



European Network of
Transmission System Operators
for Electricity

CONTINGENCY PROFILE SPECIFICATION

2022-02-16

SOC APPROVED
VERSION 2.0

1 Copyright notice:

2 **Copyright © ENTSO-E. All Rights Reserved.**

3 This document and its whole translations may be copied and furnished to others, and derivative
4 works that comment on or otherwise explain it or assist in its implementation may be prepared,
5 copied, published and distributed, in whole or in part, without restriction of any kind, provided
6 that the above copyright notice and this paragraph are included on all such copies and
7 derivative works. However, this document itself may not be modified in any way, except for
8 literal and whole translation into languages other than English and under all circumstances, the
9 copyright notice or references to ENTSO-E may not be removed.

10 This document and the information contained herein is provided on an "as is" basis.

11 **ENTSO-E DISCLAIMS ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT**
12 **LIMITED TO ANY WARRANTY THAT THE USE OF THE INFORMATION HEREIN WILL NOT**
13 **INFRINGE ANY RIGHTS OR ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR**
14 **FITNESS FOR A PARTICULAR PURPOSE.**

15 **This document is maintained by the ENTSO-E CIM EG. Comments or remarks are to be**
16 **provided at cim@entsoe.eu**

17 **NOTE CONCERNING WORDING USED IN THIS DOCUMENT**

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

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

32

33

Revision History

Version	Release	Date	Paragraph	Comments
1	0	2021-03-22		Document for SOC approval
2	0	2022-02-16		For CIM EG review. Additional information is added to exceptional contingency. The combination between assessed element and contingency is modelled. Approved by SOC.

34	CONTENTS		
35	Copyright notice:.....		2
36	Revision History.....		3
37	CONTENTS		4
38	1 Introduction		6
39	2 Application profile specification		6
40	2.1 Version information		6
41	2.2 Constraints naming convention		6
42	2.3 Profile constraints		7
43	2.4 Metadata.....		9
44	2.4.1 Constraints		10
45	2.4.2 Reference metadata		10
46	3 Detailed Profile Specification		10
47	3.1 General.....		10
48	3.2 (abstract) Contingency		11
49	3.3 (abstract) ContingencyElement		12
50	3.4 ContingencyEquipment		12
51	3.5 (abstract) Equipment root class.....		13
52	3.6 (NC) ExceptionalContingency		13
53	3.7 (abstract) IdentifiedObject root class		13
54	3.8 (NC) OrdinaryContingency		14
55	3.9 (NC) OutOfRangeContingency		14
56	3.10 (abstract,NC) SystemOperator root class		15
57	3.11 (NC) ContingencyConditionKind enumeration.....		15
58	3.12 ContingencyEquipmentStatusKind enumeration		15
59	3.13 UnitMultiplier enumeration		15
60	3.14 UnitSymbol enumeration		16
61	3.15 PerCent datatype		22
62	3.16 Boolean primitive		22
63	3.17 Date primitive.....		22
64	3.18 DateTime primitive		22
65	3.19 Float primitive		22
66	3.20 String primitive.....		22
67	Annex A (informative): Sample data		23
68	A.1 General.....		23
69	A.2 Sample instance data.....		23
70			
71	List of figures		
72	Figure 1 – Class diagram ContingencyProfile::ContingencyProfile		10
73	Figure 2 – Class diagram ContingencyProfile::ContingencyDatatypes		11
74			
75	List of tables		

