor is not assessed.
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

3.16 (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 25 shows all attributes of PowerTransformerCircuit.

Table 25 – Attributes of EquipmentReliabilityProfile::PowerTransformerCircuit

name	mult	type	description
positiveFlowIn	1..1	Boolean	(NC) inherited from: Circuit
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 26 shows all association ends of PowerTransformerCircuit with other classes.

Table 26 – Association ends of EquipmentReliabilityProfile::PowerTransformerCircuit with other classes

mult from	name	mult to	type	description
0..1	IdentifyingTerminal	0..1	Terminal	(NC) inherited from: Circuit

3.17 (abstract,NC) PropertyReference root class

The reference to a class and one of its properties.

3.18 (NC) ProportionalEnergyComponent

Inheritance path = EnergyComponent : IdentifiedObject
Serves for grouping components within an energy group, with proportional energy allocation to all components.
Table 27 shows all attributes of ProportionalEnergyComponent.

Table 27 – Attributes of EquipmentReliabilityProfile::ProportionalEnergyComponent

name	mult	type	description
normalParticipationFactor	0..1	Float	(NC) Normal participation factor.
powerDuration	0..1	Duration	(NC) Duration for the active power.
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject

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 28 shows all association ends of ProportionalEnergyComponent with other classes.

Table 28 – Association ends of EquipmentReliabilityProfile::ProportionalEnergyComponent with other classes

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

3.19 (NC,Description) PTCTriggeredEquipment

Inheritance path = IdentifiedObject

Power Transfer Corridor triggered equipment connects the equipment that will create the exceptional power transfer corridor when taking out of service. e.g. A system with three lines gets an exceptional power transfer corridor when one of the lines is taken out of service.

Table 29 shows all attributes of PTCTriggeredEquipment.

Table 29 – Attributes of EquipmentReliabilityProfile::PTCTriggeredEquipment

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 30 shows all association ends of PTCTriggeredEquipment with other classes.

Table 30 – Association ends of EquipmentReliabilityProfile::PTCTriggeredEquipment with other classes

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

3.20 (NC) ReactivePowerControlFunction

Inheritance path = ControlFunctionBlock : FunctionBlock : IdentifiedObject

Reactive power control function is a function block that calculate the operating point of the controlled equipment to achieve the target reactive power.

Table 31 shows all attributes of ReactivePowerControlFunction.

1313 **Table 31 – Attributes of EquipmentReliabilityProfile::ReactivePowerControlFunction**

name	mult	type	description
isDiscrete	1..1	Boolean	(NC) inherited from: ControlFunctionBlock
targetDeadband	0..1	Float	(NC) inherited from: ControlFunctionBlock
maxAllowedTargetValue	0..1	PerCent	(NC) inherited from: ControlFunctionBlock
minAllowedTargetValue	0..1	PerCent	(NC) inherited from: ControlFunctionBlock
normalEnabled	0..1	Boolean	(NC) inherited from: FunctionBlock
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

1314
1315 Table 32 shows all association ends of ReactivePowerControlFunction with other classes.

1316 **Table 32 – Association ends of**
1317 **EquipmentReliabilityProfile::ReactivePowerControlFunction with other classes**

mult from	name	mult to	type	description
0..*	AutomationFunction	0..1	AutomationFunction	(NC) inherited from: FunctionBlock
1..*	AutomationBlockGroup	0..1	AutomationBlockGroup	(NC) inherited from: FunctionBlock

1318

1319 ### 3.21 (NC) RecoveryOverloadLimitCurve

1320 Inheritance path = LimitDependencyCurve : Curve : IdentifiedObject
1321 The relation between the recovery time and an overload limit.
1322 Table 33 shows all attributes of RecoveryOverloadLimitCurve.

1323 **Table 33 – 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
y2Multiplier	0..1	UnitMultiplier	inherited from: Curve
y2Unit	0..1	UnitSymbol	inherited from: Curve
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

1324

1325 ### 3.22 (abstract,NC) Region

1326 Inheritance path = PowerSystemResource : IdentifiedObject
1327 A region where the system operator belongs to.

Table 34 shows all attributes of Region.

Table 34 – Attributes of EquipmentReliabilityProfile::Region

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 35 shows all association ends of Region with other classes.

Table 35 – Association ends of EquipmentReliabilityProfile::Region with other classes

mult from	name	mult to	type	description
0..*	OverlappingZone	0..1	OverlappingZone	(NC) The overlapping zone which is impacted by this region.

3.23 (abstract) RegulatingCondEq

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

A type of conducting equipment that can regulate a quantity (i.e. voltage or flow) at a specific point in the network.

Table 36 shows all attributes of RegulatingCondEq.

Table 36 – Attributes of EquipmentReliabilityProfile::RegulatingCondEq

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 37 shows all association ends of RegulatingCondEq with other classes.

Table 37 – Association ends of EquipmentReliabilityProfile::RegulatingCondEq with other classes

mult from	name	mult to	type	description
0..*	EquipmentController	0..1	EquipmentController	(NC) The equipment controller for this regulating conducting equipment.
0..*	Circuit	0..1	Circuit	(NC) inherited from: Equipment
0..*	AggregatedEquipment	0..1	Equipment	(NC) inherited from: Equipment

3.24 (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 38 shows all attributes of ScheduleResource.

Table 38 – Attributes of EquipmentReliabilityProfile::ScheduleResource

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 39 shows all association ends of ScheduleResource with other classes.

Table 39 – 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..*	PrimaryEnergySource	0..1	EnergyType	(NC) Primary energy reference type for this schedule resource.
0..*	ResourceOf	0..1	ScheduleResource	(NC) The schedule resource that has this subschedule resource.
0..1	ScheduleResourceController	0..1	ScheduleResourceController	(NC) Schedule resource controller for this schedule resource.

3.25 (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 40 shows all attributes of SchedulingArea.

Table 40 – 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.
normalParticipationFactor	0..1	Float	(NC) Normal participation factor describing the entity part of the active power provided by a collection of entities (e.g. an active power forecast to a collection of entities is divided to each of the member entity according to the participation factor). Must be a positive value.

name	mult	type	description
			In the case of a sharing strategy, the distribution is following entities value (V) equals aggregated value (T) divided by sum of participation factors (PF), i.e. V=T/sum(PF). In the case of priority strategy, the item with the lowest number gets allocated energy first.
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 41 shows all association ends of SchedulingArea with other classes.

Table 41 – Association ends of EquipmentReliabilityProfile::SchedulingArea with other classes

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

3.26 (abstract) ACDCTerminal root class

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

3.27 (NC) ActivePowerControlFunction

Inheritance path = ControlFunctionBlock : FunctionBlock : IdentifiedObject
Active power control function is a function block that calculates operating point of the controlled equipment to achieve the target active power.
Table 42 shows all attributes of ActivePowerControlFunction.

Table 42 – Attributes of EquipmentReliabilityProfile::ActivePowerControlFunction

name	mult	type	description
isDiscrete	1..1	Boolean	(NC) inherited from: ControlFunctionBlock
targetDeadband	0..1	Float	(NC) inherited from: ControlFunctionBlock
maxAllowedTargetValue	0..1	PerCent	(NC) inherited from: ControlFunctionBlock
minAllowedTargetValue	0..1	PerCent	(NC) inherited from: ControlFunctionBlock
normalEnabled	0..1	Boolean	(NC) inherited from: FunctionBlock
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject

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 43 shows all association ends of ActivePowerControlFunction with other classes.

Table 43 – Association ends of EquipmentReliabilityProfile::ActivePowerControlFunction with other classes

mult from	name	mult to	type	description
0..*	AutomationFunction	0..1	AutomationFunction	(NC) inherited from: FunctionBlock
1..*	AutomationBlockGroup	0..1	AutomationBlockGroup	(NC) inherited from: FunctionBlock

3.28 (NC) AmbientTemperatureDependencyCurve

Inheritance path = LimitDependencyCurve : Curve : IdentifiedObject

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

Table 44 shows all attributes of AmbientTemperatureDependencyCurve.

Table 44 – 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
y2Multiplier	0..1	UnitMultiplier	inherited from: Curve
y2Unit	0..1	UnitSymbol	inherited from: Curve
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

3.29 (NC) AreaDispatchableUnit

Inheritance path = PowerSystemResource : IdentifiedObject

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 45 shows all attributes of AreaDispatchableUnit.

Table 45 – 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,

name	mult	type	description
			the unit has the capability, but it is not enabled to receive a dispatch instruction.
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
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 AreaDispatchableUnit with other classes.

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

mult from	name	mult to	type	description
0..1	PowerElectronicsUnit	0..1	PowerElectronicsUnit	(NC) The power electronics unit that belongs to this area dispatchable unit.
0..1	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	0..1	SchedulingArea	(NC) The scheduling area that has this area dispatchable unit.
0..1	GeneratingUnit	0..1	GeneratingUnit	(NC) The generating unit that belongs to area dispatchable unit.
0..1	EnergyConsumer	0..1	EnergyConsumer	Energy consumer for this area dispatchable unit.
0..1	HydroPump	0..1	HydroPump	(NC) Hydro Pump which is associated with the area dispatchable unit.
0..*	TieCorridor	0..1	TieCorridor	(NC) Tie Corridor which belongs to the Area Dispatchable Unit.

3.30 (abstract,NC) AutomationFunction

Inheritance path = PowerSystemResource : IdentifiedObject
Automation function is a collection of functional block or other automation function that can be executed as a work cycle program as part of an automated system.
Table 47 shows all attributes of AutomationFunction.

Table 47 – Attributes of EquipmentReliabilityProfile::AutomationFunction

name	mult	type	description
type	0..1	String	(NC) Type of automation function.
normalEnabled	0..1	Boolean	(NC) True, if the automation function is enabled (active). Otherwise false.
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
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 AutomationFunction with other classes.

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

mult from	name	mult to	type	description
0..*	PartOf	0..1	AutomationFunction	(NC) Automation function is part of this automation function.

3.31 (NC) BaseOverloadLimitCurve

Inheritance path = LimitDependencyCurve : Curve : IdentifiedObject

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 49 shows all attributes of BaseOverloadLimitCurve.

Table 49 – 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
y2Multiplier	0..1	UnitMultiplier	inherited from: Curve
y2Unit	0..1	UnitSymbol	inherited from: Curve
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

3.32 (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 50 shows all attributes of BiddingZone.

Table 50 – Attributes of EquipmentReliabilityProfile::BiddingZone

name	mult	type	description
isTradeEnabled	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.
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
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 51 shows all association ends of BiddingZone with other classes.

Table 51 – 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.
0..*	PowerCapacity	0..1	PowerCapacity	(NC) Power capacity whidh is asocciated to the bidding zone.

3.33 (NC) BiddingZoneBorder

Inheritance path = PowerSystemResource : IdentifiedObject
Defines the aggregated connection capacity between two Bidding Zones.
Table 52 shows all attributes of BiddingZoneBorder.

Table 52 – Attributes of EquipmentReliabilityProfile::BiddingZoneBorder

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
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 BiddingZoneBorder with other classes.

Table 53 – 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.
0..*	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.

3.34 (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 54 shows all attributes of CapacityCalculationRegion.

Table 54 – Attributes of EquipmentReliabilityProfile::CapacityCalculationRegion

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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

Table 55 – 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.
0..*	CoordinatedCapacityCalculator	0..1	CoordinatedCapacityCalculator	(NC) Coordinated capacity calculator responsible for the capacity calculation of the region.
0..*	OverlappingZone	0..1	OverlappingZone	(NC) inherited from: Region

3.35 (NC) ChargingUnit

Inheritance path = PowerElectronicsUnit : Equipment : PowerSystemResource : IdentifiedObject

A unit that supplies electrical power for charging electrical non-stationary entities, e.g. electrical vehicle, trucks, buses, ferries, boats and airplanes. The characteristic is that the energy consumption is highly schedule dependent.

Table 56 shows all attributes of ChargingUnit.

Table 56 – Attributes of EquipmentReliabilityProfile::ChargingUnit

name	mult	type	description
normalParticipationFactor	0..1	Float	(NC) inherited from: PowerElectronicsUnit
maxEconomicP	0..1	ActivePower	(NC) inherited from: PowerElectronicsUnit
minEconomicP	0..1	ActivePower	(NC) inherited from: PowerElectronicsUnit
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
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 ChargingUnit with other classes.

Table 57 – Association ends of EquipmentReliabilityProfile::ChargingUnit with other classes

mult from	name	mult to	type	description
0..*	ScheduleResource	0..1	ScheduleResource	(NC) inherited from: PowerElectronicsUnit

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

3.36 (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 58 shows all attributes of Circuit.

Table 58 – Attributes of EquipmentReliabilityProfile::Circuit

name	mult	type	description
positiveFlowIn	1..1	Boolean	(NC) True, if the positive value on the terminal shall be considered flow into the circuit. False, if the positive value on the terminal shall be considered flow out of the circuit.
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 59 shows all association ends of Circuit with other classes.

Table 59 – Association ends of EquipmentReliabilityProfile::Circuit with other classes

mult from	name	mult to	type	description
0..1	IdentifyingTerminal	0..1	Terminal	(NC) Terminal that identifies the circuit.

3.37 (NC) CircuitShare

Inheritance path = IdentifiedObject

Defines the share of the circuit which is part of an associated power transfer corridor.

Table 60 shows all attributes of CircuitShare.

Table 60 – 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. The allowed value range is [0,100].
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 61 shows all association ends of CircuitShare with other classes.

Table 61 – Association ends of EquipmentReliabilityProfile::CircuitShare with other classes

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

3.38 (NC) ClosedDistributionSystemOperator

Inheritance path = SystemOperator : PowerSystemOrganisationRole : OrganisationRole : IdentifiedObject

A system operator which distributes electricity (or gas) within a geographically confined industrial, commercial or shared services and does not supply household customers.

Table 62 shows all attributes of ClosedDistributionSystemOperator.

Table 62 – Attributes of EquipmentReliabilityProfile::ClosedDistributionSystemOperator

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

Table 63 shows all association ends of ClosedDistributionSystemOperator with other classes.

Table 63 – Association ends of EquipmentReliabilityProfile::ClosedDistributionSystemOperator with other classes

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

3.39 (NC) CompensatorController

Inheritance path = EquipmentController : AutomationFunction : PowerSystemResource : IdentifiedObject

Compensator controller is controlling the equipment to optimize the use of the compensators.

Table 64 shows all attributes of CompensatorController.

Table 64 – Attributes of EquipmentReliabilityProfile::CompensatorController

name	mult	type	description
type	0..1	String	(NC) inherited from: AutomationFunction
normalEnabled	0..1	Boolean	(NC) inherited from: AutomationFunction
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
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 65 shows all association ends of CompensatorController with other classes.

Table 65 – Association ends of EquipmentReliabilityProfile::CompensatorController with other classes

mult from	name	mult to	type	description
0..*	PartOf	0..1	AutomationFunction	(NC) inherited from: AutomationFunction

3.40 (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 66 shows all attributes of ConductingEquipment.

Table 66 – Attributes of EquipmentReliabilityProfile::ConductingEquipment

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 67 shows all association ends of ConductingEquipment with other classes.

Table 67 – Association ends of EquipmentReliabilityProfile::ConductingEquipment with other classes

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

3.41 (abstract) ConnectivityNodeContainer

Inheritance path = PowerSystemResource : IdentifiedObject
A base class for all objects that may contain connectivity nodes or topological nodes.
Table 68 shows all attributes of ConnectivityNodeContainer.

Table 68 – Attributes of EquipmentReliabilityProfile::ConnectivityNodeContainer

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

3.42 (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 69 shows all attributes of ControlArea.

Table 69 – Attributes of EquipmentReliabilityProfile::ControlArea

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 70 shows all association ends of ControlArea with other classes.

Table 70 – 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.
0..*	SystemOperator	0..1	SystemOperator	(NC) The system operator that operates this control area.

3.43 (abstract,NC) ControlFunctionBlock

Inheritance path = FunctionBlock : IdentifiedObject

Control function block is a function block that contains an algorithm for controlling the equipment.

Table 71 shows all attributes of ControlFunctionBlock.

1573 **Table 71 – Attributes of EquipmentReliabilityProfile::ControlFunctionBlock**

name	mult	type	description
isDiscrete	1..1	Boolean	(NC) True, if the control function is discrete. This applies to equipment with discrete controls, e.g. tap changers and shunt compensators.
targetDeadband	0..1	Float	(NC) Target deadband is used with discrete control to avoid excessive update of controls like tap changers and shunt compensator banks while regulating. The attribute shall be a positive value or zero. If isDiscrete is set to "false", the targetDeadband is to be ignored. Note that for instance, if the targetValue is 100 kV and the targetDeadband is 2 kV the range is from 99 to 101 kV.
maxAllowedTargetValue	0..1	PerCent	(NC) Maximum allowed target value given by the percent of target value. The allowed value range is [0,100].
minAllowedTargetValue	0..1	PerCent	(NC) Minimum allowed target value given by the percent of target value. The allowed value range is [0,100].
normalEnabled	0..1	Boolean	(NC) inherited from: FunctionBlock
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

1574
1575 Table 72 shows all association ends of ControlFunctionBlock with other classes.

1576 **Table 72 – Association ends of EquipmentReliabilityProfile::ControlFunctionBlock with**
1577 **other classes**

mult from	name	mult to	type	description
0..*	AutomationFunction	0..1	AutomationFunction	(NC) inherited from: FunctionBlock
1..*	AutomationBlockGroup	0..1	AutomationBlockGroup	(NC) inherited from: FunctionBlock

1578

1579 ## 3.44 (abstract) Curve

1580 Inheritance path = IdentifiedObject
1581 A multi-purpose curve or functional relationship between an independent variable (X-axis) and
1582 dependent (Y-axis) variables.
1583 Table 73 shows all attributes of Curve.

1584 **Table 73 – 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.
y2Multiplier	0..1	UnitMultiplier	Multiplier for Y2-axis.

name	mult	type	description
y2Unit	0..1	UnitSymbol	The Y2-axis units of measure.
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

3.45 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 74 shows all attributes of CurveData.

Table 74 – 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.
y2value	0..1	Float	The data value of the second Y-axis variable (if present), depending on the Y-axis units.

Table 75 shows all association ends of CurveData with other classes.

Table 75 – Association ends of EquipmentReliabilityProfile::CurveData with other classes

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

3.46 (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 76 shows all attributes of DCConverterUnit.

Table 76 – Attributes of EquipmentReliabilityProfile::DCConverterUnit

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 77 shows all association ends of DCConverterUnit with other classes.

Table 77 – Association ends of EquipmentReliabilityProfile::DCConverterUnit with other classes

mult from	name	mult to	type	description
0..2	DCPole	0..1	DCPole	(NC) The DC pole that has this DC converter unit.
0..*	Substation	0..1	Substation	The containing substation of the DC converter unit.
0..*	DCSubstation	0..1	DCSubstation	(NC) DC substation that has one or more DC converter units.
0..1	ACPointOfCommonCoupling	1..1	ACPointOfCommonCoupling	(NC) AC point of common coupling for this DC converter unit.
0..1	DCPointOfCommonCoupling	1..1	DCPointOfCommonCoupling	(NC) DCNode that is the point of common coupling at DC side of this DCConverterUnit.

3.47 (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 78 shows all attributes of DCEquipmentContainer.

Table 78 – Attributes of EquipmentReliabilityProfile::DCEquipmentContainer

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

3.48 (Description) DCLine root class

Overhead lines and/or cables connecting two or more HVDC substations.

Table 79 shows all association ends of DCLine with other classes.

Table 79 – Association ends of EquipmentReliabilityProfile::DCLine with other classes

mult from	name	mult to	type	description
0..1	DCPole	0..1	DCPole	(NC) The DC pole that has this DC line.

3.49 (NC) DCPole

Inheritance path = PowerSystemResource : IdentifiedObject

The direct current (DC) system pole (IEC 60633) is part of a DC system consisting of all the equipment in the DC substations and the interconnecting transmission lines, if any, which during normal operation exhibit a common direct voltage polarity with respect to earth.

Table 80 shows all attributes of DCPole.

1631 **Table 80 – Attributes of EquipmentReliabilityProfile::DCPole**

name	mult	type	description
normalParticipationFactor	0..1	Float	(NC) Normal participation factor describing the entity part of the active power provided by a collection of entities (e.g. an active power forecast to a collection of entities is divided to each of the member entity according to the participation factor). Must be a positive value. In the case of a sharing strategy, the distribution is following entities value (V) equals aggregated value (T) divided by sum of participation factors (PF), i.e. V=T/sum(PF). In the case of priority strategy, the item with the lowest number gets allocated energy first.
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

1632
1633 Table 81 shows all association ends of DCPole with other classes.