76	Table 1 – Attributes of ContingencyProfile::Contingency	11
77	Table 2 – Association ends of ContingencyProfile::Contingency with other classes	12
78	Table 3 – Attributes of ContingencyProfile::ContingencyElement	12
79	Table 4 – Association ends of ContingencyProfile::ContingencyElement with other	
80	classes	12
81	Table 5 – Attributes of ContingencyProfile::ContingencyEquipment.....	12
82	Table 6 – Association ends of ContingencyProfile::ContingencyEquipment with other	
83	classes	13
84	Table 7 – Attributes of ContingencyProfile::ExceptionalContingency	13
85	Table 8 – Association ends of ContingencyProfile::ExceptionalContingency with other	
86	classes	13
87	Table 9 – Attributes of ContingencyProfile::IdentifiedObject	13
88	Table 10 – Attributes of ContingencyProfile::OrdinaryContingency	14
89	Table 11 – Association ends of ContingencyProfile::OrdinaryContingency with other	
90	classes	14
91	Table 12 – Attributes of ContingencyProfile::OutOfRangeContingency	14
92	Table 13 – Association ends of ContingencyProfile::OutOfRangeContingency with	
93	other classes	15
94	Table 14 – Literals of ContingencyProfile::ContingencyConditionKind	15
95	Table 15 – Literals of ContingencyProfile::ContingencyEquipmentStatusKind	15
96	Table 16 – Literals of ContingencyProfile::UnitMultiplier	16
97	Table 17 – Literals of ContingencyProfile::UnitSymbol	17
98	Table 18 – Attributes of ContingencyProfile::PerCent.....	22
99		

100 1 Introduction

101 The contingency profile is a profile to exchange a list of contingencies.

102 A contingency is the identified and possible or already occurred fault of an element, including
103 not only the transmission system elements, but also significant grid users and distribution
104 network elements if relevant for the transmission system operational security.¹

105 The contingencies are input data for security analysis.

106 Preventive remedial actions may be applied in the base case and consequently in each
107 contingency case since each contingency is applied on top of the base case with the
108 consideration of all applied preventive remedial actions. There is not explicit association
109 between preventive remedial actions and contingencies because of the definition of preventive
110 remedial action. Curative remedial actions may be applied to the contingencies they are
111 associated with and these association are the ones that is included in this profile. It is required
112 to have an explicit list of assessed elements that relate to a given contingency. Only these
113 assessed elements will be scanned when the contingency is simulated. Therefore, the profile
114 restricts that at least one assessed element shall be scanned for a given contingency. The
115 profile allows that contingencies can be associated to a given region, which indicates in which
116 region these contingencies are studied. For instance, in CSA process normally the region has
117 the meaning of a capacity calculation region.

118 2 Application profile specification

119 2.1 Version information

120 The content is generated from UML model file CGMES30v25_501-20v01_HeaderMetaData-
121 10v08_NC20v70.eap.

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

- 123 - Title: Contingency Vocabulary
- 124 - Keyword: CO
- 125 - Description: This vocabulary is describing the contingency profile.
- 126 - Version IRI: <http://entsoe.eu/ns/CIM/Contingency-EU/2.0>
- 127 - Version info: 2.0.0
- 128 - Prior version: <http://entsoe.eu/ns/CIM/Contingency-EU/1.0>
- 129 - Conforms to: urn:iso:std:iec:61970-600-2:ed-1|urn:iso:std:iec:61970-301:ed-7:amd1|file:///iec61970cim17v40_iec61968cim13v13a_iec62325cim03v17a.eap|urn:iso:std:iec:61970-401:draft:ed-1|urn:iso:std:iec:61970-501:draft:ed-2|file:///CGMES-30v25_501-20v01.eap
- 130
- 131
- 132
- 133 - Identifier: <urn:uuid:8947de1c-6e53-4f1f-82c3-99ef118db9eb>

134

135 2.2 Constraints naming convention

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

138 "{rule.Type}:{rule.Standard}:{rule.Profile}:{rule.Property}:{rule.Name}"

139 where

¹ [SOURCE: CACM art.2.10]

- 140 rule.Type: C – for constraint; R – for requirement
- 141 rule.Standard: the number of the standard e.g. 301 for 61970-301, 456 for 61970-456, 13 for
142 61968-13. 61970-600 specific constraints refer to 600 although they are related to one or
143 combination of the 61970-450 series profiles. For NC profiles, NC is used.
- 144 rule.Profile: the abbreviation of the profile, e.g. TP for Topology profile. If set to “ALL” the
145 constraint is applicable to all IEC 61970-600 profiles.
- 146 rule.Property: for UML classes, the name of the class, for attributes and associations, the name
147 of the class and attribute or association end, e.g. EnergyConsumer, IdentifiedObject.name, etc.
148 If set to “NA” the property is not applicable to a specific UML element.
- 149 rule.Name: the name of the rule. It is unique for the same property.
- 150 Example: C:600:ALL:IdentifiedObject.name:stringLength

151 2.3 Profile constraints

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

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

- 157 • C:452:ALL:NA:datatypes

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

- 160 • R:452:ALL:NA:exchange

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

- 163 • R:452:ALL:NA:exchange1

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

- 169 • R:452:ALL:NA:exchange2

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

- 178 • R:452:ALL:NA:exchange3

- 179 An exporter may, at his or her discretion, produce a serialization containing additional
180 class data described by the CIM Schema but not required by this document provided
181 these data adhere to the conventions established in Clause 5.
- 182 • R:452:ALL:NA:exchange4
- 183 From the standpoint of the model import used by a data recipient, the document
184 describes a subset of the CIM that importing software shall be able to interpret in order
185 to import exported models. Data providers are free to exceed the minimum requirements
186 described herein as long as their resulting data files are compliant with the CIM Schema
187 and the conventions established in Clause 5. The document, therefore, describes
188 additional classes and class data that, although not required, exporters will, in all
189 likelihood, choose to include in their data files. The additional classes and data are
190 labelled as required (cardinality 1..1) or as optional (cardinality 0..1) to distinguish them
191 from their required counterparts. Please note, however, that data importers could
192 potentially receive data containing instances of any and all classes described by the
193 CIM Schema.
- 194 • R:452:ALL:NA:cardinality
- 195 The cardinality defined in the CIM model shall be followed, unless a more restrictive
196 cardinality is explicitly defined in this document. For instance, the cardinality on the
197 association between VoltageLevel and BaseVoltage indicates that a VoltageLevel shall
198 be associated with one and only one BaseVoltage, but a BaseVoltage can be associated
199 with zero to many VoltageLevels.
- 200 • R:452:ALL:NA:associations
- 201 Associations between classes referenced in this document and classes not referenced
202 here are not required regardless of cardinality.
- 203 • R:452:ALL:IdentifiedObject.name:rule
- 204 The attribute “name” inherited by many classes from the abstract class IdentifiedObject
205 is not required to be unique. It must be a human readable identifier without additional
206 embedded information that would need to be parsed. The attribute is used for purposes
207 such as User Interface and data exchange debugging. The MRID defined in the data
208 exchange format is the only unique and persistent identifier used for this data exchange.
209 The attribute IdentifiedObject.name is, however, always required for CoreEquipment
210 profile and Short Circuit profile.
- 211 • R:452:ALL:IdentifiedObject.description:rule
- 212 The attribute “description” inherited by many classes from the abstract class
213 IdentifiedObject must contain human readable text without additional embedded
214 information that would need to be parsed.
- 215 • R:452:ALL:NA:uniqueIdentifier
- 216 All IdentifiedObject-s shall have a persistent and globally unique identifier (Master
217 Resource Identifier - mRID).
- 218 • R:452:ALL:NA:unitMultiplier
- 219 For exchange of attributes defined using CIM Data Types (ActivePower, Susceptance,
220 etc.) a unit multiplier of 1 is used if the UnitMultiplier specified in this document is “none”.
- 221 • C:452:ALL:IdentifiedObject.name:stringLength

- 222 The string IdentifiedObject.name has a maximum of 128 characters.
- 223 • C:452:ALL:IdentifiedObject.description:stringLength
- 224 The string IdentifiedObject.description is maximum 256 characters.
- 225 • C:452:ALL:NA:float
- 226 An attribute that is defined as float (e.g. has a type Float or a type which is a Datatype
227 with .value attribute of type Float) shall support ISO/IEC 60559:2020 for floating-point
228 arithmetic using single precision floating point. A single precision float supports 7
229 significant digits where the significant digits are described as an integer, or a decimal
230 number with 6 decimal digits. Two float values are equal when the significant with 7
231 digits are identical, e.g. 1234567 is equal 1.234567E6 and so are 1.2345678 and
232 1.234567E0.
- 233 • R:NC:ALL:Region:reference
- 234 The reference to the Region is normally a reference to the capacity calculation region,
235 which is identified by “Y” EIC code of the capacity calculation region.
- 236 • R:NC:ALL:SystemOperator:reference
- 237 The reference to the System Operator is normally identified by “X” EIC code of TSO.
- 238 • C:NC:CO:Contingency.RemedialAction:usageCurative
- 239 For a RemedialAction which is curative (RemedialAction.kind equals
240 RemedialActionKind.curative and RemedialActionKind.curativeAndPreventive), the
241 association Contingency.RemedialAction is required and a contingency shall be defined.
242 If RemedialAction.kind equals RemedialActionKind.preventive, the association
243 Contingency.RemedialAction shall not be exchanged and a contingency shall not be
244 defined.
- 245 • C:NC:CO:Contingency.ContingencyElement:ordinaryContingency
- 246 The multiplicity of the association end Contingency.ContingencyElement is restricted to
247 1 for an OrdinaryContingency.
- 248 • C:NC:CO:Contingency.ContingencyElement:outOfRangeAndExceptional
- 249 The multiplicity of the association end Contingency.ContingencyElement is restricted to
250 2..* for both OutOfRangeContingency and ExceptionalContingency.
- 251 • C:NC:CO:ContingencyElement.ContingencyStatus:allowedValues
- 252 The allowed value for the ContingencyElement.ContingencyStatus is
253 ContingencyEquipmentStatusKind.outOfService.