1634 **Table 81 – Association ends of EquipmentReliabilityProfile::DCPole with other classes**

mult from	name	mult to	type	description
0..*	DCTieCorridor	0..1	DCTieCorridor	(NC) The DCTieCorridor that has this DC pole.
1..2	DCBiPole	0..1	DCBiPole	(NC) DC system bipole that has two independently operatable DC system poles.
0..1	AsymmetricMonopolarDCSystem	0..1	MonopolarDCSystem	(NC) Asymmetric monopolar DC system that has this DC pole.

1635

1636 ### 3.50 (NC) DCTieCorridor

1637 Inheritance path = TieCorridor : PowerSystemResource : IdentifiedObject
1638 A collection of one or more direct current poles that connect two different control areas.
1639 Table 82 shows all attributes of DCTieCorridor.

1640 **Table 82 – Attributes of EquipmentReliabilityProfile::DCTieCorridor**

name	mult	type	description
maxRegulatingReserve	0..1	ActivePower	(NC) Maximum regulating reserve.
minRegulatingReserve	0..1	ActivePower	(NC) Minimum regulating reserve.
rampingKind	0..1	RampingPrincipleKind	(NC) Ramping principle is used to define a transition from one scheduled value to next one.
delayRegulatingReserve	0..1	Seconds	(NC) inherited from: TieCorridor
maxRegulatingReserveRamp	0..1	Float	(NC) inherited from: TieCorridor
thresholdRegulatingReserve	0..1	ActivePower	(NC) inherited from: TieCorridor
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
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 83 shows all association ends of DCTieCorridor with other classes.

Table 83 – Association ends of EquipmentReliabilityProfile::DCTieCorridor with other classes

mult from	name	mult to	type	description
0..1	SchedulingArea	0..1	SchedulingArea	(NC) The scheduling area that has this DC tie corridor.
0..*	LoadFrequencyControlArea	0..1	LoadFrequencyControlArea	(NC) inherited from: TieCorridor
0..*	BiddingZoneBorder	0..1	BiddingZoneBorder	(NC) inherited from: TieCorridor

3.51 (NC) DirectCurrentMasterController

Inheritance path = DirectCurrentEquipmentController : EquipmentController : AutomationFunction : PowerSystemResource : IdentifiedObject

Direct current system control is a control system which governs the operation of an entire DC system consisting of more than one DC substation and performs those functions of controlling, monitoring and protection which require information from more than one substation. This can also be a multiterminal control which is a DC system control for more that two DC substations or a DC master control, which is a general concept for control coordination of a DC system. The DC master control may be implemented at the bipole and/or pole level as defined in IEC 60633. The DC system control/multiterminal control/master control is part of the hierarchical structure of an HVDC control system that has an integrated AC/DC system control as the highest level of control which governs the integrated operation of AC and DC systems of a power system. This control system is under the responsibility of the system operator.

Table 84 shows all attributes of DirectCurrentMasterController.

Table 84 – Attributes of EquipmentReliabilityProfile::DirectCurrentMasterController

name	mult	type	description
type	0..1	String	(NC) inherited from: AutomationFunction
normalEnabled	0..1	Boolean	(NC) inherited from: AutomationFunction
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 85 shows all association ends of DirectCurrentMasterController with other classes.

Table 85 – Association ends of EquipmentReliabilityProfile::DirectCurrentMasterController with other classes

mult from	name	mult to	type	description
0..1	DCTieCorridor	0..1	DCTieCorridor	(NC) DCTieCorridor controlled by this direct current master controller.
0..*	PartOf	0..1	AutomationFunction	(NC) inherited from: AutomationFunction

3.52 (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 operator from the connected control areas.
Table 86 shows all attributes of DirectCurrentSystemOperator.

Table 86 – Attributes of EquipmentReliabilityProfile::DirectCurrentSystemOperator

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

Table 87 shows all association ends of DirectCurrentSystemOperator with other classes.

Table 87 – Association ends of EquipmentReliabilityProfile::DirectCurrentSystemOperator with other classes

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

3.53 (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 88 shows all attributes of DistributionSystemOperator.

Table 88 – Attributes of EquipmentReliabilityProfile::DistributionSystemOperator

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

Table 89 shows all association ends of DistributionSystemOperator with other classes.

Table 89 – Association ends of EquipmentReliabilityProfile::DistributionSystemOperator with other classes

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

3.54 (NC) DurationOverloadLimitCurve

Inheritance path = LimitDependencyCurve : Curve : IdentifiedObject

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

Table 90 shows all attributes of DurationOverloadLimitCurve.

Table 90 – 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
y2Multiplier	0..1	UnitMultiplier	inherited from: Curve
y2Unit	0..1	UnitSymbol	inherited from: Curve
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

3.55 (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 91 shows all attributes of EnergyAlignmentCoordinator.

Table 91 – Attributes of EquipmentReliabilityProfile::EnergyAlignmentCoordinator

name	mult	type	description
globalLocationNumber	0..1	String	(NC) inherited from: OrganisationRole
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
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 EnergyAlignmentCoordinator with other classes.

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

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

3.56 (NC) EnergyBlockComponent

Inheritance path = EnergyComponent : IdentifiedObject

Energy block component where the energy group is distributed according to the energy block order of each energy component in an energy group.

Table 93 shows all attributes of EnergyBlockComponent.

Table 93 – Attributes of EquipmentReliabilityProfile::EnergyBlockComponent

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
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 EnergyBlockComponent with other classes.

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

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

3.57 (NC) EnergyBlockOrder

Inheritance path = IdentifiedObject

The energy block order is a block (an amount) of energy that forms the sequence of orders that are going to be distributed to an energy block component.

Table 95 shows all attributes of EnergyBlockOrder.

Table 95 – Attributes of EquipmentReliabilityProfile::EnergyBlockOrder

name	mult	type	description
normalParticipationFactor	0..1	Float	(NC) Normal participation factor.
normalSequence	0..1	Integer	(NC) Normal sequence represents the local order of the power block order. 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.
powerDuration	0..1	Duration	(NC) Duration for the active power.
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
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 EnergyBlockOrder with other classes.

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

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

3.58 (abstract,NC) EnergyComponent

Inheritance path = IdentifiedObject
The energy component for a producer or a consumer that has the same energy characteristic, e.g. fuel type and technology.
Table 97 shows all attributes of EnergyComponent.

Table 97 – Attributes of EquipmentReliabilityProfile::EnergyComponent

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
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 EnergyComponent with other classes.

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

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

3.59 (abstract) EnergyConnection

Inheritance path = ConductingEquipment : Equipment : PowerSystemResource : IdentifiedObject
A connection of energy generation or consumption on the power system model.
Table 99 shows all attributes of EnergyConnection.

Table 99 – Attributes of EquipmentReliabilityProfile::EnergyConnection

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject

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 100 shows all association ends of EnergyConnection with other classes.

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

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

3.60 (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 101 shows all attributes of EnergyConsumer.

Table 101 – Attributes of EquipmentReliabilityProfile::EnergyConsumer

name	mult	type	description
normalParticipationFactor	0..1	Float	(NC) Participation factor describing the entity part of the active power provided by a collection of entities (e.g. an active power forecast to a collection of entities is divided to each of the member entity according to the participation factor). Must be a positive value. In the case of a sharing strategy, the distribution is following entities value (V) equals aggregated value (T) divided by sum of participation factors (PF), i.e. V=T/sum(PF). In the case of priority strategy, the item with the lowest number gets allocated energy first.
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.
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 102 shows all association ends of EnergyConsumer with other classes.

Table 102 – Association ends of EquipmentReliabilityProfile::EnergyConsumer with other classes

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

3.61 (NC) EnergyCoordinationRegion

Inheritance path = Region : PowerSystemResource : IdentifiedObject

A region that has a common organisation or a service that is responsible for alignment of forecast and scheduling of energy.

Table 103 shows all attributes of EnergyCoordinationRegion.

Table 103 – Attributes of EquipmentReliabilityProfile::EnergyCoordinationRegion

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
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 EnergyCoordinationRegion with other classes.

Table 104 – Association ends of EquipmentReliabilityProfile::EnergyCoordinationRegion 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.
0..*	OverlappingZone	0..1	OverlappingZone	(NC) inherited from: Region

3.62 (NC) EnergyType

Inheritance path = IdentifiedObject

A source of the energy.

An energy type reference refers to an energy characteristic that is needed for reporting, e.g. European Energy Certificate System (EECS). The kind of energy should be possible to be linked with different type of energy forecast, e.g. wind production for a given area based on wind forecast.

Table 105 shows all attributes of EnergyType.

Table 105 – Attributes of EquipmentReliabilityProfile::EnergyType

name	mult	type	description
kind	1..1	EnergyKind	(NC) The kind of energy type.
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
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 EnergyType with other classes.

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

mult from	name	mult to	type	description
0..*	EnergySourceReference	0..1	EnergySourceReference	(NC) Energy source refrence which has energy type references.

3.63 (abstract,Description) Equipment

Inheritance path = PowerSystemResource : IdentifiedObject

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

Table 107 shows all attributes of Equipment.

Table 107 – Attributes of EquipmentReliabilityProfile::Equipment

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
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 Equipment with other classes.

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

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

3.64 (abstract) EquipmentContainer

Inheritance path = ConnectivityNodeContainer : PowerSystemResource : IdentifiedObject

A modelling construct to provide a root class for containing equipment.

Table 109 shows all attributes of EquipmentContainer.

Table 109 – Attributes of EquipmentReliabilityProfile::EquipmentContainer

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

3.65 (abstract,NC) EquipmentController

Inheritance path = AutomationFunction : PowerSystemResource : IdentifiedObject

Equipment controller is an automation function that can control one or multiple equipment function to achieve all the targets inside the given tolerance.
Table 110 shows all attributes of EquipmentController.

Table 110 – Attributes of EquipmentReliabilityProfile::EquipmentController

name	mult	type	description
type	0..1	String	(NC) inherited from: AutomationFunction
normalEnabled	0..1	Boolean	(NC) inherited from: AutomationFunction
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 111 shows all association ends of EquipmentController with other classes.

Table 111 – Association ends of EquipmentReliabilityProfile::EquipmentController with other classes

mult from	name	mult to	type	description
0..*	PartOf	0..1	AutomationFunction	(NC) inherited from: AutomationFunction

3.66 (NC) ExceptionalPowerTransferCorridor

Inheritance path = PowerTransferCorridor : PowerSystemResource : IdentifiedObject
Potential power transfer corridor that can be triggered by equipment which changes its in service status or it is operating in an island.
Table 112 shows all attributes of ExceptionalPowerTransferCorridor.

Table 112 – Attributes of EquipmentReliabilityProfile::ExceptionalPowerTransferCorridor

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

3.67 (abstract,NC) FACTSEquipment

Inheritance path = RegulatingCondEq : EnergyConnection : ConductingEquipment : Equipment : PowerSystemResource : IdentifiedObject
Flexible Alternating Current Transmission System regulating equipment.
Table 113 shows all attributes of FACTSEquipment.

Table 113 – Attributes of EquipmentReliabilityProfile::FACTSEquipment

name	mult	type	description
slope	1..1	VoltagePerReactivePower	(NC) The characteristics slope which defines how the reactive power output changes in

name	mult	type	description
			proportion to the difference between the regulated bus voltage and the voltage setpoint. The attribute shall be a positive value or zero.
ratedI	0..1	CurrentFlow	(NC) Rated current of the FACTS equipment.
ratedU	0..1	Voltage	(NC) Rated voltage of the FACTS equipment.
ratedC	0..1	Reactance	(NC) Capacitive reactance at maximum reactive power. Shall always be positive.
ratedL	0..1	Reactance	(NC) Inductive rating at maximum inductive reactive power. Shall always be negative.
minC	0..1	Reactance	(NC) Capacitive reactance at minimum reactive power. Shall always be positive.
maxC	0..1	Reactance	(NC) Capacitive reactance at maximum reactive power. Shall always be positive.
minL	0..1	Reactance	(NC) Inductive rating at minimum inductive reactive power. Shall always be negative.
maxL	0..1	Reactance	(NC) Inductive rating at maximum inductive reactive power. Shall always be negative.
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
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 FACTSEquipment with other classes.

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

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

3.68 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 115 shows all attributes of Feeder.

Table 115 – Attributes of EquipmentReliabilityProfile::Feeder

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
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 Feeder with other classes.

1849 **Table 116 – Association ends of EquipmentReliabilityProfile::Feeder with other classes**

mult from	name	mult to	type	description
0..*	NormalEnergizingSubstation	0..1	Substation	The substation that nominally energizes the feeder. Also used for naming purposes.
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..*	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.

1850

1851 ## 3.69 (NC) FlexibleEnergyUnit

1852 Inheritance path = PowerElectronicsUnit : Equipment : PowerSystemResource :
1853 IdentifiedObject
1854 Flexible consumer or embedded producer of energy. The unit cannot be a net producer.
1855 Table 117 shows all attributes of FlexibleEnergyUnit.

1856 **Table 117 – Attributes of EquipmentReliabilityProfile::FlexibleEnergyUnit**

name	mult	type	description
uncontrollable	0..1	ActivePower	(NC) The active power, that forms the base consumption for the unit. This is measured and expected consumption. Load sign convention is used, i.e. positive sign means flow out from a node.
timeShift	0..1	ActivePower	(NC) The active power, that can be shifted from one pricing interval (market time unit) to another. It is expected to be a limited on the length of the shift. Example from household could be washing machine or dishwasher. Example from industry is the possible to shut down a machine for the relevant period. Load sign convention is used, i.e. positive sign means flow out from a node.
buffer	0..1	ActivePower	(NC) The active power, that has the flexibility to operate as production and/or consumption. The buffer is bound. Example are heat pump, cooling system, embedded batteries including electric vehicle. Load sign convention is used, i.e. positive sign means flow out from a node.
unconstrained	0..1	ActivePower	(NC) The active power, that has the flexibility to operate as production without any bound by a buffer. Example are alternative heating (wood, gas, diesel etc) or power generators. Load sign convention is used, i.e. positive sign means flow out from a node.
normalParticipationFactor	0..1	Float	(NC) inherited from: PowerElectronicsUnit
maxEconomicP	0..1	ActivePower	(NC) inherited from: PowerElectronicsUnit
minEconomicP	0..1	ActivePower	(NC) inherited from: PowerElectronicsUnit
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject

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 118 shows all association ends of FlexibleEnergyUnit with other classes.

Table 118 – Association ends of EquipmentReliabilityProfile::FlexibleEnergyUnit with other classes

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

3.70 (abstract,NC) FunctionBlock

Inheritance path = IdentifiedObject
Function block is a function described as a set of elementary blocks. The blocks describe the function between input variables and output variables.
Table 119 shows all attributes of FunctionBlock.

Table 119 – Attributes of EquipmentReliabilityProfile::FunctionBlock

name	mult	type	description
normalEnabled	0..1	Boolean	(NC) True, if the function block is enabled (active). Otherwise false.
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 120 shows all association ends of FunctionBlock with other classes.

Table 120 – Association ends of EquipmentReliabilityProfile::FunctionBlock with other classes

mult from	name	mult to	type	description
0..*	AutomationFunction	0..1	AutomationFunction	(NC) Automation function describe automation that this function block is part of.
1..*	AutomationBlockGroup	0..1	AutomationBlockGroup	(NC) Automation block group which has function blocks.

3.71 (abstract,NC) FunctionInputVariable

Inheritance path = IdentifiedObject
Functional input variable defines the domain of the function.
Table 121 shows all attributes of FunctionInputVariable.

Table 121 – Attributes of EquipmentReliabilityProfile::FunctionInputVariable

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 122 shows all association ends of FunctionInputVariable with other classes.

Table 122 – Association ends of EquipmentReliabilityProfile::FunctionInputVariable with other classes

mult from	name	mult to	type	description
1..*	Function	1..1	FunctionBlock	(NC) Function block describe the function that function input variable provides the domain for.

3.72 (NC) FunctionOutputVariable

Inheritance path = IdentifiedObject
Functional output variable defines the codomain of the function.
Table 123 shows all attributes of FunctionOutputVariable.

Table 123 – Attributes of EquipmentReliabilityProfile::FunctionOutputVariable

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
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 FunctionOutputVariable with other classes.

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

mult from	name	mult to	type	description
1..*	FunctionBlock	1..1	FunctionBlock	(NC) Function block describe the function that function output variable provides the codomain for.
0..*	PropertyReference	1..1	PropertyReference	(NC) Property reference refers to a given class and property that is populated by the function output variable.

3.73 (NC) GateInputPin

Inheritance path = FunctionInputVariable : IdentifiedObject
Input pin for a logical gate. The condition described in the input pin gives a logical true or false.
The result from measurement and calculation are converted to a true or false.
Table 125 shows all attributes of GateInputPin.

1898 **Table 125 – Attributes of EquipmentReliabilityProfile::GateInputPin**

name	mult	type	description
absoluteValue	0..1	Boolean	(NC) Indicates if the absolute value is used for comparison. If true, use the absolute value. If false, use the complex value (vector).
logicKind	0..1	LogicalOperatorsKind	(NC) The logical operator kind used for comparison.
duration	0..1	Duration	(NC) The time duration for which the condition is satisfied before acting. Default is 0 seconds.
negate	0..1	Boolean	(NC) Invert/negate the result of the comparison.
thresholdPercentage	0..1	PerCent	(NC) The threshold percentage that should be used for compare with the percentage change between input value and threshold value. The allowed value range is [0,100].
thresholdValue	0..1	Float	(NC) The threshold value that should be used for compare with the input value.
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

1899
1900 Table 126 shows all association ends of GateInputPin with other classes.

1901 **Table 126 – Association ends of EquipmentReliabilityProfile::GateInputPin with other**
1902 **classes**

mult from	name	mult to	type	description
1..*	Function	1..1	FunctionBlock	(NC) inherited from: FunctionInputVariable

1903

1904 ## 3.74 (Description) GeneratingUnit

1905 Inheritance path = Equipment : PowerSystemResource : IdentifiedObject
1906 A single or set of synchronous machines for converting mechanical power into alternating-
1907 current power. For example, individual machines within a set may be defined for scheduling
1908 purposes while a single control signal is derived for the set. In this case there would be a
1909 GeneratingUnit for each member of the set and an additional GeneratingUnit corresponding to
1910 the set.
1911 Table 127 shows all attributes of GeneratingUnit.

1912 **Table 127 – Attributes of EquipmentReliabilityProfile::GeneratingUnit**

name	mult	type	description
maxEconomicP	0..1	ActivePower	Maximum high economic active power limit, that should not exceed the maximum operating active power limit.
maxStartupLoad	0..1	ActivePower	(NC) Maximum consumption by the generating unit as part of the startup process.
minEconomicP	0..1	ActivePower	Low economic active power limit that shall be greater than or equal to the minimum operating active power limit.

name	mult	type	description
shutdownCost	0..1	Money	(NC) The shutdown cost incurred for each shutdown of the GeneratingUnit.
shutdownTime	0..1	Duration	(NC) Time it takes to shutdown the unit.
normalMustRunP	0..1	ActivePower	(NC) Normal minimum active power injection that is needed to meet must-run requirement. This value can be higher or equal to minimum operational limit. Load sign convention is used, i.e. positive sign means flow out from a node.
runningLeadTime	0..1	Duration	(NC) Time it takes to change the schedule when the unit is operating due to technical configuration of a supporting system, e.g. gas pipeline.
lowerRampRate	0..1	ActivePowerChangeRate	The normal maximum rate the generating unit active power output can be lowered by control actions.
raiseRampRate	0..1	ActivePowerChangeRate	The normal maximum rate the generating unit active power output can be raised by control actions.
minimumOffTime	0..1	Seconds	Minimum time interval between unit shutdown and startup.
warmStartupTime	0..1	Duration	(NC) Time it takes to startup the unit when it is warm.
coolDownTime	0..1	Duration	(NC) Time it takes from a unit shutdown until it is considered cold.
startupRampRate	0..1	ActivePowerChangeRate	(NC) The startup ramp rate of the generating unit which describes the speed of change of active power from zero to the minimum active power. When the ramp is not provided, the optimisation process shall consider the change as an instant change of active power from zero to minimum active power.
minimumUpTime	0..1	Duration	(NC) The time that a generating unit has to stay running after it has been switched on by the Remedial Action Optimizer.
normalStartupCost	0..1	Money	(NC) The normal initial startup cost incurred for each start of the GeneratingUnit.
normalWarmStartupCost	0..1	Money	(NC) The normal warm startup cost incurred for each start of the GeneratingUnit.
normalMustRunQ	0..1	ReactivePower	(NC) Normal minimum reactive power injection that is needed to meet must-run requirement. This value can be higher or equal to minimum operational limit. Load sign convention is used, i.e. positive sign means flow out from a node.
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 128 shows all association ends of GeneratingUnit with other classes.

Table 128 – 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.
0..*	Circuit	0..1	Circuit	(NC) inherited from: Equipment
0..*	AggregatedEquipment	0..1	Equipment	(NC) inherited from: Equipment

3.75 (NC) GeothermalGeneratingUnit

Inheritance path = GeneratingUnit : Equipment : PowerSystemResource : IdentifiedObject

Generating unit that is generating electrical power from geothermal energy.

Table 129 shows all attributes of GeothermalGeneratingUnit.

Table 129 – Attributes of EquipmentReliabilityProfile::GeothermalGeneratingUnit

name	mult	type	description
kind	1..1	GeothermalUnitKind	(NC) Kind of geothermal generating unit.
maxEconomicP	0..1	ActivePower	inherited from: GeneratingUnit
maxStartupLoad	0..1	ActivePower	(NC) inherited from: GeneratingUnit
minEconomicP	0..1	ActivePower	inherited from: GeneratingUnit
shutdownCost	0..1	Money	(NC) inherited from: GeneratingUnit
shutdownTime	0..1	Duration	(NC) inherited from: GeneratingUnit
normalMustRunP	0..1	ActivePower	(NC) inherited from: GeneratingUnit
runningLeadTime	0..1	Duration	(NC) inherited from: GeneratingUnit
lowerRampRate	0..1	ActivePowerChangeRate	inherited from: GeneratingUnit
raiseRampRate	0..1	ActivePowerChangeRate	inherited from: GeneratingUnit
minimumOffTime	0..1	Seconds	inherited from: GeneratingUnit
warmStartupTime	0..1	Duration	(NC) inherited from: GeneratingUnit
coolDownTime	0..1	Duration	(NC) inherited from: GeneratingUnit
startupRampRate	0..1	ActivePowerChangeRate	(NC) inherited from: GeneratingUnit
minimumUpTime	0..1	Duration	(NC) inherited from: GeneratingUnit
normalStartupCost	0..1	Money	(NC) inherited from: GeneratingUnit
normalWarmStartupCost	0..1	Money	(NC) inherited from: GeneratingUnit
normalMustRunQ	0..1	ReactivePower	(NC) inherited from: GeneratingUnit
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
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 GeothermalGeneratingUnit with other classes.

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

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

3.76 (Description) HydroPump

Inheritance path = Equipment : PowerSystemResource : IdentifiedObject

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

Table 131 shows all attributes of HydroPump.

Table 131 – Attributes of EquipmentReliabilityProfile::HydroPump

name	mult	type	description
normalParticipationFactor	0..1	Float	(NC) Participation factor describing the entity part of the active power provided by a collection of entities (e.g. an active power forecast to a collection of entities is divided to each of the member entity according to the participation factor). Must be a positive value. In the case of a sharing strategy, the distribution is following entities value (V) equals aggregated value (T) divided by sum of participation factors (PF), i.e. V=T/sum(PF). In the case of priority strategy, the item with the lowest number gets allocated energy first.
maxEconomicP	0..1	ActivePower	(NC) Maximum high economic active power limit, that should not exceed the maximum operating active power limit.
maxOperatingP	0..1	ActivePower	(NC) This is the maximum operating active power limit the dispatcher can enter for this unit.
minEconomicP	0..1	ActivePower	(NC) Low economic active power limit that shall be greater than or equal to the minimum operating active power limit.
minOperatingP	0..1	ActivePower	(NC) This is the minimum operating active power limit the dispatcher can enter for this unit.
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 132 shows all association ends of HydroPump with other classes.

Table 132 – 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.
0..*	Circuit	0..1	Circuit	(NC) inherited from: Equipment

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

3.77 (abstract) IdentifiedObject root class

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

Table 133 shows all attributes of IdentifiedObject.

Table 133 – Attributes of EquipmentReliabilityProfile::IdentifiedObject

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) The attribute is used for an exchange of the EIC code (Energy identification Code). The length of the string is 16 characters as defined by the EIC code. For details on EIC scheme please refer to ENTSO-E web site.
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.

3.78 (NC) ImpedanceControlFunction

Inheritance path = ControlFunctionBlock : FunctionBlock : IdentifiedObject

Impedance control function is a function block that calculates the operating point of the controlled equipment to achieve the target impedance.

Table 134 shows all attributes of ImpedanceControlFunction.

Table 134 – Attributes of EquipmentReliabilityProfile::ImpedanceControlFunction

name	mult	type	description
isDiscrete	1..1	Boolean	(NC) inherited from: ControlFunctionBlock
targetDeadband	0..1	Float	(NC) inherited from: ControlFunctionBlock
maxAllowedTargetValue	0..1	PerCent	(NC) inherited from: ControlFunctionBlock
minAllowedTargetValue	0..1	PerCent	(NC) inherited from: ControlFunctionBlock
normalEnabled	0..1	Boolean	(NC) inherited from: FunctionBlock
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 135 shows all association ends of ImpedanceControlFunction with other classes.

Table 135 – Association ends of EquipmentReliabilityProfile::ImpedanceControlFunction with other classes

mult from	name	mult to	type	description
0..*	AutomationFunction	0..1	AutomationFunction	(NC) inherited from: FunctionBlock
1..*	AutomationBlockGroup	0..1	AutomationBlockGroup	(NC) inherited from: FunctionBlock

3.79 (abstract,NC) LimitDependencyCurve

Inheritance path = Curve : IdentifiedObject

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

Table 136 shows all attributes of LimitDependencyCurve.

Table 136 – Attributes of EquipmentReliabilityProfile::LimitDependencyCurve

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
y2Multiplier	0..1	UnitMultiplier	inherited from: Curve
y2Unit	0..1	UnitSymbol	inherited from: Curve
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

3.80 (Description) Line

Inheritance path = EquipmentContainer : ConnectivityNodeContainer : PowerSystemResource : IdentifiedObject

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

Table 137 shows all attributes of Line.

Table 137 – Attributes of EquipmentReliabilityProfile::Line

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 138 shows all association ends of Line with other classes.

Table 138 – Association ends of EquipmentReliabilityProfile::Line with other classes

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

3.81 (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 139 shows all attributes of LineCircuit.

Table 139 – Attributes of EquipmentReliabilityProfile::LineCircuit

name	mult	type	description
positiveFlowIn	1..1	Boolean	(NC) inherited from: Circuit
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 140 shows all association ends of LineCircuit with other classes.

Table 140 – Association ends of EquipmentReliabilityProfile::LineCircuit with other classes

mult from	name	mult to	type	description
0..1	IdentifyingTerminal	0..1	Terminal	(NC) inherited from: Circuit

3.82 (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 141 shows all attributes of LoadFrequencyControlArea.

Table 141 – 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. The value shall be a positive value between 0 and 100.
frequencyBiasFactor	0..1	Float	(NC) Frequency bias in MW/Hz.
includeFrequencyBias	1..1	Boolean	(NC) True means the frequency bias that is taken into consideration in the frequency bias computation.
frequencyRestorationReserveDelay	0..1	Seconds	(NC) FRR delay expressed in seconds. Must be a positive multiple of AGC's cycle duration.

name	mult	type	description
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.
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 142 shows all association ends of LoadFrequencyControlArea with other classes.

Table 142 – Association ends of EquipmentReliabilityProfile::LoadFrequencyControlArea with other classes

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

3.83 (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 143 shows all attributes of LoadFrequencyControlBlock.

Table 143 – Attributes of EquipmentReliabilityProfile::LoadFrequencyControlBlock

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 144 shows all association ends of LoadFrequencyControlBlock with other classes.

Table 144 – 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.

3.84 (NC) LoadFrequencyControlOperator

Inheritance path = PowerSystemOrganisationRole : OrganisationRole : IdentifiedObject

A role that is responsible for operational security by operating the load frequency control (LFC) mechanism.
Table 145 shows all attributes of LoadFrequencyControlOperator.

Table 145 – Attributes of EquipmentReliabilityProfile::LoadFrequencyControlOperator

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

Table 146 shows all association ends of LoadFrequencyControlOperator with other classes.

Table 146 – Association ends of EquipmentReliabilityProfile::LoadFrequencyControlOperator with other classes

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

3.85 (NC) ModularStaticSynchronousSeriesCompensator

Inheritance path = FACTSEquipment : RegulatingCondEq : EnergyConnection : ConductingEquipment : Equipment : PowerSystemResource : IdentifiedObject
Modular static synchronous series compensator (MSSSC) is a type of flexible AC transmission system regulating equipment which consists of solid-state voltage source inverter connected in series with a transmission line. This is similar to static synchronous series compensator (SSSC), but without injection transformer. This enables the MSSSC to be truly modular with the ability to simply install a number of equipment in series to provide a desired maximum level of impedance. MSSSC can be dispersed into multiple location in a circuit working collectively under the same controller scheme.
Table 147 shows all attributes of ModularStaticSynchronousSeriesCompensator.

Table 147 – Attributes of EquipmentReliabilityProfile::ModularStaticSynchronousSeriesCompensator

name	mult	type	description
slope	1..1	VoltagePerReactivePower	(NC) inherited from: FACTSEquipment
ratedI	0..1	CurrentFlow	(NC) inherited from: FACTSEquipment
ratedU	0..1	Voltage	(NC) inherited from: FACTSEquipment
ratedC	0..1	Reactance	(NC) inherited from: FACTSEquipment
ratedL	0..1	Reactance	(NC) inherited from: FACTSEquipment
minC	0..1	Reactance	(NC) inherited from: FACTSEquipment
maxC	0..1	Reactance	(NC) inherited from: FACTSEquipment
minL	0..1	Reactance	(NC) inherited from: FACTSEquipment
maxL	0..1	Reactance	(NC) inherited from: FACTSEquipment
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
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 148 shows all association ends of ModularStaticSynchronousSeriesCompensator with other classes.

Table 148 – Association ends of EquipmentReliabilityProfile::ModularStaticSynchronousSeriesCompensator with other classes

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

3.86 (Description) NuclearGeneratingUnit

Inheritance path = GeneratingUnit : Equipment : PowerSystemResource : IdentifiedObject

A nuclear generating unit.

Table 149 shows all attributes of NuclearGeneratingUnit.

Table 149 – Attributes of EquipmentReliabilityProfile::NuclearGeneratingUnit

name	mult	type	description
reactorKind	1..1	NuclearReactorKind	(NC) Kind of nuclear reactor.
maxEconomicP	0..1	ActivePower	inherited from: GeneratingUnit
maxStartupLoad	0..1	ActivePower	(NC) inherited from: GeneratingUnit
minEconomicP	0..1	ActivePower	inherited from: GeneratingUnit
shutdownCost	0..1	Money	(NC) inherited from: GeneratingUnit
shutdownTime	0..1	Duration	(NC) inherited from: GeneratingUnit
normalMustRunP	0..1	ActivePower	(NC) inherited from: GeneratingUnit
runningLeadTime	0..1	Duration	(NC) inherited from: GeneratingUnit
lowerRampRate	0..1	ActivePowerChangeRate	inherited from: GeneratingUnit
raiseRampRate	0..1	ActivePowerChangeRate	inherited from: GeneratingUnit
minimumOffTime	0..1	Seconds	inherited from: GeneratingUnit
warmStartupTime	0..1	Duration	(NC) inherited from: GeneratingUnit
coolDownTime	0..1	Duration	(NC) inherited from: GeneratingUnit
startupRampRate	0..1	ActivePowerChangeRate	(NC) inherited from: GeneratingUnit
minimumUpTime	0..1	Duration	(NC) inherited from: GeneratingUnit
normalStartupCost	0..1	Money	(NC) inherited from: GeneratingUnit
normalWarmStartupCost	0..1	Money	(NC) inherited from: GeneratingUnit
normalMustRunQ	0..1	ReactivePower	(NC) inherited from: GeneratingUnit
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
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 150 shows all association ends of NuclearGeneratingUnit with other classes.

Table 150 – Association ends of EquipmentReliabilityProfile::NuclearGeneratingUnit with other classes

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

3.87 (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 151 shows all attributes of OperationalLimit.

Table 151 – Attributes of EquipmentReliabilityProfile::OperationalLimit

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 152 shows all association ends of OperationalLimit with other classes.

Table 152 – 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.

3.88 (Description) 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 153 shows all attributes of OperationalLimitSet.

Table 153 – Attributes of EquipmentReliabilityProfile::OperationalLimitSet

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 154 shows all association ends of OperationalLimitSet with other classes.

Table 154 – Association ends of EquipmentReliabilityProfile::OperationalLimitSet with other classes

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

3.89 OperationalLimitType

Inheritance path = IdentifiedObject

The operational meaning of a category of limits.

Table 155 shows all attributes of OperationalLimitType.

Table 155 – Attributes of EquipmentReliabilityProfile::OperationalLimitType

name	mult	type	description
direction	1..1	OperationalLimitDirectionKind	The direction of the limit.
isMinimum	0..1	Boolean	(NC) Defines if the operational limit type is minimum. If true, the value is a minimum value of the same kind. This applies to stability and PATL. If false, the limit has the normal behaviour. OperationalLimitType.direction attribute shall be absoluteValue.
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 156 shows all association ends of OperationalLimitType with other classes.

Table 156 – 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.

mult from	name	mult to	type	description
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	SolarRadiationDependencyCurve	(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.

3.90 (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 157 shows all attributes of SecurityCoordinator.

Table 157 – Attributes of EquipmentReliabilityProfile::SecurityCoordinator

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

Table 158 shows all association ends of SecurityCoordinator with other classes.

Table 158 – Association ends of EquipmentReliabilityProfile::SecurityCoordinator with other classes

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

3.91 (NC) SolarRadiationDependencyCurve

Inheritance path = LimitDependencyCurve : Curve : IdentifiedObject

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

Table 159 shows all attributes of SolarRadiationDependencyCurve.

Table 159 – Attributes of EquipmentReliabilityProfile::SolarRadiationDependencyCurve

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

name	mult	type	description
y1Unit	0..1	UnitSymbol	inherited from: Curve
y2Multiplier	0..1	UnitMultiplier	inherited from: Curve
y2Unit	0..1	UnitSymbol	inherited from: Curve
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

3.92 (NC) StaticSynchronousCompensator

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

Static synchronous compensator (STATCOM), also known as a static synchronous condenser (STATCON), is a type of flexible AC transmission system regulating equipment used on alternating current electricity transmission networks. It is based on a power electronics voltage-source converter and can act as either a source or sink of reactive AC power to an electricity network. If connected to a source of power it can also provide active AC power.

Table 160 shows all attributes of StaticSynchronousCompensator.

Table 160 – Attributes of EquipmentReliabilityProfile::StaticSynchronousCompensator

name	mult	type	description
slope	1..1	VoltagePerReactivePower	(NC) inherited from: FACTSEquipment
ratedI	0..1	CurrentFlow	(NC) inherited from: FACTSEquipment
ratedU	0..1	Voltage	(NC) inherited from: FACTSEquipment
ratedC	0..1	Reactance	(NC) inherited from: FACTSEquipment
ratedL	0..1	Reactance	(NC) inherited from: FACTSEquipment
minC	0..1	Reactance	(NC) inherited from: FACTSEquipment
maxC	0..1	Reactance	(NC) inherited from: FACTSEquipment
minL	0..1	Reactance	(NC) inherited from: FACTSEquipment
maxL	0..1	Reactance	(NC) inherited from: FACTSEquipment
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 161 shows all association ends of StaticSynchronousCompensator with other classes.

Table 161 – Association ends of EquipmentReliabilityProfile::StaticSynchronousCompensator with other classes

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

3.93 (NC) StaticSynchronousSeriesCompensator

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

Static synchronous series compensator (SSSC) is a type of flexible AC transmission system which consists of a solid-state voltage source inverter coupled with a transformer that is connected in series with a transmission line. This device can inject an almost sinusoidal voltage in series with the line. This injected voltage could be considered as an inductive or capacitive reactance, which is connected in series with the transmission line. This feature can provide controllable voltage compensation. In addition, SSSC is able to reverse the power flow by injecting a sufficiently large series reactive compensating voltage. Moreover it can inject a voltage proportional to the difference between the line current and the pre-configured current threshold. It shall have two Terminal-s associated with it.

Table 162 shows all attributes of StaticSynchronousSeriesCompensator.

Table 162 – Attributes of EquipmentReliabilityProfile::StaticSynchronousSeriesCompensator

name	mult	type	description
slope	1..1	VoltagePerReactivePower	(NC) inherited from: FACTSEquipment
ratedI	0..1	CurrentFlow	(NC) inherited from: FACTSEquipment
ratedU	0..1	Voltage	(NC) inherited from: FACTSEquipment
ratedC	0..1	Reactance	(NC) inherited from: FACTSEquipment
ratedL	0..1	Reactance	(NC) inherited from: FACTSEquipment
minC	0..1	Reactance	(NC) inherited from: FACTSEquipment
maxC	0..1	Reactance	(NC) inherited from: FACTSEquipment
minL	0..1	Reactance	(NC) inherited from: FACTSEquipment
maxL	0..1	Reactance	(NC) inherited from: FACTSEquipment
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 163 shows all association ends of StaticSynchronousSeriesCompensator with other classes.

Table 163 – Association ends of EquipmentReliabilityProfile::StaticSynchronousSeriesCompensator with other classes

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

3.94 (NC) SubSchedulingArea

Inheritance path = SchedulingArea : PowerSystemResource : IdentifiedObject

An area that is a part of another scheduling area. Typically part of a Transmission System Operator (TSO) scheduling area 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 164 shows all attributes of SubSchedulingArea.

Table 164 – Attributes of EquipmentReliabilityProfile::SubSchedulingArea

name	mult	type	description
isIslandingEnabled	0..1	Boolean	(NC) inherited from: SchedulingArea
isMeteringGridArea	0..1	Boolean	(NC) inherited from: SchedulingArea
normalParticipationFactor	0..1	Float	(NC) inherited from: SchedulingArea
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 165 shows all association ends of SubSchedulingArea with other classes.

Table 165 – 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..*	SystemOperator	0..1	SystemOperator	(NC) inherited from: SchedulingArea
0..*	SynchronousArea	0..1	SynchronousArea	(NC) inherited from: SchedulingArea
0..*	LoadFrequencyControlArea	0..1	LoadFrequencyControlArea	(NC) inherited from: SchedulingArea
0..*	EnergyCoordinationRegion	0..1	EnergyCoordinationRegion	(NC) inherited from: SchedulingArea
1..*	ControlArea	0..1	ControlArea	(NC) inherited from: SchedulingArea
1..*	BiddingZone	1..1	BiddingZone	(NC) inherited from: SchedulingArea

3.95 (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 166 shows all attributes of Substation.

Table 166 – Attributes of EquipmentReliabilityProfile::Substation

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 167 shows all association ends of Substation with other classes.

Table 167 – 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.

3.96 (NC) SubstationController

Inheritance path = EquipmentController : AutomationFunction : PowerSystemResource : IdentifiedObject

Substation controller is controlling the equipment to optimize the use of the controlling equipment within a substation.

Table 168 shows all attributes of SubstationController.

Table 168 – Attributes of EquipmentReliabilityProfile::SubstationController

name	mult	type	description
type	0..1	String	(NC) inherited from: AutomationFunction
normalEnabled	0..1	Boolean	(NC) inherited from: AutomationFunction
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 169 shows all association ends of SubstationController with other classes.

Table 169 – Association ends of EquipmentReliabilityProfile::SubstationController with other classes

mult from	name	mult to	type	description
0..*	PartOf	0..1	AutomationFunction	(NC) inherited from: AutomationFunction

3.97 (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 170 shows all attributes of SynchronousArea.

Table 170 – 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.
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

3.98 (abstract,NC) SystemOperationCoordinator

Inheritance path = PowerSystemOrganisationRole : OrganisationRole : IdentifiedObject
A role that coordinates relevant information and impact in regards to operating the power system.
Table 171 shows all attributes of SystemOperationCoordinator.