254 2.4 Metadata

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

261 The header vocabulary contains all attributes defined in IEC 61970-552. This is done only for
262 the purpose of having one vocabulary for header and to ensure transition for data exchanges

263 that are using IEC 61970-552:2016 header. This profile does not use IEC 61970-552:2016
264 header attributes and relies only on the extended attributes.

265 **2.4.1 Constraints**

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

- 268 • R:NC:ALL:wasAttributedTo:usage

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

270

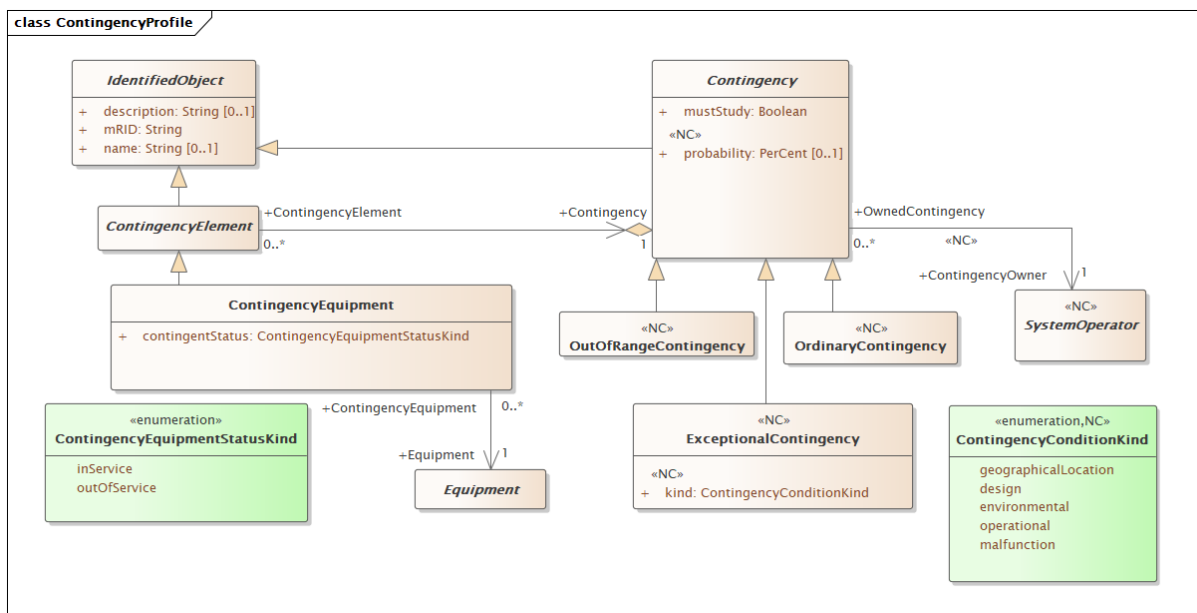
271 **2.4.2 Reference metadata**

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

280 **3 Detailed Profile Specification**

281 **3.1 General**

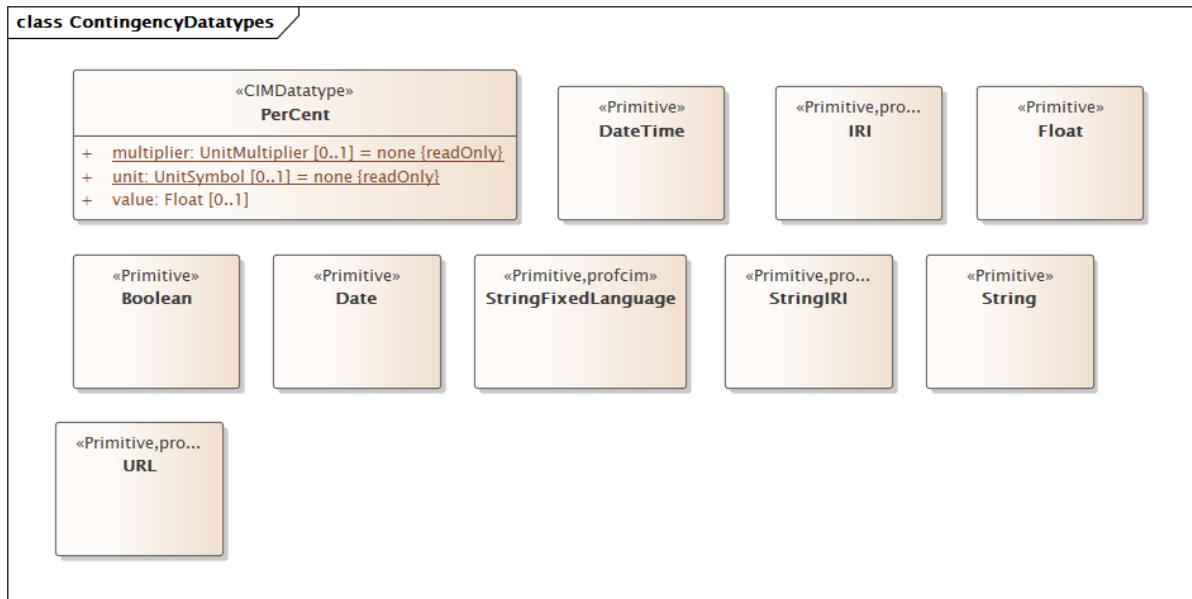
282 This package contains contingency profile.



283

284 **Figure 1 – Class diagram ContingencyProfile::ContingencyProfile**

285 Figure 1: The diagram contains the main classes used in the profile.



286

287

Figure 2 – Class diagram ContingencyProfile::ContingencyDatatypes

288 Figure 2: The diagram shows datatypes that are used by classes in the profile. Stereotypes are
289 used to describe the datatypes. The following stereotypes are defined:

290 <<enumeration>> A list of permissible constant values.

291 <<Primitive>> The most basic data types used to compose all other data types.

292 <<CIMDatatype>> A datatype that contains a value attribute, an optional unit of measure and