Table 171 – Attributes of EquipmentReliabilityProfile::SystemOperationCoordinator

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

Table 172 shows all association ends of SystemOperationCoordinator with other classes.

Table 172 – Association ends of EquipmentReliabilityProfile::SystemOperationCoordinator with other classes

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

3.99 (abstract,NC) SystemOperator

Inheritance path = PowerSystemOrganisationRole : OrganisationRole : IdentifiedObject
System operator.
Table 173 shows all attributes of SystemOperator.

Table 173 – Attributes of EquipmentReliabilityProfile::SystemOperator

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

Table 174 shows all association ends of SystemOperator with other classes.

Table 174 – Association ends of EquipmentReliabilityProfile::SystemOperator with other classes

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

3.100 (abstract,Description) TapChanger root class

Mechanism for changing transformer winding tap positions.

Table 175 shows all association ends of TapChanger with other classes.

Table 175 – Association ends of EquipmentReliabilityProfile::TapChanger with other classes

mult from	name	mult to	type	description
0..*	TapChangeController	0..1	TapChangerController	(NC) The tap changer controller that controls this TapChanger.

3.101 (abstract) Terminal

Inheritance path = ACDCTerminal

An AC electrical connection point to a piece of conducting equipment. Terminals are connected at physical connection points called connectivity nodes.

3.102 (NC) TieCorridor

Inheritance path = PowerSystemResource : IdentifiedObject

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

Table 176 shows all attributes of TieCorridor.

Table 176 – Attributes of EquipmentReliabilityProfile::TieCorridor

name	mult	type	description
delayRegulatingReserve	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.
maxRegulatingReserveRamp	0..1	Float	(NC) Maximum authorized ramp for regulating reserve.
thresholdRegulatingReserve	0..1	ActivePower	(NC) Regulating reserve threshold.
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 177 shows all association ends of TieCorridor with other classes.

Table 177 – Association ends of EquipmentReliabilityProfile::TieCorridor with other classes

mult from	name	mult to	type	description
0..*	LoadFrequencyControlArea	0..1	LoadFrequencyControlArea	(NC) LoadFrequencyControlArea controlling the TieCorridor.
0..*	BiddingZoneBorder	0..1	BiddingZoneBorder	(NC) Bidding zone border in which the tie corridor is located.

3.103 (NC) ThyristorControlledSeriesCompensator

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

Thyristor-controlled series capacitors (TCSC) is a type of flexible AC transmission system regulating equipment that is configured with controlled reactors in parallel with sections of a

capacitor bank. This combination allows smooth control of the fundamental frequency capacitive reactance over a wide range. The thyristor valve contains a string of series connected high power thyristors. TCSC can control power flows in order to achieve eliminating of line overloads, reducing loop flows and minimising system losses.
Table 178 shows all attributes of ThyristorControlledSeriesCompensator.

Table 178 – Attributes of EquipmentReliabilityProfile::ThyristorControlledSeriesCompensator

name	mult	type	description
flexibleCapacitiveZ	1..1	Impedance	(NC) Flexible impedance that can be controlled by the compensator when operating in the capacitive range. Shall always be positive.
flexibleInductiveZ	1..1	Impedance	(NC) Flexible impedance that can be controlled by the compensator when operating in the inductive range. Shall always be negative.
minI	1..1	CurrentFlow	(NC) Minimum current below which the device bypassed.
reconnectionI	1..1	CurrentFlow	(NC) The current for which the TCSC returns back to operation after bypass.
slope	1..1	VoltagePerReactivePower	(NC) inherited from: FACTSEquipment
ratedI	0..1	CurrentFlow	(NC) inherited from: FACTSEquipment
ratedU	0..1	Voltage	(NC) inherited from: FACTSEquipment
ratedC	0..1	Reactance	(NC) inherited from: FACTSEquipment
ratedL	0..1	Reactance	(NC) inherited from: FACTSEquipment
minC	0..1	Reactance	(NC) inherited from: FACTSEquipment
maxC	0..1	Reactance	(NC) inherited from: FACTSEquipment
minL	0..1	Reactance	(NC) inherited from: FACTSEquipment
maxL	0..1	Reactance	(NC) inherited from: FACTSEquipment
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 179 shows all association ends of ThyristorControlledSeriesCompensator with other classes.

Table 179 – Association ends of EquipmentReliabilityProfile::ThyristorControlledSeriesCompensator with other classes

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

3.104 (NC) TransmissionSystemOperator

Inheritance path = SystemOperator : PowerSystemOrganisationRole : OrganisationRole : IdentifiedObject
A system operator role that is responsible for operating of an energy transmission network.

Table 180 shows all attributes of TransmissionSystemOperator.

Table 180 – Attributes of EquipmentReliabilityProfile::TransmissionSystemOperator

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

Table 181 shows all association ends of TransmissionSystemOperator with other classes.

Table 181 – Association ends of EquipmentReliabilityProfile::TransmissionSystemOperator with other classes

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

3.105 (NC) UnifiedPowerFlowController

Inheritance path = EquipmentController : AutomationFunction : PowerSystemResource : IdentifiedObject

Unified power flow controller (UPFC) is providing fast-acting reactive power compensation on high-voltage electricity transmission networks.

Table 182 shows all attributes of UnifiedPowerFlowController.

Table 182 – Attributes of EquipmentReliabilityProfile::UnifiedPowerFlowController

name	mult	type	description
type	0..1	String	(NC) inherited from: AutomationFunction
normalEnabled	0..1	Boolean	(NC) inherited from: AutomationFunction
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 183 shows all association ends of UnifiedPowerFlowController with other classes.

Table 183 – Association ends of EquipmentReliabilityProfile::UnifiedPowerFlowController with other classes

mult from	name	mult to	type	description
0..*	PartOf	0..1	AutomationFunction	(NC) inherited from: AutomationFunction

3.106 (NC) VoltageAngleLimit

Inheritance path = OperationalLimit : IdentifiedObject

Voltage angle limit between two terminals. The association end OperationalLimitSet.Terminal defines one end and the host of the limit. The association end VoltageAngleLimit.AngleReferenceTerminal defines the reference terminal.

2279 Table 184 shows all attributes of VoltageAngleLimit.

2280 **Table 184 – Attributes of EquipmentReliabilityProfile::VoltageAngleLimit**

name	mult	type	description
normalValue	1..1	AngleDegrees	(NC) The difference in angle degrees between referenced by the association end OperationalLimitSet.Terminal and the Terminal referenced by the association end VoltageAngleLimit.AngleReferenceTerminal. The value shall be positive (greater than zero).
isFlowToRefTerminal	0..1	Boolean	(NC) True if the flow is from the operating limit terminal to the angle reference terminal. False means that the flow is the other direction. When it is not given, the limit is the same for both directions.
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

2281
2282 Table 185 shows all association ends of VoltageAngleLimit with other classes.

2283 **Table 185 – Association ends of EquipmentReliabilityProfile::VoltageAngleLimit with**
2284 **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

2285

2286 ### 3.107 (NC) VoltageControlFunction

2287 Inheritance path = ControlFunctionBlock : FunctionBlock : IdentifiedObject
2288 Voltage control function is a function block that calculate the operating point of the controlled
2289 equipment to achieve the target voltage.
2290 Table 186 shows all attributes of VoltageControlFunction.

2291 **Table 186 – Attributes of EquipmentReliabilityProfile::VoltageControlFunction**

name	mult	type	description
isDiscrete	1..1	Boolean	(NC) inherited from: ControlFunctionBlock
targetDeadband	0..1	Float	(NC) inherited from: ControlFunctionBlock
maxAllowedTargetValue	0..1	PerCent	(NC) inherited from: ControlFunctionBlock
minAllowedTargetValue	0..1	PerCent	(NC) inherited from: ControlFunctionBlock
normalEnabled	0..1	Boolean	(NC) inherited from: FunctionBlock
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 187 shows all association ends of VoltageControlFunction with other classes.

Table 187 – Association ends of EquipmentReliabilityProfile::VoltageControlFunction with other classes

mult from	name	mult to	type	description
0..*	AutomationFunction	0..1	AutomationFunction	(NC) inherited from: FunctionBlock
1..*	AutomationBlockGroup	0..1	AutomationBlockGroup	(NC) inherited from: FunctionBlock

3.108 Currency enumeration

Monetary currencies. ISO 4217 standard including 3-character currency code.
Table 188 shows all literals of Currency.

Table 188 – 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.
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.

literal	value	description
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.
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.

literal	value	description
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.
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.

literal	value	description
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.
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.

literal	value	description
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.

3.109 CurveStyle enumeration

Style or shape of curve.
Table 189 shows all literals of CurveStyle.

Table 189 – 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.

3.110 (NC) MarineUnitKind enumeration

Kind of marine energy capture.
Table 190 shows all literals of MarineUnitKind.

Table 190 – Literals of EquipmentReliabilityProfile::MarineUnitKind

literal	value	description
currents		Capture energy from ocean current which are caused by forces like breaking waves, wind, coriolis effect etc.
pressure		Capture energy from pressure.
tidal		Capture energy from tidal power, which captures the energy of the current caused by the gravitational pull of the Sun and Moon.
wave		Capture energy from wind waves.
other		Other way of capture energy from marine elements.

3.111 OperationalLimitDirectionKind enumeration

The direction attribute describes the side of a limit that is a violation.
Table 191 shows all literals of OperationalLimitDirectionKind.

Table 191 – 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.

3.112 (NC) PinTerminalKind enumeration

The kind of quantities that can serve as an input value for the pin.
Table 192 shows all literals of PinTerminalKind.

Table 192 – Literals of EquipmentReliabilityProfile::PinTerminalKind

literal	value	description
activePower		Active power on the Terminal.
apparentPower		Apparent power on the Terminal.
voltageMagnitude		Voltage magnitude on the Terminal.
voltageAngle		Voltage angle on the Terminal.
current		Current on the Terminal.
reactivePower		Reactive power on the Terminal.

3.113 (NC) NuclearReactorKind enumeration

Kind of nuclear reactor.
Table 193 shows all literals of NuclearReactorKind.

Table 193 – Literals of EquipmentReliabilityProfile::NuclearReactorKind

literal	value	description
breeder		Reactor whose heat source is a nuclear reactor that generates more fissile material than it consumes.
graphite		Reactor whose heat source is a graphite-moderated reactor that is a nuclear reactor that uses carbon as a neutron moderator, which allows natural uranium to be used as nuclear fuel.
heavyWater		Reactor whose heat source is a pressurized heavy-water reactor (PHWR) that uses heavy water (deuterium oxide D2O) as its coolant and neutron moderator.
lightWater		Reactor whose heat source is a light-water reactor (LWR) that is a type of thermal-neutron reactor that uses normal water, as both its coolant and neutron moderator – furthermore a solid form of fissile elements is used as fuel.
liquidMetal		Reactor whose liquid metal cooled nuclear reactor, liquid metal fast reactor or LMFR is an advanced type of nuclear reactor where the primary coolant is a liquid metal.

literal	value	description
other		Other type of nuclear reactors.

3.114 (NC) GeothermalUnitKind enumeration

Kind of geothermal.
Table 194 shows all literals of GeothermalUnitKind.

Table 194 – Literals of EquipmentReliabilityProfile::GeothermalUnitKind

literal	value	description
binaryCycle		The moderately hot geothermal water is passed by a secondary fluid with a much lower boiling point than water.
drySteam		Uses geothermal steam of 150 degree Celsius or greater to turn turbines.
flashSteam		Pull deep, high-pressure hot water into lower-pressure tanks and use the resulting flashed steam to drive turbines.
other		Other type of geothermal generating unit.

3.115 (NC) LogicalOperatorsKind enumeration

Kinds of logical operators for comparison.
Table 195 shows all literals of LogicalOperatorsKind.

Table 195 – Literals of EquipmentReliabilityProfile::LogicalOperatorsKind

literal	value	description
notEqual		Not equal (unlike) comparison operation.
equals		Equals (like) comparison operation.
lessThanOrEquals		Less than or equals comparison operation.
lessThan		Less than comparison operation.
greaterThanOrEquals		Greater than or equals comparison operation.
greaterThan		Greater than comparison operation.

3.116 (NC) PowerElectricalChemicalUnitKind enumeration

Kind of power electrical chemical unit.
Table 196 shows all literals of PowerElectricalChemicalUnitKind.

Table 196 – Literals of EquipmentReliabilityProfile::PowerElectricalChemicalUnitKind

literal	value	description
electrolyticCell		An electrolytic cell is an electrochemical cell that drives a non-spontaneous redox reaction through the application of electrical energy. Example are the decomposition of water into hydrogen and oxygen.
fuelCell		A fuel cell is an electrochemical cell that converts the chemical energy from a fuel into electricity through an electrochemical reaction of hydrogen fuel with oxygen or another oxidizing agent.
other		Other type of cell used in chemical reactions.

3.117 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 197 shows all literals of UnitMultiplier.

Table 197 – Literals of EquipmentReliabilityProfile::UnitMultiplier

literal	value	description
none	0	No multiplier or equivalently multiply by 1.
k	3	Kilo 10**3.
M	6	Mega 10**6.

3.118 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 198 shows all literals of UnitSymbol.

2387 **Table 198 – Literals of EquipmentReliabilityProfile::UnitSymbol**

literal	value	description
none	0	Dimension less quantity, e.g. count, per unit, etc.
s	4	Time in seconds.
A	5	Current in amperes.
deg	9	Plane angle in degrees.
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.
V	29	Electric potential in volts (W/A).
ohm	30	Electric resistance in ohms (V/A).
Hz	33	Frequency in hertz (1/s).
W	38	Real power in watts (J/s). Electrical power may have real and reactive components. The real portion of electrical power (I^2R or VIcos(phi)), is expressed in Watts. See also apparent power and reactive power.
Pa	39	Pressure in pascals (N/m^2). Note: the absolute or relative measurement of pressure is implied with this entry. See below for more explicit forms.
WPerm2	55	Heat flux density, irradiance, watts per square metre.
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.
WPers	81	Ramp rate in watts per second.
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.

2388

2389 ### 3.119 ActivePower datatype

2390 Product of RMS value of the voltage and the RMS value of the in-phase component of the
2391 current.
2392 Table 199 shows all attributes of ActivePower.

2393 **Table 199 – Attributes of EquipmentReliabilityProfile::ActivePower**

name	mult	type	description
multiplier	0..1	UnitMultiplier	(const=M)

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

3.120 ActivePowerChangeRate datatype

Rate of change of active power per time.
Table 200 shows all attributes of ActivePowerChangeRate.

Table 200 – Attributes of EquipmentReliabilityProfile::ActivePowerChangeRate

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

3.121 AngleDegrees datatype

Measurement of angle in degrees.
Table 201 shows all attributes of AngleDegrees.

Table 201 – Attributes of EquipmentReliabilityProfile::AngleDegrees

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

3.122 Frequency datatype

Cycles per second.
Table 202 shows all attributes of Frequency.

Table 202 – Attributes of EquipmentReliabilityProfile::Frequency

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

3.123 Impedance datatype

Ratio of voltage to current.
Table 203 shows all attributes of Impedance.

Table 203 – Attributes of EquipmentReliabilityProfile::Impedance

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

3.124 Money datatype

Amount of money.
Table 204 shows all attributes of Money.

Table 204 – Attributes of EquipmentReliabilityProfile::Money

name	mult	type	description
multiplier	0..1	UnitMultiplier	(const=none)
unit	0..1	Currency	
value	0..1	Decimal	

3.125 PerCent datatype

Percentage on a defined base. For example, specify as 100 to indicate at the defined base.
Table 205 shows all attributes of PerCent.

Table 205 – 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)

3.126 Reactance datatype

Reactance (imaginary part of impedance), at rated frequency.
Table 206 shows all attributes of Reactance.

Table 206 – Attributes of EquipmentReliabilityProfile::Reactance

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

3.127 Seconds datatype

Time, in seconds.
Table 207 shows all attributes of Seconds.

Table 207 – 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)

3.128 VoltagePerReactivePower datatype

Voltage variation with reactive power.
Table 208 shows all attributes of VoltagePerReactivePower.

Table 208 – Attributes of EquipmentReliabilityProfile::VoltagePerReactivePower

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

3.129 Boolean primitive

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

3.130 Decimal primitive

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

3.131 Duration primitive

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

3.132 Float primitive

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

3.133 Integer primitive

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

3.134 String primitive

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

3.135 (NC) SSSCSimulationSettings root class

SSSC control simulation settings used by the algorithm for power flow calculations.
Table 209 shows all attributes of SSSCSimulationSettings.

Table 209 – Attributes of EquipmentReliabilityProfile::SSSCSimulationSettings

name	mult	type	description
deltaX	1..1	Reactance	(NC) Reactance delta for the solution algorithm. The solution “outer-loop” algorithm is based on a secant method which needs two initial points. The second point is calculated from the first one by either adding or subtracting this “delta”. The “seed” is assumed to be 0 ohms.
maxIterations	1..1	Integer	(NC) Maximum number of iterations before claiming an open line condition. The algorithm uses it to assess if a line is really open by making sure low-currents are observed on various consecutive iterations.
maxMismatch	1..1	Voltage	(NC) Maximum mismatch tolerance of voltage target value. If mismatch is lower, convergence is claimed. It is only used for voltageInjection and currentDroop control modes.
maxCorrectionX	1..1	Reactance	(NC) Maximum value of the reactance correction applied between Iterations of the power flow calculation algorithm for the purpose of achieving control target value.

name	mult	type	description
isEstimateDLDVSensitive	1..1	Boolean	(NC) Defines if the estimate is considering the dI/dV sensitivity (true) instead of the secant algorithm (false).
mRID	1..1	String	(NC) 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.

3.136 (NC) RotatingMachineController

Inheritance path = EquipmentController : AutomationFunction : PowerSystemResource : IdentifiedObject

Rotating machine controller is controlling the equipment which may be used as a generator or motor.

Table 210 shows all attributes of RotatingMachineController.

Table 210 – Attributes of EquipmentReliabilityProfile::RotatingMachineController

name	mult	type	description
type	0..1	String	(NC) inherited from: AutomationFunction
normalEnabled	0..1	Boolean	(NC) inherited from: AutomationFunction
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 211 shows all association ends of RotatingMachineController with other classes.

Table 211 – Association ends of EquipmentReliabilityProfile::RotatingMachineController with other classes

mult from	name	mult to	type	description
0..*	PartOf	0..1	AutomationFunction	(NC) inherited from: AutomationFunction

3.137 (NC) InjectionController

Inheritance path = EquipmentController : AutomationFunction : PowerSystemResource : IdentifiedObject

Injection controller is controlling the equipment which represents an injection or an external network.

Table 212 shows all attributes of InjectionController.

Table 212 – Attributes of EquipmentReliabilityProfile::InjectionController

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

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 213 shows all association ends of InjectionController with other classes.

Table 213 – Association ends of EquipmentReliabilityProfile::InjectionController with other classes

mult from	name	mult to	type	description
0..*	PartOf	0..1	AutomationFunction	(NC) inherited from: AutomationFunction

3.138 (NC) CurrentControlFunction

Inheritance path = ControlFunctionBlock : FunctionBlock : IdentifiedObject
Current control function is a function block that calculates the operating point of the controlled equipment to achieve the target current.
Table 214 shows all attributes of CurrentControlFunction.

Table 214 – Attributes of EquipmentReliabilityProfile::CurrentControlFunction

name	mult	type	description
isDiscrete	1..1	Boolean	(NC) inherited from: ControlFunctionBlock
targetDeadband	0..1	Float	(NC) inherited from: ControlFunctionBlock
maxAllowedTargetValue	0..1	PerCent	(NC) inherited from: ControlFunctionBlock
minAllowedTargetValue	0..1	PerCent	(NC) inherited from: ControlFunctionBlock
normalEnabled	0..1	Boolean	(NC) inherited from: FunctionBlock
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 215 shows all association ends of CurrentControlFunction with other classes.

Table 215 – Association ends of EquipmentReliabilityProfile::CurrentControlFunction with other classes

mult from	name	mult to	type	description
0..*	AutomationFunction	0..1	AutomationFunction	(NC) inherited from: FunctionBlock
1..*	AutomationBlockGroup	0..1	AutomationBlockGroup	(NC) inherited from: FunctionBlock

3.139 (NC) TCSCCompensationPoint root class

Compensation point of a TCSC compensator.
Table 216 shows all attributes of TCSCCompensationPoint.

Table 216 – Attributes of EquipmentReliabilityProfile::TCSCCompensationPoint

name	mult	type	description
compensationZ	1..1	Impedance	(NC) The compensation impedance for this compensation point.
mRID	1..1	String	(NC) 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.
section	1..1	Integer	(NC) The number of the section.

Table 217 shows all association ends of TCSCCompensationPoint with other classes.

Table 217 – Association ends of EquipmentReliabilityProfile::TCSCCompensationPoint with other classes

mult from	name	mult to	type	description
0..*	ThyristorControlledSeriesCompensator	1..1	ThyristorControlledSeriesCompensator	(NC) TCSC that has different compensation points.

3.140 (NC) StaticVarCompensator

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

A facility for providing variable and controllable shunt reactive power. The SVC typically consists of a stepdown transformer, filter, thyristor-controlled reactor, and thyristor-switched capacitor arms.

The SVC may operate in fixed MVar output mode or in voltage control mode. When in voltage control mode, the output of the SVC will be proportional to the deviation of voltage at the controlled bus from the voltage setpoint. The SVC characteristic slope defines the proportion. If the voltage at the controlled bus is equal to the voltage setpoint, the SVC MVar output is zero.

Table 218 shows all attributes of StaticVarCompensator.

Table 218 – Attributes of EquipmentReliabilityProfile::StaticVarCompensator

name	mult	type	description
slope	1..1	VoltagePerReactivePower	(NC) inherited from: FACTSEquipment
ratedI	0..1	CurrentFlow	(NC) inherited from: FACTSEquipment
ratedU	0..1	Voltage	(NC) inherited from: FACTSEquipment
ratedC	0..1	Reactance	(NC) inherited from: FACTSEquipment
ratedL	0..1	Reactance	(NC) inherited from: FACTSEquipment
minC	0..1	Reactance	(NC) inherited from: FACTSEquipment
maxC	0..1	Reactance	(NC) inherited from: FACTSEquipment
minL	0..1	Reactance	(NC) inherited from: FACTSEquipment
maxL	0..1	Reactance	(NC) inherited from: FACTSEquipment
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject

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 219 shows all association ends of StaticVarCompensator with other classes.

Table 219 – Association ends of EquipmentReliabilityProfile::StaticVarCompensator with other classes

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

3.141 (NC) LossCurve

Inheritance path = Curve : IdentifiedObject

Represents the losses in the equipment due to operation position.

Table 220 shows all attributes of LossCurve.

Table 220 – Attributes of EquipmentReliabilityProfile::LossCurve

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
y2Multiplier	0..1	UnitMultiplier	inherited from: Curve
y2Unit	0..1	UnitSymbol	inherited from: Curve
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 221 shows all association ends of LossCurve with other classes.

Table 221 – Association ends of EquipmentReliabilityProfile::LossCurve with other classes

mult from	name	mult to	type	description
0..*	FACTSEquipment	0..1	FACTSEquipment	(NC) The FACTS equipment which has a loss curve.

3.142 (Description) DCSwitch

Inheritance path = DCConductingEquipment : Equipment : PowerSystemResource : IdentifiedObject

A switch within the DC system.
Table 222 shows all attributes of DCSwitch.

Table 222 – Attributes of EquipmentReliabilityProfile::DCSwitch

name	mult	type	description
ratedCurrent	0..1	CurrentFlow	(NC) inherited from: DCConductingEquipment
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 223 shows all association ends of DCSwitch with other classes.

Table 223 – Association ends of EquipmentReliabilityProfile::DCSwitch with other classes

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

3.143 (abstract) DCConductingEquipment

Inheritance path = Equipment : PowerSystemResource : IdentifiedObject
The parts of the DC power system that are designed to carry current or that are conductively connected through DC terminals.
Table 224 shows all attributes of DCConductingEquipment.

Table 224 – Attributes of EquipmentReliabilityProfile::DCConductingEquipment

name	mult	type	description
ratedCurrent	0..1	CurrentFlow	(NC) The maximum continuous current carrying capacity in amps governed by the device material and construction. The attribute shall be a positive value.
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 225 shows all association ends of DCConductingEquipment with other classes.

Table 225 – Association ends of EquipmentReliabilityProfile::DCConductingEquipment with other classes

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

3.144 (Description) DCDisconnector

Inheritance path = DCSwitch : DCConductingEquipment : Equipment : PowerSystemResource : IdentifiedObject

A disconnector within a DC system.

Table 226 shows all attributes of DCDisconnector.

Table 226 – Attributes of EquipmentReliabilityProfile::DCDisconnector

name	mult	type	description
ratedCurrent	0..1	CurrentFlow	(NC) inherited from: DCConductingEquipment
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 227 shows all association ends of DCDisconnector with other classes.

Table 227 – Association ends of EquipmentReliabilityProfile::DCDisconnector with other classes

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

3.145 (Description) DCBreaker

Inheritance path = DCSwitch : DCConductingEquipment : Equipment : PowerSystemResource : IdentifiedObject

A breaker within a DC system.

Table 228 shows all attributes of DCBreaker.

Table 228 – Attributes of EquipmentReliabilityProfile::DCBreaker

name	mult	type	description
ratedCurrent	0..1	CurrentFlow	(NC) inherited from: DCConductingEquipment
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 229 shows all association ends of DCBreaker with other classes.

Table 229 – Association ends of EquipmentReliabilityProfile::DCBreaker with other classes

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

3.146 (Description) DCGround

Inheritance path = DCConductingEquipment : Equipment : PowerSystemResource : IdentifiedObject

A ground within a DC system.

Table 230 shows all attributes of DCGround.

Table 230 – Attributes of EquipmentReliabilityProfile::DCGround

name	mult	type	description
ratedCurrent	0..1	CurrentFlow	(NC) inherited from: DCConductingEquipment
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 231 shows all association ends of DCGround with other classes.

Table 231 – Association ends of EquipmentReliabilityProfile::DCGround with other classes

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

3.147 (Description) DCBusbar

Inheritance path = DCConductingEquipment : Equipment : PowerSystemResource : IdentifiedObject

A busbar within a DC system.

Table 232 shows all attributes of DCBusbar.

Table 232 – Attributes of EquipmentReliabilityProfile::DCBusbar

name	mult	type	description
ratedCurrent	0..1	CurrentFlow	(NC) inherited from: DCConductingEquipment
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 233 shows all association ends of DCBusbar with other classes.

Table 233 – Association ends of EquipmentReliabilityProfile::DCBusbar with other classes

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

3.148 (Description) DCShunt

Inheritance path = DCConductingEquipment : Equipment : PowerSystemResource : IdentifiedObject

A shunt device within the DC system, typically used for filtering. Needed for transient and short circuit studies.

Table 234 shows all attributes of DCShunt.

Table 234 – Attributes of EquipmentReliabilityProfile::DCShunt

name	mult	type	description
ratedCurrent	0..1	CurrentFlow	(NC) inherited from: DCConductingEquipment
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 235 shows all association ends of DCShunt with other classes.

Table 235 – Association ends of EquipmentReliabilityProfile::DCShunt with other classes

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

3.149 (Description) DCSeriesDevice

Inheritance path = DCConductingEquipment : Equipment : PowerSystemResource : IdentifiedObject

A series device within the DC system, typically a reactor used for filtering or smoothing. Needed for transient and short circuit studies.

Table 236 shows all attributes of DCSeriesDevice.

Table 236 – Attributes of EquipmentReliabilityProfile::DCSeriesDevice

name	mult	type	description
ratedCurrent	0..1	CurrentFlow	(NC) inherited from: DCConductingEquipment
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 237 shows all association ends of DCSeriesDevice with other classes.

Table 237 – Association ends of EquipmentReliabilityProfile::DCSeriesDevice with other classes

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

3.150 (Description) DCLineSegment

Inheritance path = DCConductingEquipment : Equipment : PowerSystemResource : IdentifiedObject

A wire or combination of wires not insulated from one another, with consistent electrical characteristics, used to carry direct current between points in the DC region of the power system.

Table 238 shows all attributes of DCLineSegment.

Table 238 – Attributes of EquipmentReliabilityProfile::DCLineSegment

name	mult	type	description
ratedCurrent	0..1	CurrentFlow	(NC) inherited from: DCConductingEquipment
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 239 shows all association ends of DCLineSegment with other classes.

Table 239 – Association ends of EquipmentReliabilityProfile::DCLineSegment with other classes

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

3.151 (Description) DCChopper

Inheritance path = DCConductingEquipment : Equipment : PowerSystemResource : IdentifiedObject

Low resistance equipment used in the internal DC circuit to balance voltages. It has typically positive and negative pole terminals and a ground.

Table 240 shows all attributes of DCChopper.

Table 240 – Attributes of EquipmentReliabilityProfile::DCChopper

name	mult	type	description
ratedCurrent	0..1	CurrentFlow	(NC) inherited from: DCConductingEquipment
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 241 shows all association ends of DCChopper with other classes.

Table 241 – Association ends of EquipmentReliabilityProfile::DCChopper with other classes

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

3.152 (Description) TieFlow

Inheritance path = IdentifiedObject

Defines the structure (in terms of location and direction) of the net interchange constraint for a control area. This constraint may be used by either AGC or power flow.

Table 242 shows all attributes of TieFlow.

Table 242 – Attributes of EquipmentReliabilityProfile::TieFlow

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 243 shows all association ends of TieFlow with other classes.

Table 243 – Association ends of EquipmentReliabilityProfile::TieFlow with other classes

mult from	name	mult to	type	description
0..*	TieCorridor	0..1	TieCorridor	(NC) Tie corridor which has the tie flow.

3.153 (NC) PowerPlantController

Inheritance path = EquipmentController : AutomationFunction : PowerSystemResource : IdentifiedObject

Power plant controller is controlling the equipment of a power plant.

Table 244 shows all attributes of PowerPlantController.

Table 244 – Attributes of EquipmentReliabilityProfile::PowerPlantController

name	mult	type	description
type	0..1	String	(NC) inherited from: AutomationFunction
normalEnabled	0..1	Boolean	(NC) inherited from: AutomationFunction
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 245 shows all association ends of PowerPlantController with other classes.

Table 245 – Association ends of EquipmentReliabilityProfile::PowerPlantController with other classes

mult from	name	mult to	type	description
0..*	PartOf	0..1	AutomationFunction	(NC) inherited from: AutomationFunction

3.154 (NC) TCSCController

Inheritance path = EquipmentController : AutomationFunction : PowerSystemResource : IdentifiedObject

TCSC controller is controlling the equipment to optimize the performance of the TCSC.

Table 246 shows all attributes of TCSCController.

Table 246 – Attributes of EquipmentReliabilityProfile::TCSCController

name	mult	type	description
type	0..1	String	(NC) inherited from: AutomationFunction
normalEnabled	0..1	Boolean	(NC) inherited from: AutomationFunction
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 247 shows all association ends of TCSCController with other classes.

Table 247 – Association ends of EquipmentReliabilityProfile::TCSCController with other classes

mult from	name	mult to	type	description
0..*	PartOf	0..1	AutomationFunction	(NC) inherited from: AutomationFunction

3.155 (NC) DCCurrentControlFunction

Inheritance path = ControlFunctionBlock : FunctionBlock : IdentifiedObject

DC current control function is a function block that calculates the operating point of the controlled equipment to achieve the target current.

Table 248 shows all attributes of DCCurrentControlFunction.

Table 248 – Attributes of EquipmentReliabilityProfile::DCCurrentControlFunction

name	mult	type	description
droop	0..1	PU	(NC) Droop constant. The pu value is obtained as D [kV/MW] x Sb / Ubdc. The attribute shall be a positive value.
droopCompensation	0..1	Resistance	(NC) Compensation constant. Used to compensate for voltage drop when controlling voltage at a distant bus. The attribute shall be a positive value.
isDiscrete	1..1	Boolean	(NC) inherited from: ControlFunctionBlock
targetDeadband	0..1	Float	(NC) inherited from: ControlFunctionBlock
maxAllowedTargetValue	0..1	PerCent	(NC) inherited from: ControlFunctionBlock
minAllowedTargetValue	0..1	PerCent	(NC) inherited from: ControlFunctionBlock

name	mult	type	description
normalEnabled	0..1	Boolean	(NC) inherited from: FunctionBlock
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 249 shows all association ends of DCCurrentControlFunction with other classes.

Table 249 – Association ends of EquipmentReliabilityProfile::DCCurrentControlFunction with other classes

mult from	name	mult to	type	description
0..*	AutomationFunction	0..1	AutomationFunction	(NC) inherited from: FunctionBlock
1..*	AutomationBlockGroup	0..1	AutomationBlockGroup	(NC) inherited from: FunctionBlock

3.156 (NC) DCVoltageControlFunction

Inheritance path = ControlFunctionBlock : FunctionBlock : IdentifiedObject

DC voltage control function is a function block that calculate the operating point of the controlled equipment to achieve the target voltage.

Table 250 shows all attributes of DCVoltageControlFunction.

Table 250 – Attributes of EquipmentReliabilityProfile::DCVoltageControlFunction

name	mult	type	description
isDiscrete	1..1	Boolean	(NC) inherited from: ControlFunctionBlock
targetDeadband	0..1	Float	(NC) inherited from: ControlFunctionBlock
maxAllowedTargetValue	0..1	PerCent	(NC) inherited from: ControlFunctionBlock
minAllowedTargetValue	0..1	PerCent	(NC) inherited from: ControlFunctionBlock
normalEnabled	0..1	Boolean	(NC) inherited from: FunctionBlock
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 251 shows all association ends of DCVoltageControlFunction with other classes.

Table 251 – Association ends of EquipmentReliabilityProfile::DCVoltageControlFunction with other classes

mult from	name	mult to	type	description
0..*	AutomationFunction	0..1	AutomationFunction	(NC) inherited from: FunctionBlock
1..*	AutomationBlockGroup	0..1	AutomationBlockGroup	(NC) inherited from: FunctionBlock

3.157 (NC) PhaseControlFunction

Inheritance path = ControlFunctionBlock : FunctionBlock : IdentifiedObject

Phase control function is a function block that calculate the operating point of the controlled equipment to achieve the target voltage.
Table 252 shows all attributes of PhaseControlFunction.

Table 252 – Attributes of EquipmentReliabilityProfile::PhaseControlFunction

name	mult	type	description
isDiscrete	1..1	Boolean	(NC) inherited from: ControlFunctionBlock
targetDeadband	0..1	Float	(NC) inherited from: ControlFunctionBlock
maxAllowedTargetValue	0..1	PerCent	(NC) inherited from: ControlFunctionBlock
minAllowedTargetValue	0..1	PerCent	(NC) inherited from: ControlFunctionBlock
normalEnabled	0..1	Boolean	(NC) inherited from: FunctionBlock
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 253 shows all association ends of PhaseControlFunction with other classes.

Table 253 – Association ends of EquipmentReliabilityProfile::PhaseControlFunction with other classes

mult from	name	mult to	type	description
0..*	AutomationFunction	0..1	AutomationFunction	(NC) inherited from: FunctionBlock
1..*	AutomationBlockGroup	0..1	AutomationBlockGroup	(NC) inherited from: FunctionBlock

3.158 (NC) RampingPrincipleKind enumeration

Kind of ramping principle.
Table 254 shows all literals of RampingPrincipleKind.

Table 254 – Literals of EquipmentReliabilityProfile::RampingPrincipleKind

literal	value	description
fiveMinutes		Five minutes ramping principle. Ramping starts five minutes before the schedule time point and ends five minutes after. For instance, if the schedule time point is 19:30h it starts at 19:25h and ends at 19:35h.
fifteenMinutes		Fifteen minutes ramping principle. Ramping starts 15 minutes before the schedule time point and ends 15 minutes after. For instance, if the schedule time point is 19:30h it starts at 19:15h and ends at 19:45h.
continuous		Continuous ramping principle is applied between two scheduled time point. For instance, from 10 MW to 70 MW over one hour the change is 1 MW/min.
tenMinutes		Ten minutes ramping principle. Ramping starts 10 minutes before the schedule time point and ends 10 minutes after. For instance, if the schedule time point is 19:30h it starts at 19:20h and ends at 19:40h.

literal	value	description
maxContinuous		Maximum continuous ramping principle. The schedule is kept as long as possible and the maximum ramping rate is used to get from one point to another, symmetrically around the schedule time points. For example, there is 40 MW change in the schedule the maximum ramp rate is 20 MW/min the ramping starts 1 min before (e.g. 19:29h) and finishes 1 min after (e.g. 19:31h).

3.159 (NC) DirectCurrentCircuit

Inheritance path = Circuit : PowerSystemResource : IdentifiedObject

A direct current circuit is a circuit consists of direct current equipment.

Table 255 shows all attributes of DirectCurrentCircuit.

Table 255 – Attributes of EquipmentReliabilityProfile::DirectCurrentCircuit

name	mult	type	description
positiveFlowIn	1..1	Boolean	(NC) inherited from: Circuit
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 256 shows all association ends of DirectCurrentCircuit with other classes.

Table 256 – Association ends of EquipmentReliabilityProfile::DirectCurrentCircuit with other classes

mult from	name	mult to	type	description
0..1	IdentifyingTerminal	0..1	Terminal	(NC) inherited from: Circuit

3.160 (NC) OverlappingZone

Inheritance path = IdentifiedObject

A collection of all the overlapping cross border assessed elements which have the same sets of impacted and impacting regions.

Table 257 shows all attributes of OverlappingZone.

Table 257 – Attributes of EquipmentReliabilityProfile::OverlappingZone

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

3.161 (NC) TapChangerController

Inheritance path = EquipmentController : AutomationFunction : PowerSystemResource : IdentifiedObject

Tap changer controller is an equipment controller that controls a tap changer, e.g. how the voltage at the end of a line varies with the load level and compensation of the voltage drop by tap adjustment.
Table 258 shows all attributes of TapChangerController.

Table 258 – Attributes of EquipmentReliabilityProfile::TapChangerController

name	mult	type	description
type	0..1	String	(NC) inherited from: AutomationFunction
normalEnabled	0..1	Boolean	(NC) inherited from: AutomationFunction
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 259 shows all association ends of TapChangerController with other classes.

Table 259 – Association ends of EquipmentReliabilityProfile::TapChangerController with other classes

mult from	name	mult to	type	description
0..*	PartOf	0..1	AutomationFunction	(NC) inherited from: AutomationFunction

3.162 (NC) CurrentDroopControlFunction

Inheritance path = ControlFunctionBlock : FunctionBlock : IdentifiedObject
Current droop control function is a function block that calculates the operating point of the controlled equipment to achieve the target current.
Table 260 shows all attributes of CurrentDroopControlFunction.

Table 260 – Attributes of EquipmentReliabilityProfile::CurrentDroopControlFunction

name	mult	type	description
offsetInductive	1..1	CurrentFlow	(NC) Offset in capacitive region.
droopInductive	1..1	Float	(NC) Droop in inductive region. The unit is V/A.
offsetCapacitive	1..1	CurrentFlow	(NC) Offset in capacitive region.
droopCapacitive	1..1	Float	(NC) Droop in capacitive region. The unit is V/A.
isDiscrete	1..1	Boolean	(NC) inherited from: ControlFunctionBlock
targetDeadband	0..1	Float	(NC) inherited from: ControlFunctionBlock
maxAllowedTargetValue	0..1	PerCent	(NC) inherited from: ControlFunctionBlock
minAllowedTargetValue	0..1	PerCent	(NC) inherited from: ControlFunctionBlock
normalEnabled	0..1	Boolean	(NC) inherited from: FunctionBlock
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 261 shows all association ends of CurrentDroopControlFunction with other classes.

Table 261 – Association ends of EquipmentReliabilityProfile::CurrentDroopControlFunction with other classes

mult from	name	mult to	type	description
0..*	AutomationFunction	0..1	AutomationFunction	(NC) inherited from: FunctionBlock
1..*	AutomationBlockGroup	0..1	AutomationBlockGroup	(NC) inherited from: FunctionBlock

3.163 (NC) VoltageInjectionControlFunction

Inheritance path = ControlFunctionBlock : FunctionBlock : IdentifiedObject

Voltage injection control function is a function block that calculates the operating point of the controlled equipment to achieve the target voltage injection. The controlled point is the Terminal with sequenceNumber =1.

Table 262 shows all attributes of VoltageInjectionControlFunction.

Table 262 – Attributes of EquipmentReliabilityProfile::VoltageInjectionControlFunction

name	mult	type	description
isDiscrete	1..1	Boolean	(NC) inherited from: ControlFunctionBlock
targetDeadband	0..1	Float	(NC) inherited from: ControlFunctionBlock
maxAllowedTargetValue	0..1	PerCent	(NC) inherited from: ControlFunctionBlock
minAllowedTargetValue	0..1	PerCent	(NC) inherited from: ControlFunctionBlock
normalEnabled	0..1	Boolean	(NC) inherited from: FunctionBlock
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 263 shows all association ends of VoltageInjectionControlFunction with other classes.

Table 263 – Association ends of EquipmentReliabilityProfile::VoltageInjectionControlFunction with other classes

mult from	name	mult to	type	description
0..*	AutomationFunction	0..1	AutomationFunction	(NC) inherited from: FunctionBlock
1..*	AutomationBlockGroup	0..1	AutomationBlockGroup	(NC) inherited from: FunctionBlock

3.164 (NC) SSSCController

Inheritance path = EquipmentController : AutomationFunction : PowerSystemResource : IdentifiedObject

The controller of a Static synchronous series compensator (SSSC).

Table 264 shows all attributes of SSSCController.

Table 264 – Attributes of EquipmentReliabilityProfile::SSSCController

name	mult	type	description
minInjectionU	1..1	Voltage	(NC) Minimum voltage that the device can inject.
maxInjectionU	1..1	Voltage	(NC) Maximum voltage that the device can inject.

name	mult	type	description
maxLimitI	0..1	CurrentFlow	(NC) Maximum operating current limit applied for the controller and used by any of the available control functions.
minLimitI	0..1	CurrentFlow	(NC) Minimum operating current limit applied for the controller and used by any of the available control functions.
type	0..1	String	(NC) inherited from: AutomationFunction
normalEnabled	0..1	Boolean	(NC) inherited from: AutomationFunction
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 265 shows all association ends of SSSCController with other classes.

Table 265 – Association ends of EquipmentReliabilityProfile::SSSCController with other classes

mult from	name	mult to	type	description
0..*	SSSCSimulationSettings	0..1	SSSCSimulationSettings	(NC) The simulation setings that apply for this controller.
0..*	PartOf	0..1	AutomationFunction	(NC) inherited from: AutomationFunction

3.165 (NC) CurrentDroopOverride root class

Current droop override uses the following logic:
- When the current exceeds a threshold the device executes the following transitions: 1) When injecting an inductive voltage or in monitoring mode the device tends to inject a voltage proportional to the difference between the line current and the aforementioned threshold. 2) When injecting a capacitive voltage the device transitions to monitoring mode.
- If the aforementioned proportional voltage is lower than the initial one, the voltage injection remains unchanged.

Current droop override is not applied when the device operates in currentDroop mode.
Table 266 shows all attributes of CurrentDroopOverride.

Table 266 – Attributes of EquipmentReliabilityProfile::CurrentDroopOverride

name	mult	type	description
droopCapacitive	1..1	Float	(NC) Droop in capacitive region. The unit is V/A.
droopInductive	1..1	Float	(NC) Droop in inductive region. The unit is V/A.
offsetCapacitiveI	1..1	CurrentFlow	(NC) Offset in capacitive region.
offsetInductiveI	1..1	CurrentFlow	(NC) Offset in capacitive region.
mRID	1..1	String	(NC) 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.

Table 267 shows all association ends of CurrentDroopOverride with other classes.

Table 267 – Association ends of EquipmentReliabilityProfile::CurrentDroopOverride with other classes

mult from	name	mult to	type	description
0..1	SSSCController	1..1	SSSCController	(NC) The SSSC controller to which this CurrentDroopOverride applies to.

3.166 CurrentFlow datatype

Electrical current with sign convention: positive flow is out of the conducting equipment into the connectivity node. Can be both AC and DC.
Table 268 shows all attributes of CurrentFlow.

Table 268 – Attributes of EquipmentReliabilityProfile::CurrentFlow

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

3.167 Voltage datatype

Electrical voltage, can be both AC and DC.
Table 269 shows all attributes of Voltage.

Table 269 – Attributes of EquipmentReliabilityProfile::Voltage

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

3.168 PU datatype

Per Unit - a positive or negative value referred to a defined base. Values typically range from -10 to +10.
Table 270 shows all attributes of PU.

Table 270 – Attributes of EquipmentReliabilityProfile::PU

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

3.169 Resistance datatype

Resistance (real part of impedance).
Table 271 shows all attributes of Resistance.

Table 271 – Attributes of EquipmentReliabilityProfile::Resistance

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

3.170 (abstract) SynchronousMachine root class

An electromechanical device that operates with shaft rotating synchronously with the network. It is a single machine operating either as a generator or synchronous condenser or pump.

3.171 ReactiveCapabilityCurve

Inheritance path = Curve : IdentifiedObject

Reactive power rating envelope versus the synchronous machine's active power, in both the generating and motoring modes. For each active power value there is a corresponding high and low reactive power limit value. Typically there will be a separate curve for each coolant condition, such as hydrogen pressure. The Y1 axis values represent reactive minimum and the Y2 axis values represent reactive maximum.

Table 272 shows all attributes of ReactiveCapabilityCurve.

Table 272 – Attributes of EquipmentReliabilityProfile::ReactiveCapabilityCurve

name	mult	type	description
referenceVoltage	1..1	Voltage	(NC) The reference voltage for which the capability curve is valid.
coolantTemperature	0..1	Temperature	The machine's coolant temperature (e.g., ambient air or stator circulating water).
hydrogenPressure	0..1	Pressure	The hydrogen coolant pressure.
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
y2Multiplier	0..1	UnitMultiplier	inherited from: Curve
y2Unit	0..1	UnitSymbol	inherited from: Curve
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 273 shows all association ends of ReactiveCapabilityCurve with other classes.

Table 273 – Association ends of EquipmentReliabilityProfile::ReactiveCapabilityCurve with other classes

mult from	name	mult to	type	description
0..*	SynchronousMachine2	0..1	SynchronousMachine	(NC) Synchronous machine using this curve.

mult from	name	mult to	type	description
0..*	EquivalentInjection2	0..1	EquivalentInjection	(NC) The equivalent injection using this reactive capability curve.

3.172 Temperature datatype

Value of temperature in degrees Celsius.
Table 274 shows all attributes of Temperature.

Table 274 – Attributes of EquipmentReliabilityProfile::Temperature

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

3.173 Pressure datatype

Pressure in pascals.
Table 275 shows all attributes of Pressure.

Table 275 – Attributes of EquipmentReliabilityProfile::Pressure

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

3.174 (abstract) VsConverter root class

DC side of the voltage source converter (VSC).

3.175 VsCapabilityCurve

Inheritance path = Curve : IdentifiedObject
The P-Q capability curve for a voltage source converter, with P on X-axis and Qmin and Qmax on Y1-axis and Y2-axis.
Table 276 shows all attributes of VsCapabilityCurve.

Table 276 – Attributes of EquipmentReliabilityProfile::VsCapabilityCurve

name	mult	type	description
referenceVoltage	1..1	Voltage	(NC) The reference voltage for which the capability curve is valid.
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
y2Multiplier	0..1	UnitMultiplier	inherited from: Curve
y2Unit	0..1	UnitSymbol	inherited from: Curve
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject

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 277 shows all association ends of VsCapabilityCurve with other classes.

Table 277 – Association ends of EquipmentReliabilityProfile::VsCapabilityCurve with other classes

mult from	name	mult to	type	description
0..*	VsConverter	1..1	VsConverter	(NC) Converter with this capability curve.

3.176 (Description) EquivalentInjection root class

This class represents equivalent injections (generation or load). Voltage regulation is allowed only at the point of connection.
Table 278 shows all association ends of EquivalentInjection with other classes.

Table 278 – Association ends of EquipmentReliabilityProfile::EquivalentInjection with other classes

mult from	name	mult to	type	description
0..*	InjectionController	0..1	InjectionController	(NC) Injection controller which controls the equivalent injection.

3.177 (abstract) ACDCConverter

Inheritance path = ConductingEquipment : Equipment : PowerSystemResource : IdentifiedObject
A unit with valves for three phases, together with unit control equipment, essential protective and switching devices, DC storage capacitors, phase reactors and auxiliaries, if any, used for conversion.
Table 279 shows all attributes of ACDCConverter.

Table 279 – Attributes of EquipmentReliabilityProfile::ACDCConverter

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 280 shows all association ends of ACDCConverter with other classes.

Table 280 – Association ends of EquipmentReliabilityProfile::ACDCConverter with other classes

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

3.178 Reservoir

Inheritance path = PowerSystemResource : IdentifiedObject
A water storage facility within a hydro system, including: ponds, lakes, lagoons, and rivers. The storage is usually behind some type of dam.
Table 281 shows all attributes of Reservoir.

Table 281 – Attributes of EquipmentReliabilityProfile::Reservoir

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

3.179 (Description) HydroPowerPlant root class

A hydro power station which can generate or pump. When generating, the generator turbines receive water from an upper reservoir. When pumping, the pumps receive their water from a lower reservoir.
Table 282 shows all association ends of HydroPowerPlant with other classes.

Table 282 – Association ends of EquipmentReliabilityProfile::HydroPowerPlant with other classes

mult from	name	mult to	type	description
0..*	Reservoir	0..1	Reservoir	Generators discharge water to or pumps are supplied water from a downstream reservoir.

3.180 (NC) InfeedLimit

Inheritance path = OperationalLimit : IdentifiedObject
Infeed limit set constraints fed in to the network by two or more terminals.
Table 283 shows all attributes of InfeedLimit.

Table 283 – Attributes of EquipmentReliabilityProfile::InfeedLimit

name	mult	type	description
normalValueW	0..1	ActivePower	(NC) The normal value of active power limit. The attribute shall be a positive value or zero.
normalValueA	0..1	CurrentFlow	(NC) The normal current limit. The attribute shall be a positive value or zero.
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 284 shows all association ends of InfeedLimit with other classes.

Table 284 – Association ends of EquipmentReliabilityProfile::InfeedLimit with other classes

mult from	name	mult to	type	description
1..*	OperationalLimitType	1..1	OperationalLimitType	inherited from: OperationalLimit
1..*	OperationalLimitSet	1..1	OperationalLimitSet	inherited from: OperationalLimit

3.181 (NC) InfeedTerminal root class

Infeed terminal defines the terminals that are linked to an infeed limit.
Table 285 shows all attributes of InfeedTerminal.

Table 285 – Attributes of EquipmentReliabilityProfile::InfeedTerminal

name	mult	type	description
mRID	1..1	String	(NC) 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.

Table 286 shows all association ends of InfeedTerminal with other classes.

Table 286 – Association ends of EquipmentReliabilityProfile::InfeedTerminal with other classes

mult from	name	mult to	type	description
0..*	ACDCTerminal	1..1	ACDCTerminal	(NC) ACDCTerminal which is connected to an infeed terminal.
0..*	InfeedConstraint	1..1	InfeedLimit	(NC) Infeed constraint which belongs to an infeed terminal.

3.182 (NC) FuelStorage

Inheritance path = PowerSystemResource : IdentifiedObject
Fuel storage. e.g. pile of coal that can be shared between multiple thermal generating units.
Table 287 shows all attributes of FuelStorage.

Table 287 – Attributes of EquipmentReliabilityProfile::FuelStorage

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

3.183 (Description) FossilFuel root class

The fossil fuel consumed by the non-nuclear thermal generating unit. For example, coal, oil, gas, etc. These are the specific fuels that the generating unit can consume.

Table 288 shows all association ends of FossilFuel with other classes.

Table 288 – Association ends of EquipmentReliabilityProfile::FossilFuel with other classes

mult from	name	mult to	type	description
0..*	FuelStorage	0..1	FuelStorage	(NC) Fuel storage that store fossil fuels.

3.184 (NC) ACTieCorridor

Inheritance path = TieCorridor : PowerSystemResource : IdentifiedObject

A collection of one or more AC tie lines that connect two different control areas.

Table 289 shows all attributes of ACTieCorridor.

Table 289 – Attributes of EquipmentReliabilityProfile::ACTieCorridor

name	mult	type	description
delayRegulatingReserve	0..1	Seconds	(NC) inherited from: TieCorridor
maxRegulatingReserveRamp	0..1	Float	(NC) inherited from: TieCorridor
thresholdRegulatingReserve	0..1	ActivePower	(NC) inherited from: TieCorridor
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 290 shows all association ends of ACTieCorridor with other classes.

Table 290 – Association ends of EquipmentReliabilityProfile::ACTieCorridor with other classes

mult from	name	mult to	type	description
0..*	LoadFrequencyControlArea	0..1	LoadFrequencyControlArea	(NC) inherited from: TieCorridor
0..*	BiddingZoneBorder	0..1	BiddingZoneBorder	(NC) inherited from: TieCorridor

3.185 (NC) PowerCapacity root class

Power capacity defines the capacity in regard to generation, consumption and transmission (import and export) for a relevant power system resource, e.g. bidding zone, including maximum and minimum electrical power capacity and any capacity allocation.

3.186 (NC) PowerShiftKeyStrategy

Inheritance path = IdentifiedObject

Strategy of the power shift key.

Table 291 shows all attributes of PowerShiftKeyStrategy.

Table 291 – Attributes of EquipmentReliabilityProfile::PowerShiftKeyStrategy

name	mult	type	description
powerShiftKey	0..1	PowerShiftKeyKind	(NC) Power shift keys strategy gives instruction on how the value (Active power) is going to be distributed inside the relevant bidding zone.
method	0..1	ShiftMethodKind	(NC) Shift method used for the power shift strategy.
normalParticipationFactor	0..1	Float	(NC) Normal participation factor describing the entities part of the power shift strategy. Must be a positive value.
powerBlockKind	0..1	PowerBlockKind	(NC) Power block kind creates block (one or more) of power shift key strategy to address increase and/or decrease of power for a given scheduling area.
dispatchableUnitOnly	0..1	Boolean	(NC) If true, only dispatchable units are included in the power shift key strategy. A unit is considered dispatchable if it is associated with an area dispatchable unit that is linked to the same scheduling area as the power shift key strategy. Exceptions are done for units that are included in explicit or distributed strategies.
normalEnabled	0..1	Boolean	(NC) If true, the assessed element shall be considered under normal operating conditions.
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 292 shows all association ends of PowerShiftKeyStrategy with other classes.

Table 292 – Association ends of EquipmentReliabilityProfile::PowerShiftKeyStrategy with other classes

mult from	name	mult to	type	description
0..*	SchedulingArea	0..1	SchedulingArea	(NC) Scheduling area associated with power shift key strategy.

3.187 (NC) ShiftMethodKind enumeration

Kind of shift method. Describes the way a power schedule should be distributed amongst production and consumption. e.g. Type of generating and load shift key.

Table 293 shows all literals of ShiftMethodKind.

Table 293 – Literals of EquipmentReliabilityProfile::ShiftMethodKind

literal	value	description
shared		Power schedule shift (distribution) is done by a shared fraction e.g. A two unit with the participation factor 60 and 40 will distribute a 10 MW schedule by 6 and 4 MW.
priority		Power schedule shift (distribution) is done by a shared fraction prioritizing the unit e.g. A two unit with the participation factor 60 and 40 will distribute a 10 MW increased schedule by first

literal	value	description
		filling the highest participation factor (priority) until max economy power or maximum power allowed by the unit before it starts filling the next on the list. e.g. The unit with 60 will be getting its maximum shared first. The same logic applies with reducing the schedule. e.g. The 60 participation factor unit will be reduced to its min economy factor or minimum power.

3.188 (NC) PowerShiftKeyKind enumeration

Kind of generating and load shift keys strategy.
Table 294 shows all literals of PowerShiftKeyKind.

Table 294 – Literals of EquipmentReliabilityProfile::PowerShiftKeyKind

literal	value	description
explicitInstruction		The distribution is done according to the individual participation factor on the unit.
explicitDistribution		The distribution is explicitly done according to the power shift key distribution in the power bid Schedule.
generatorsFlat		Flat adjustment, equal amount of power, on all active generators. e.g. 100 MW increase adjustment on 4 generators, it means that each of them get increased 25 MW, as long as no other constraints are violated.
consumptionsFlat		Flat adjustment, equal amount of power, on all active consumption units (Energy Consumers and Power Electronics like FlexibleEnergyUnit). e.g. 100 MW decrease adjustment on 4 loads, it means that each of them get reduced 25 MW, as long as no other constraints are violated.
generatorsPmax		The distribution is relative to the maximum p of the generator.
generatorsP		The distribution is based on the generators active power in the given case.
consumptionsP		The distribution is based on the consumptions active power in the given case.
generatorsAndConsumptionsP		The distribution is based on the generator and consumption active power in the given case.
generatorsRemainingCapacity		The distribution is based on the remaining capacity for generators in the given case.
nonConformLoadP		The distribution is based on the non conform load active power in the given case.
storageP		The distribution is based on the batteries and any operating hydro pumps active power in the given case.
storageFlat		Flat adjustment, equal amount of power, on all the batteries and any operating hydro pumps. e.g. 100 MW increase or decrease adjustment on 4 batteries, it means that each of them get increased or reduced 25 MW, as long as no other constraints are violated.
generatorsPmin		The distribution is relative to the minimum p of the generator.

literal	value	description
generatorsUsedCapacity		The distribution is based on the used capacity, the difference between the minimum operation and operating p (GeneratingUnit.minOperatingP)

3.189 (NC) FrequencyControlFunction

Inheritance path = ControlFunctionBlock : FunctionBlock : IdentifiedObject
Frequency control function is a function block that calculate the operating point of the controlled equipment to achieve the target frequency.
Table 295 shows all attributes of FrequencyControlFunction.

Table 295 – Attributes of EquipmentReliabilityProfile::FrequencyControlFunction

name	mult	type	description
isDiscrete	1..1	Boolean	(NC) inherited from: ControlFunctionBlock
targetDeadband	0..1	Float	(NC) inherited from: ControlFunctionBlock
maxAllowedTargetValue	0..1	PerCent	(NC) inherited from: ControlFunctionBlock
minAllowedTargetValue	0..1	PerCent	(NC) inherited from: ControlFunctionBlock
normalEnabled	0..1	Boolean	(NC) inherited from: FunctionBlock
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 296 shows all association ends of FrequencyControlFunction with other classes.

Table 296 – Association ends of EquipmentReliabilityProfile::FrequencyControlFunction with other classes

mult from	name	mult to	type	description
0..*	AutomationFunction	0..1	AutomationFunction	(NC) inherited from: FunctionBlock
1..*	AutomationBlockGroup	0..1	AutomationBlockGroup	(NC) inherited from: FunctionBlock

3.190 (abstract,NC) SystemControl

Inheritance path = AutomationFunction : PowerSystemResource : IdentifiedObject
System control is the management and regulation of various parameters within the electrical grid to ensure its stable and reliable operation. The primary goal of system control is to maintain the balance between electricity generation and consumption, while also managing factors such as voltage, frequency, and power quality. This involves the use of control devices, automation, and monitoring systems to respond to changes in the grid and maintain its overall stability.
This serves as Integrated AC and DC control system (IEC 60633) which governs the integrated operation of AC and DC systems of a power system.
Table 297 shows all attributes of SystemControl.

Table 297 – Attributes of EquipmentReliabilityProfile::SystemControl

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

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 298 shows all association ends of SystemControl with other classes.

Table 298 – Association ends of EquipmentReliabilityProfile::SystemControl with other classes

mult from	name	mult to	type	description
0..1	EquipmentController	1..*	EquipmentController	(NC) Equipment controller controlles by this system control
0..*	PartOf	0..1	AutomationFunction	(NC) inherited from: AutomationFunction

3.191 (NC) AreaInterchangeController

Inheritance path = SystemControl : AutomationFunction : PowerSystemResource : IdentifiedObject

Area interchange control is set to control active power of an area.

Table 299 shows all attributes of AreaInterchangeController.

Table 299 – Attributes of EquipmentReliabilityProfile::AreaInterchangeController

name	mult	type	description
pTolerance	1..1	ActivePower	(NC) Active power net interchange tolerance. The attribute shall be a positive value or zero.
type	0..1	String	(NC) inherited from: AutomationFunction
normalEnabled	0..1	Boolean	(NC) inherited from: AutomationFunction
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 300 shows all association ends of AreaInterchangeController with other classes.

Table 300 – Association ends of EquipmentReliabilityProfile::AreaInterchangeController with other classes

mult from	name	mult to	type	description
0..1	BiddingZone	0..1	BiddingZone	(NC) Bidding zone which has an area interchange controller.
0..1	BiddingZoneBorder	0..1	BiddingZoneBorder	(NC) Bidding zone border that has an area interchange controller.
0..1	ControlArea	0..1	ControlArea	(NC) Control area that has a area interchange controller.
0..1	EquipmentController	1..*	EquipmentController	(NC) inherited from: SystemControl
0..*	PartOf	0..1	AutomationFunction	(NC) inherited from: AutomationFunction

3.192 (NC) PowerFrequencyController

Inheritance path = SystemControl : AutomationFunction : PowerSystemResource : IdentifiedObject

Power frequency controller is controlling the active power balance as typically done by the secondary control. If an unbalance between the scheduled active power values of each generation unit and the loads plus losses occurs, primary control will adapt (increase/decrease) the active power production of each unit (depending on the power shift key strategy), leading to an over- or under-frequency situation. The secondary frequency controller will then control the frequency back to its nominal value, re- establishing a cost-efficient generation delivered by each unit.

Table 301 shows all attributes of PowerFrequencyController.

Table 301 – Attributes of EquipmentReliabilityProfile::PowerFrequencyController

name	mult	type	description
mode	1..1	PowerFrequencyControlKind	(NC) Mode of the power frequency controller.
type	0..1	String	(NC) inherited from: AutomationFunction
normalEnabled	0..1	Boolean	(NC) inherited from: AutomationFunction
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 302 shows all association ends of PowerFrequencyController with other classes.

Table 302 – Association ends of EquipmentReliabilityProfile::PowerFrequencyController with other classes

mult from	name	mult to	type	description
0..1	ControlArea	0..1	ControlArea	(NC) Control area which has a power frequency controller.
0..*	PowerShiftKeyStrategy	0..1	PowerShiftKeyStrategy	(NC) Power shift key strategy for this power frequency controller.
0..1	MonitoringArea	0..1	MonitoringArea	(NC) Monitoring area that has this power frequency controller.
0..1	EquipmentController	1..*	EquipmentController	(NC) inherited from: SystemControl
0..*	PartOf	0..1	AutomationFunction	(NC) inherited from: AutomationFunction

3.193 (NC) PowerFrequencyControlKind enumeration

Kinds of power frequency control modes.

Table 303 shows all literals of PowerFrequencyControlKind.

Table 303 – Literals of EquipmentReliabilityProfile::PowerFrequencyControlKind

literal	value	description
frequency		Frequency control mode.
activePower		Active power control mode.
activePowerAndFrequency		Active power and frequency control mode.

3.194 (abstract,NC) MonitoringArea

Inheritance path = PowerSystemResource : IdentifiedObject

A coherent part of the interconnected electrical power system, that includes the system operators' responsibility area and the surrounding parts of other system operators' responsibility area, that need to be monitored for security assessment.

Table 304 shows all attributes of MonitoringArea.

Table 304 – Attributes of EquipmentReliabilityProfile::MonitoringArea

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

3.195 (NC) PowerBlockKind enumeration

Power block kind describes the increase and/or decrease of power.

Table 305 shows all literals of PowerBlockKind.

Table 305 – Literals of EquipmentReliabilityProfile::PowerBlockKind

literal	value	description
powerIncrease		Increase in the power. The block represents action for increased power.
powerDecrease		Decrease in the power. The block represents action for decreased power.
powerIncreaseAndDecrease		Increase and decrease in the power. The block represents action for increased and decreased power.

3.196 (NC) EnergyGroup

Inheritance path = PowerSystemResource : IdentifiedObject

An energy group is an aggregation of energy components which have the same energy characteristic, e.g. fuel type and technology. It can be used to allocate energy.

Table 306 shows all attributes of EnergyGroup.

Table 306 – Attributes of EquipmentReliabilityProfile::EnergyGroup

name	mult	type	description
normalParticipationFactor	1..1	Float	(NC) Normal participation factor for the power group in relation to scheduling area. Must be a positive value.
powerDuration	0..1	Duration	(NC) Duration for the active power.
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 307 shows all association ends of EnergyGroup with other classes.

Table 307 – Association ends of EquipmentReliabilityProfile::EnergyGroup with other classes

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

3.197 (NC) EnergyKind enumeration

Categories of energy used for energy groups.
Table 308 shows all literals of EnergyKind.

Table 308 – Literals of EquipmentReliabilityProfile::EnergyKind

literal	value	description
hydroRunOfRiver		Hydro run of river.
hydroWaterReservoir		Hydro water reservoir.
hydroPump		Hydro pump.
biomass		Biomass.
fossil		Fossil.
geothermal		Geothermal.
marine		Marine.
nuclear		Nuclear.
uncontrollableConsumption		Consumption where there is no flexibility and it is measurable and under possibility to provide a forecast. e.g. TV, indoor lightning.
timeShiftConsumption		Operation can be shifted in time but can have a deadline e.g. washing machine, dishwasher.
battery		Battery storage.
bufferConsumption		Flexibility in operation but bound to some buffering capability e.g. battery, electrical vehicle, cooling system, freezer.
solar		Solar.
unconstrainedConsumption		Consumption is not constrained by any buffer and provides full flexibility. It is difficult to measure and to provide forecast. The consumption can be provided by local production. e.g. gas generator, diesel generator wood fire, etc.
waste		Waste.
wind		Wind.
other		Other.

3.198 (abstract,NC) EnergySourceReference root class

An energy source reference refers to a set of fuel types characteristic for reporting, e.g. European Energy Certificate System (EECS). The kind of energy should be possible to be linked with different type of energy forecast, e.g. wind production for a given area based on wind forecast.

3.199 (NC) DCHarmonicFilter

Inheritance path = DCSeriesDevice : DCConductingEquipment : Equipment : PowerSystemResource : IdentifiedObject

DC harmonic filter (IEC 60633) is a filter which, in conjunction with the DC reactor(s) and with the DC surge capacitor(s), if any, serves the primary function of reducing (current or voltage) ripple on the DC transmission line and/or earth electrode line.

Table 309 shows all attributes of DCHarmonicFilter.

Table 309 – Attributes of EquipmentReliabilityProfile::DCHarmonicFilter

name	mult	type	description
ratedCurrent	0..1	CurrentFlow	(NC) inherited from: DCConductingEquipment
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 310 shows all association ends of DCHarmonicFilter with other classes.

Table 310 – Association ends of EquipmentReliabilityProfile::DCHarmonicFilter with other classes

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

3.200 (NC) DCSmoothingReactor

Inheritance path = DCSeriesDevice : DCConductingEquipment : Equipment : PowerSystemResource : IdentifiedObject

Reactor (IEC 60633) connected in series with a converter unit or converter units on the DC side for the primary purpose of smoothing the direct current and reducing current transients.

Table 311 shows all attributes of DCSmoothingReactor.

Table 311 – Attributes of EquipmentReliabilityProfile::DCSmoothingReactor

name	mult	type	description
ratedCurrent	0..1	CurrentFlow	(NC) inherited from: DCConductingEquipment
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 312 shows all association ends of DCSmoothingReactor with other classes.

Table 312 – Association ends of EquipmentReliabilityProfile::DCSmoothingReactor with other classes

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

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

3.201 (NC) DCSmoothingReactorArrester

Inheritance path = DCSeriesDevice : DCConductingEquipment : Equipment : PowerSystemResource : IdentifiedObject

Arrester (IEC 60633) connected between the terminals of a smoothing reactor.

Table 313 shows all attributes of DCSmoothingReactorArrester.

Table 313 – Attributes of EquipmentReliabilityProfile::DCSmoothingReactorArrester

name	mult	type	description
ratedCurrent	0..1	CurrentFlow	(NC) inherited from: DCConductingEquipment
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 314 shows all association ends of DCSmoothingReactorArrester with other classes.

Table 314 – Association ends of EquipmentReliabilityProfile::DCSmoothingReactorArrester with other classes

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

3.202 (abstract,NC) DCHighSpeedSwitch

Inheritance path = DCSwitch : DCConductingEquipment : Equipment : PowerSystemResource : IdentifiedObject

High-speed DC switch (IEC 60633) is a type of switchgear used on a DC scheme, required to open or close rapidly (< 1 s), including in some cases the need to commutate load current into a parallel conducting path, but with no requirement to interrupt fault or load current. DC switchgear is usually based on a single-phase unit of an AC circuit-breaker, appropriately modified for their DC applications. Their capabilities to perform faster opening and closing than disconnect switches are used but the function of breaking short-circuit currents is not required.

Table 315 shows all attributes of DCHighSpeedSwitch.

Table 315 – Attributes of EquipmentReliabilityProfile::DCHighSpeedSwitch

name	mult	type	description
ratedCurrent	0..1	CurrentFlow	(NC) inherited from: DCConductingEquipment
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 316 shows all association ends of DCHighSpeedSwitch with other classes.

Table 316 – Association ends of EquipmentReliabilityProfile::DCHighSpeedSwitch with other classes

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

3.203 (abstract,NC) DCCommutationSwitch

Inheritance path = DCHighSpeedSwitch : DCSwitch : DCConductingEquipment : Equipment : PowerSystemResource : IdentifiedObject

DC commutation switch (IEC 60633) is a type of high-speed DC switch specifically designed to commutate load current into an alternative parallel current path.

Table 317 shows all attributes of DCCommutationSwitch.

Table 317 – Attributes of EquipmentReliabilityProfile::DCCommutationSwitch

name	mult	type	description
ratedCurrent	0..1	CurrentFlow	(NC) inherited from: DCConductingEquipment
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 318 shows all association ends of DCCommutationSwitch with other classes.

Table 318 – Association ends of EquipmentReliabilityProfile::DCCommutationSwitch with other classes

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

3.204 (NC) DCConverterParallelingSwitch

Inheritance path = DCHighSpeedSwitch : DCSwitch : DCConductingEquipment : Equipment : PowerSystemResource : IdentifiedObject

Converter paralleling switch (IEC 60633) is a high-speed DC switch connected in series with each converter at the DC terminal in DC schemes where two or more converters are connected in parallel onto a common pole conductor, designed to allow additional converter(s) to be connected in parallel or disconnected without affecting the load current in the other converter.

Table 319 shows all attributes of DCConverterParallelingSwitch.

Table 319 – Attributes of EquipmentReliabilityProfile::DCConverterParallelingSwitch

name	mult	type	description
ratedCurrent	0..1	CurrentFlow	(NC) inherited from: DCConductingEquipment
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
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 320 shows all association ends of DCConverterParallelingSwitch with other classes.

Table 320 – Association ends of EquipmentReliabilityProfile::DCConverterParallelingSwitch with other classes

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

3.205 (NC) DCBypassSwitch

Inheritance path = DCHighSpeedSwitch : DCSwitch : DCConductingEquipment : Equipment : PowerSystemResource : IdentifiedObject

By-pass switch (IEC 60633) is a high-speed DC switch connected across each converter valve group in DC schemes using more than one independent converter per pole, designed to close rapidly to bypass a converter group that is being taken out of service and commutate the current back into a valve group that is being taken back in service. A by-pass switch may also be used for prolonged shunting of the bridge(s).

Table 321 shows all attributes of DCBypassSwitch.

Table 321 – Attributes of EquipmentReliabilityProfile::DCBypassSwitch

name	mult	type	description
ratedCurrent	0..1	CurrentFlow	(NC) inherited from: DCConductingEquipment
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 322 shows all association ends of DCBypassSwitch with other classes.

Table 322 – Association ends of EquipmentReliabilityProfile::DCBypassSwitch with other classes

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

3.206 (NC) DCNeutralBusGroundingSwitch

Inheritance path = DCCommutationSwitch : DCHighSpeedSwitch : DCSwitch : DCConductingEquipment : Equipment : PowerSystemResource : IdentifiedObject

Neutral bus grounding switch (IEC 60633) or a neutral bus earthing switch is a DC commutation switch connected from the neutral bus to the station earth mat on a bipolar DC scheme, designed to provide a temporary earth connection in the event of an open circuit fault on the electrode line until the imbalance of current between the two poles can be reduced to a safe minimum level or the electrode line connection can be restored.

Table 323 shows all attributes of DCNeutralBusGroundingSwitch.

Table 323 – Attributes of EquipmentReliabilityProfile::DCNeutralBusGroundingSwitch

name	mult	type	description
ratedCurrent	0..1	CurrentFlow	(NC) inherited from: DCConductingEquipment
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 324 shows all association ends of DCNeutralBusGroundingSwitch with other classes.

Table 324 – Association ends of EquipmentReliabilityProfile::DCNeutralBusGroundingSwitch with other classes

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

3.207 (NC) DCNeutralBusSwitch

Inheritance path = DCCommutationSwitch : DCHighSpeedSwitch : DCSwitch : DCConductingEquipment : Equipment : PowerSystemResource : IdentifiedObject

Neutral bus switch (IEC 60633) is a DC commutation switch connected in series with the neutral bus on a bipolar DC scheme, designed to commutate current out of the pole conductor or neutral bus and into the electrode line or dedicated metallic return conductor or earth in response to a fault in a converter or neutral bus.

Table 325 shows all attributes of DCNeutralBusSwitch.

Table 325 – Attributes of EquipmentReliabilityProfile::DCNeutralBusSwitch

name	mult	type	description
ratedCurrent	0..1	CurrentFlow	(NC) inherited from: DCConductingEquipment
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 326 shows all association ends of DCNeutralBusSwitch with other classes.

Table 326 – Association ends of EquipmentReliabilityProfile::DCNeutralBusSwitch with other classes

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

3.208 (NC) DCMetalicReturnSwitch

Inheritance path = DCCommutationSwitch : DCHighSpeedSwitch : DCSwitch : DCConductingEquipment : Equipment : PowerSystemResource : IdentifiedObject

Metallic return transfer switch (IEC 60633) is a DC commutation switch used to transfer DC current from an earth return path to a metallic return path. Although the term "metallic return transfer breaker" has been widely used in the industry for many years, it is misleading since such switches have no ability to interrupt fault current.
Table 327 shows all attributes of DCMetalicReturnSwitch.

Table 327 – Attributes of EquipmentReliabilityProfile::DCMetalicReturnSwitch

name	mult	type	description
ratedCurrent	0..1	CurrentFlow	(NC) inherited from: DCConductingEquipment
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 328 shows all association ends of DCMetalicReturnSwitch with other classes.

Table 328 – Association ends of EquipmentReliabilityProfile::DCMetalicReturnSwitch with other classes

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

3.209 (NC) DCEarthReturnTransferSwitch

Inheritance path = DCCommutationSwitch : DCHighSpeedSwitch : DCSwitch : DCConductingEquipment : Equipment : PowerSystemResource : IdentifiedObject
Earth return transfer switch (IEC 60633) DC commutation switch used to transfer DC current from a metallic return path to an earth return path. In some applications, this function is performed by a by-pass switch. Although the term "earth return transfer breaker" has been widely used in the industry for many years, it is misleading since such switches have no ability to interrupt fault current.
Table 329 shows all attributes of DCEarthReturnTransferSwitch.

Table 329 – Attributes of EquipmentReliabilityProfile::DCEarthReturnTransferSwitch

name	mult	type	description
ratedCurrent	0..1	CurrentFlow	(NC) inherited from: DCConductingEquipment
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 330 shows all association ends of DCEarthReturnTransferSwitch with other classes.

Table 330 – Association ends of EquipmentReliabilityProfile::DCEarthReturnTransferSwitch with other classes

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

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

3.210 (NC) DCLineParallelingSwitch

Inheritance path = DCCommutationSwitch : DCHighSpeedSwitch : DCSwitch : DCConductingEquipment : Equipment : PowerSystemResource : IdentifiedObject
Line paralleling switch (IEC 60633) DC commutation switch placed in series with one or more high-voltage pole conductors, allowing two or more lines to be connected in parallel or to revert to single-line operation while conducting load current.
Table 331 shows all attributes of DCLineParallelingSwitch.

Table 331 – Attributes of EquipmentReliabilityProfile::DCLineParallelingSwitch

name	mult	type	description
ratedCurrent	0..1	CurrentFlow	(NC) inherited from: DCConductingEquipment
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 332 shows all association ends of DCLineParallelingSwitch with other classes.

Table 332 – Association ends of EquipmentReliabilityProfile::DCLineParallelingSwitch with other classes

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

3.211 (abstract,NC) DirectCurrentEquipmentController

Inheritance path = EquipmentController : AutomationFunction : PowerSystemResource : IdentifiedObject
Direct current equipment controller used to control different parts of the hierarchical structure of the DC control system defined by IEC 60633.
Table 333 shows all attributes of DirectCurrentEquipmentController.

Table 333 – Attributes of EquipmentReliabilityProfile::DirectCurrentEquipmentController

name	mult	type	description
type	0..1	String	(NC) inherited from: AutomationFunction
normalEnabled	0..1	Boolean	(NC) inherited from: AutomationFunction
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 334 shows all association ends of DirectCurrentEquipmentController with other classes.

Table 334 – Association ends of EquipmentReliabilityProfile::DirectCurrentEquipmentController with other classes

mult from	name	mult to	type	description
0..*	PartOf	0..1	AutomationFunction	(NC) inherited from: AutomationFunction

3.212 (NC) ACDCConverterController

Inheritance path = DirectCurrentEquipmentController : EquipmentController : AutomationFunction : PowerSystemResource : IdentifiedObject

ACDC converter unit control. According to IEC 60633, it is the control system used for the controlling, monitoring and protection of a single converter unit.

Table 335 shows all attributes of ACDCConverterController.

Table 335 – Attributes of EquipmentReliabilityProfile::ACDCConverterController

name	mult	type	description
type	0..1	String	(NC) inherited from: AutomationFunction
normalEnabled	0..1	Boolean	(NC) inherited from: AutomationFunction
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 336 shows all association ends of ACDCConverterController with other classes.

Table 336 – Association ends of EquipmentReliabilityProfile::ACDCConverterController with other classes

mult from	name	mult to	type	description
0..1	ACDCConverter	1..1	ACDCConverter	(NC) ACDC converter controlled by the direct current controller.
2..2	DirectCurrentPoleController	0..1	DirectCurrentPoleController	(NC) DC pole controller that controls this ACDC controller.
0..*	PartOf	0..1	AutomationFunction	(NC) inherited from: AutomationFunction

3.213 (NC) DirectCurrentPoleController

Inheritance path = DirectCurrentEquipmentController : EquipmentController : AutomationFunction : PowerSystemResource : IdentifiedObject

DC system pole control, which is the control system of a pole in accordance with IEC 60633.

Table 337 shows all attributes of DirectCurrentPoleController.

Table 337 – Attributes of EquipmentReliabilityProfile::DirectCurrentPoleController

name	mult	type	description
type	0..1	String	(NC) inherited from: AutomationFunction
normalEnabled	0..1	Boolean	(NC) inherited from: AutomationFunction
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
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 338 shows all association ends of DirectCurrentPoleController with other classes.

Table 338 – Association ends of EquipmentReliabilityProfile::DirectCurrentPoleController with other classes

mult from	name	mult to	type	description
0..1	DCPole	1..1	DCPole	(NC) DC pole that is controlled by a DC pole controller.
0..*	DirectCurrentMasterController	0..1	DirectCurrentMasterController	(NC) DC master controller that has a DC pole controller.
2..2	DirectCurrentBipoleController	0..1	DirectCurrentBipoleController	(NC) DC bipole controller that controls this DC pole controller.
0..*	PartOf	0..1	AutomationFunction	(NC) inherited from: AutomationFunction

3.214 (NC) DirectCurrentBipoleController

Inheritance path = DirectCurrentEquipmentController : EquipmentController : AutomationFunction : PowerSystemResource : IdentifiedObject

DC system bipole control that is the control system of a bipole in accordance with IEC 60633.

Table 339 shows all attributes of DirectCurrentBipoleController.

Table 339 – Attributes of EquipmentReliabilityProfile::DirectCurrentBipoleController

name	mult	type	description
type	0..1	String	(NC) inherited from: AutomationFunction
normalEnabled	0..1	Boolean	(NC) inherited from: AutomationFunction
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 340 shows all association ends of DirectCurrentBipoleController with other classes.

Table 340 – Association ends of EquipmentReliabilityProfile::DirectCurrentBipoleController with other classes

mult from	name	mult to	type	description
0..*	DirectCurrentMasterController	0..1	DirectCurrentMasterController	(NC) Direct current master controller which has direct current bipole controllers.
0..*	PartOf	0..1	AutomationFunction	(NC) inherited from: AutomationFunction

3.215 (abstract,NC) DirectCurrentSubstationController

Inheritance path = DirectCurrentEquipmentController : EquipmentController : AutomationFunction : PowerSystemResource : IdentifiedObject

Control system used for the controlling, monitoring and protection within a DC substation (IEC 60633). A DC substation control may be implemented at the bipole and/or pole level and may be referred to as local control.
Table 341 shows all attributes of DirectCurrentSubstationController.

Table 341 – Attributes of EquipmentReliabilityProfile::DirectCurrentSubstationController

name	mult	type	description
type	0..1	String	(NC) inherited from: AutomationFunction
normalEnabled	0..1	Boolean	(NC) inherited from: AutomationFunction
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 342 shows all association ends of DirectCurrentSubstationController with other classes.

Table 342 – Association ends of EquipmentReliabilityProfile::DirectCurrentSubstationController with other classes

mult from	name	mult to	type	description
2..*	MultiterminalControl	0..1	DirectCurrentMasterController	(NC) Multiterminal control that controls more than two DC substation controllers.
0..*	PartOf	0..1	AutomationFunction	(NC) inherited from: AutomationFunction

3.216 (NC) DirectCurrentSubstationPoleController

Inheritance path = DirectCurrentSubstationController : DirectCurrentEquipmentController : EquipmentController : AutomationFunction : PowerSystemResource : IdentifiedObject
Control system of a substation pole (IEC 60633).
Table 343 shows all attributes of DirectCurrentSubstationPoleController.

Table 343 – Attributes of EquipmentReliabilityProfile::DirectCurrentSubstationPoleController

name	mult	type	description
type	0..1	String	(NC) inherited from: AutomationFunction
normalEnabled	0..1	Boolean	(NC) inherited from: AutomationFunction
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 344 shows all association ends of DirectCurrentSubstationPoleController with other classes.

Table 344 – Association ends of EquipmentReliabilityProfile::DirectCurrentSubstationPoleController with other classes

mult from	name	mult to	type	description
0..1	DCSubstationPole	1..1	DCSubstationPole	(NC) DC substation pole that is controlled by a DC substation pole controller.
2..*	MultiterminalControl	0..1	DirectCurrentMasterController	(NC) inherited from: DirectCurrentSubstationController
0..*	PartOf	0..1	AutomationFunction	(NC) inherited from: AutomationFunction

3.217 (NC) DirectCurrentSubstationBipoleController

Inheritance path = DirectCurrentSubstationController : DirectCurrentEquipmentController : EquipmentController : AutomationFunction : PowerSystemResource : IdentifiedObject
Control system of a substation bipole (IEC 60633).
Table 345 shows all attributes of DirectCurrentSubstationBipoleController.

Table 345 – Attributes of EquipmentReliabilityProfile::DirectCurrentSubstationBipoleController

name	mult	type	description
type	0..1	String	(NC) inherited from: AutomationFunction
normalEnabled	0..1	Boolean	(NC) inherited from: AutomationFunction
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 346 shows all association ends of DirectCurrentSubstationBipoleController with other classes.

Table 346 – Association ends of EquipmentReliabilityProfile::DirectCurrentSubstationBipoleController with other classes

mult from	name	mult to	type	description
0..1	DCSubstationBipole	1..1	DCSubstationBipole	(NC) DC substation bipole that is controlled by a DC substation bipole controller.
2..*	MultiterminalControl	0..1	DirectCurrentMasterController	(NC) inherited from: DirectCurrentSubstationController
0..*	PartOf	0..1	AutomationFunction	(NC) inherited from: AutomationFunction

3.218 (NC) DCSubstation

Inheritance path = DCEquipmentContainer : EquipmentContainer : ConnectivityNodeContainer : PowerSystemResource : IdentifiedObject
DC substation or DC converter station (IEC 60633) is part of an DC system which consists of one or more converter units installed in a single location together with buildings, reactors, filters, reactive power supply, control, monitoring, protective, measuring and auxiliary equipment. A

DC substation forming part of an DC transmission system may be referred to as an DC transmission substation.
Table 347 shows all attributes of DCSubstation.

Table 347 – Attributes of EquipmentReliabilityProfile::DCSubstation

name	mult	type	description
isTapping	1..1	Boolean	(NC) DC tapping substation (IEC 60633) is a DC substation, mainly used for inversion, with a rating which is a small fraction of that of the rectifier(s) in the system.
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 348 shows all association ends of DCSubstation with other classes.

Table 348 – Association ends of EquipmentReliabilityProfile::DCSubstation with other classes

mult from	name	mult to	type	description
0..*	Substation	0..1	Substation	(NC) Substation that contains this DC susbstation.

3.219 (NC) DCSubstationPole

Inheritance path = DCEquipmentContainer : EquipmentContainer : ConnectivityNodeContainer : PowerSystemResource : IdentifiedObject
Part of an DC system pole (IEC 60633) which is contained within a DC substation.
Table 349 shows all attributes of DCSubstationPole.

Table 349 – Attributes of EquipmentReliabilityProfile::DCSubstationPole

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 350 shows all association ends of DCSubstationPole with other classes.

Table 350 – Association ends of EquipmentReliabilityProfile::DCSubstationPole with other classes

mult from	name	mult to	type	description
0..*	DCSubstation	0..1	DCSubstation	(NC) DC substation that contains this DC substation pole part.

3.220 (NC) DCSubstationBipole

Inheritance path = DCEquipmentContainer : EquipmentContainer : ConnectivityNodeContainer : PowerSystemResource : IdentifiedObject

Part of a bipolar DC system (IEC 60633) contained within a DC substation.
Table 351 shows all attributes of DCSubstationBipole.

Table 351 – Attributes of EquipmentReliabilityProfile::DCSubstationBipole

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 352 shows all association ends of DCSubstationBipole with other classes.

Table 352 – Association ends of EquipmentReliabilityProfile::DCSubstationBipole with other classes

mult from	name	mult to	type	description
0..*	DCSubstation	0..1	DCSubstation	(NC) DC substation that contains this DC substation bipole part.

3.221 (abstract,NC) DCSystem

Inheritance path = PowerSystemResource : IdentifiedObject
Electrical power system which transfers energy in the form of direct current between two or more AC buses (defined in IEC 60633).
Table 353 shows all attributes of DCSystem.

Table 353 – Attributes of EquipmentReliabilityProfile::DCSystem

name	mult	type	description
directionKind	0..1	DCSystemDirectionKind	(NC) Direction kind of the DC system.
transmissionKind	0..1	DCSystemTransmissionKind	(NC) Transmission kind of the DC system.
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

3.222 (NC) BipolarDCSystem

Inheritance path = DCSystem : PowerSystemResource : IdentifiedObject
Bipolar DC system (IEC 60633) consists of two poles of opposite polarity with respect to earth. The overhead lines, if any, of the two poles may be carried on common or separate towers.
Table 354 shows all attributes of BipolarDCSystem.

Table 354 – Attributes of EquipmentReliabilityProfile::BipolarDCSystem

name	mult	type	description
isRigid	1..1	Boolean	(NC) If true, the bipolar DC system is a rigid DC current bipolar system (IEC 60633). It is a bipolar DC system without neutral connection between both converter stations. Since only two (pole) conductors exist, no unbalance current between both poles is possible. In case of

name	mult	type	description
			interruption of power transfer of one converter pole, the current of the other pole has to be interrupted as well (at least for a limited time to allow reconfiguration of the DC circuit).
directionKind	0..1	DCSystemDirectionKind	(NC) inherited from: DCSystem
transmissionKind	0..1	DCSystemTransmissionKind	(NC) inherited from: DCSystem
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

3.223 (NC) MonopolarDCSystem

Inheritance path = DCSystem : PowerSystemResource : IdentifiedObject

Monopolar DC system (IEC 60633) is a DC system with only one pole.

Table 355 shows all attributes of MonopolarDCSystem.

Table 355 – Attributes of EquipmentReliabilityProfile::MonopolarDCSystem

name	mult	type	description
isSymmetrical	1..1	Boolean	(NC) if true, the monopolar DC system is symmetrical monopolar DC system (IEC 60633). It is a DC system with only one symmetrical monopole. A symmetrical monopole is part of an DC system consisting of all the equipment in the DC substations and the interconnecting transmission lines, if any, which during normal operation exhibits equal and opposite direct voltage polarities with respect to earth but without series connection of converters in each converter station. The term "symmetrical monopole" is used even though there are two polarities with DC voltages, because with only one converter it is not possible to provide the redundancy which is normally associated with the term "bipole".
directionKind	0..1	DCSystemDirectionKind	(NC) inherited from: DCSystem
transmissionKind	0..1	DCSystemTransmissionKind	(NC) inherited from: DCSystem
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

3.224 (NC) DCBiPole

Inheritance path = PowerSystemResource : IdentifiedObject

DC system bipole (IEC 60633), which is part of an DC system consisting of two independently operable DC system poles, which during normal operation, exhibit opposite direct voltage polarities with respect to earth.

Table 356 shows all attributes of DCBiPole.

Table 356 – Attributes of EquipmentReliabilityProfile::DCBiPole

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 357 shows all association ends of DCBiPole with other classes.

Table 357 – Association ends of EquipmentReliabilityProfile::DCBiPole with other classes

mult from	name	mult to	type	description
0..1	BipolarDCSystem	0..1	BipolarDCSystem	(NC) Bipolar DC system that has this DC bipole.

3.225 (abstract,NC) PointOfCommonCoupling

Inheritance path = IdentifiedObject

Point of Common Coupling (PCC) refers to the location where multiple electrical sources or loads are electrically connected and provide a reference point where the voltages and currents from different parts of the system are considered to be common. The PCC is used to support system analysis, control, and monitoring, as it provides a reference for understanding the interactions and power flow between various components within the system. It is also relevant to define the requirement and responsibility between different actors in operating a power system.

Table 358 shows all attributes of PointOfCommonCoupling.

Table 358 – Attributes of EquipmentReliabilityProfile::PointOfCommonCoupling

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

3.226 (NC) ACPointOfCommonCoupling

Inheritance path = PointOfCommonCoupling : IdentifiedObject

Point of interconnection of the DC converter station to the adjacent AC system (IEC 60633).

Table 359 shows all attributes of ACPointOfCommonCoupling.

Table 359 – Attributes of EquipmentReliabilityProfile::ACPointOfCommonCoupling

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 360 shows all association ends of ACPointOfCommonCoupling with other classes.

Table 360 – Association ends of EquipmentReliabilityProfile::ACPointOfCommonCoupling with other classes

mult from	name	mult to	type	description
0..1	ConnectivityNode	1..1	ConnectivityNode	(NC) Connectivity node which is a point of common coupling AC.

3.227 (NC) DCPointOfCommonCoupling

Inheritance path = PointOfCommonCoupling : IdentifiedObject

Point of interconnection of the DC converter station to the DC transmission line (IEC 60633).

Table 361 shows all attributes of DCPointOfCommonCoupling.

Table 361 – Attributes of EquipmentReliabilityProfile::DCPointOfCommonCoupling

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 362 shows all association ends of DCPointOfCommonCoupling with other classes.

Table 362 – Association ends of EquipmentReliabilityProfile::DCPointOfCommonCoupling with other classes

mult from	name	mult to	type	description
0..1	DCNode	1..1	DCNode	(NC) The DCNode that is a point of common coupling DC.

3.228 ConnectivityNode

Inheritance path = IdentifiedObject

Connectivity nodes are points where terminals of AC conducting equipment are connected together with zero impedance.

Table 363 shows all attributes of ConnectivityNode.

Table 363 – Attributes of EquipmentReliabilityProfile::ConnectivityNode

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

3.229 DCNode

Inheritance path = IdentifiedObject

DC nodes are points where terminals of DC conducting equipment are connected together with zero impedance.
Table 364 shows all attributes of DCNode.

Table 364 – Attributes of EquipmentReliabilityProfile::DCNode

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

3.230 (NC) AutomationBlockGroup root class

Grouping of function block that are operated with the same priority as settings.
Table 365 shows all attributes of AutomationBlockGroup.

Table 365 – Attributes of EquipmentReliabilityProfile::AutomationBlockGroup

name	mult	type	description
priority	0..1	Integer	(NC) Value 0 means ignore priority. 1 means the highest priority, 2 is the second highest priority.

Table 366 shows all association ends of AutomationBlockGroup with other classes.

Table 366 – Association ends of EquipmentReliabilityProfile::AutomationBlockGroup with other classes

mult from	name	mult to	type	description
0..*	AutomationFunction	1..1	AutomationFunction	(NC) Automation function which has automation block group.

3.231 (NC) FrequencyMonitoringTerminal root class

Frequency monitoring terminal provides location in the model where the frequency is monitored for the purpose of power frequency control.
Table 367 shows all attributes of FrequencyMonitoringTerminal.

Table 367 – Attributes of EquipmentReliabilityProfile::FrequencyMonitoringTerminal

name	mult	type	description
mRID	1..1	String	(NC) 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.
priority	1..1	Integer	(NC) Value 0 means ignore priority. 1 means the highest priority, 2 is the second highest priority.

Table 368 shows all association ends of FrequencyMonitoringTerminal with other classes.

Table 368 – Association ends of EquipmentReliabilityProfile::FrequencyMonitoringTerminal with other classes

mult from	name	mult to	type	description
0..*	Terminal	0..1	Terminal	(NC) The terminal for this frequency monitoring terminal.
0..*	PowerFrequencyController	0..1	PowerFrequencyController	(NC) Power frequency controller that has this frequency monitoring terminal.

3.232 (NC) PowerElectronicsUnitController

Inheritance path = EquipmentController : AutomationFunction : PowerSystemResource : IdentifiedObject

Power electronics unit controller is controlling the equipment to optimize the power electronics unit.

Table 369 shows all attributes of PowerElectronicsUnitController.

Table 369 – Attributes of EquipmentReliabilityProfile::PowerElectronicsUnitController

name	mult	type	description
type	0..1	String	(NC) inherited from: AutomationFunction
normalEnabled	0..1	Boolean	(NC) inherited from: AutomationFunction
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 370 shows all association ends of PowerElectronicsUnitController with other classes.

Table 370 – Association ends of EquipmentReliabilityProfile::PowerElectronicsUnitController with other classes

mult from	name	mult to	type	description
0..*	PowerElectronicsConnectionController	0..1	PowerElectronicsConnectionController	(NC) Power electronics connection controller for the power electronics unit controller.
0..*	PartOf	0..1	AutomationFunction	(NC) inherited from: AutomationFunction

3.233 (NC) ScheduleResourceController

Inheritance path = EquipmentController : AutomationFunction : PowerSystemResource : IdentifiedObject

Schedule resource controller is controlling the equipment to optimize the schedule resource.

Table 371 shows all attributes of ScheduleResourceController.

Table 371 – Attributes of EquipmentReliabilityProfile::ScheduleResourceController

name	mult	type	description
type	0..1	String	(NC) inherited from: AutomationFunction
normalEnabled	0..1	Boolean	(NC) inherited from: AutomationFunction
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject

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 372 shows all association ends of ScheduleResourceController with other classes.

Table 372 – Association ends of EquipmentReliabilityProfile::ScheduleResourceController with other classes

mult from	name	mult to	type	description
0..*	PartOf	0..1	AutomationFunction	(NC) inherited from: AutomationFunction

3.234 (NC) PowerElectronicsConnectionController

Inheritance path = EquipmentController : AutomationFunction : PowerSystemResource : IdentifiedObject

Power electronics connection controller is controlling the equipment to optimize the power electronics connection.

Table 373 shows all attributes of PowerElectronicsConnectionController.

Table 373 – Attributes of EquipmentReliabilityProfile::PowerElectronicsConnectionController

name	mult	type	description
type	0..1	String	(NC) inherited from: AutomationFunction
normalEnabled	0..1	Boolean	(NC) inherited from: AutomationFunction
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 374 shows all association ends of PowerElectronicsConnectionController with other classes.

Table 374 – Association ends of EquipmentReliabilityProfile::PowerElectronicsConnectionController with other classes

mult from	name	mult to	type	description
0..*	PartOf	0..1	AutomationFunction	(NC) inherited from: AutomationFunction

3.235 (NC) DCSystemDirectionKind enumeration

Direction kinds of the DC system.

Table 375 shows all literals of DCSystemDirectionKind.

Table 375 – Literals of EquipmentReliabilityProfile::DCSystemDirectionKind

literal	value	description
unidirectional		Unidirectional DC system used for the transfer of energy in only one direction. According to IEC 60633, most DC systems are inherently

literal	value	description
		bidirectional. However, some systems may be optimized to transmit power in only one preferred direction. Such systems may still be considered as "bidirectional".
bidirectional		Bidirectional DC system used for the transfer of energy in either direction. According to IEC 60633 a multiterminal DC system is bidirectional if one or more substations are bidirectional.

3.236 (NC) DCSystemTransmissionKind enumeration

DC system transmission kind.
Table 376 shows all literals of DCSystemTransmissionKind.

Table 376 – Literals of EquipmentReliabilityProfile::DCSystemTransmissionKind

literal	value	description
twoTerminal		Two-terminal DC transmission system (IEC 60633), consisting of two DC substations and the connecting DC transmission line(s).
multiTerminal		Multiterminal DC transmission system (IEC 60633) consisting of more than two separated DC substations and the interconnecting DC transmission lines.
backToBack		DC back-to-back system (IEC 60633) is a DC system which transfers energy between AC buses at the same location.

3.237 ReactivePower datatype

Product of RMS value of the voltage and the RMS value of the quadrature component of the current.
Table 377 shows all attributes of ReactivePower.

Table 377 – Attributes of EquipmentReliabilityProfile::ReactivePower

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

3.238 (abstract) Conductor

Inheritance path = ConductingEquipment : Equipment : PowerSystemResource : IdentifiedObject
Combination of conducting material with consistent electrical characteristics, building a single electrical system, used to carry current between points in the power system.
Table 378 shows all attributes of Conductor.

Table 378 – Attributes of EquipmentReliabilityProfile::Conductor

name	mult	type	description
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
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 379 shows all association ends of Conductor with other classes.

Table 379 – Association ends of EquipmentReliabilityProfile::Conductor with other classes

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

3.239 (NC) CoordinatedCapacityCalculator

Inheritance path = SystemOperationCoordinator : PowerSystemOrganisationRole : OrganisationRole : IdentifiedObject

A role that coordinates and executes the task of calculating transmission capacity.

Table 380 shows all attributes of CoordinatedCapacityCalculator.

Table 380 – Attributes of EquipmentReliabilityProfile::CoordinatedCapacityCalculator

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

Table 381 shows all association ends of CoordinatedCapacityCalculator with other classes.

Table 381 – Association ends of EquipmentReliabilityProfile::CoordinatedCapacityCalculator with other classes

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

3.240 (NC) ACEmulationControlFunction

Inheritance path = ControlFunctionBlock : FunctionBlock : IdentifiedObject

The AC emulation control function is used when AC emulation model is activated for a DC system. It consists in computing the active power set point of the DC system as a function of the voltage angle difference between both points of common coupling with the AC network in order to mimic the behavior of an AC transmission line. This control mode enables the automatic adjustment of the active power reference following variations of the AC system operational point.

The setpoint of the DC system is calculated by Psetpoint=Pref+Kdc*(angle1-angle2), where

- Pref is the existing active power setpoint;
- Kdc is the control system gain and
- angle1 and angle2 are the phase angle measurement (measured at points of common coupling with the AC network) respectively at the side 1 and 2 of the DC system.

Table 382 shows all attributes of ACEmulationControlFunction.

3532 **Table 382 – Attributes of EquipmentReliabilityProfile::ACEmulationControlFunction**

name	mult	type	description
isDiscrete	1..1	Boolean	(NC) inherited from: ControlFunctionBlock
targetDeadband	0..1	Float	(NC) inherited from: ControlFunctionBlock
maxAllowedTargetValue	0..1	PerCent	(NC) inherited from: ControlFunctionBlock
minAllowedTargetValue	0..1	PerCent	(NC) inherited from: ControlFunctionBlock
normalEnabled	0..1	Boolean	(NC) inherited from: FunctionBlock
energyIdentCodeEic	0..1	String	(deprecated,European) inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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3534 Table 383 shows all association ends of ACEmulationControlFunction with other classes.

3535 **Table 383 – Association ends of**
3536 **EquipmentReliabilityProfile::ACEmulationControlFunction with other classes**

mult from	name	mult to	type	description
0..*	AutomationFunction	0..1	AutomationFunction	(NC) inherited from: FunctionBlock
1..*	AutomationBlockGroup	0..1	AutomationBlockGroup	(NC) inherited from: FunctionBlock

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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

Test data files are available in the CIM EG SharePoint.