293 a unit multiplier. The unit and multiplier may be specified as a static variable initialized to the
294 allowed value.

295 <<Compound>> A composite of Primitive, enumeration, CIMDatatype or other Compound
296 classes, as long as the Compound classes do not recurse.

297 For all datatypes both positive and negative values are allowed unless stated otherwise for a
298 particular datatype.

299 **3.2 (abstract) Contingency**

300 Inheritance path = [IdentifiedObject](#)

301 An event threatening system reliability, consisting of one or more contingency elements.

302 Table 1 shows all attributes of Contingency.

303

Table 1 – Attributes of ContingencyProfile::Contingency

name	mult	type	description
mustStudy	1..1	Boolean	Set true if must study this contingency.
probability	0..1	PerCent	(NC) Probability of occurrence.
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

304

305 Table 2 shows all association ends of Contingency with other classes.

306 **Table 2 – Association ends of ContingencyProfile::Contingency with other classes**

mult from	name	mult to	type	description
0..*	ContingencyOwner	1..1	SystemOperator	(NC) System operator owning this contingency.

307

308 **3.3 (abstract) ContingencyElement**309 Inheritance path = [IdentifiedObject](#)310 An element of a system event to be studied by contingency analysis, representing a change in
311 status of a single piece of equipment.

312 Table 3 shows all attributes of ContingencyElement.

313 **Table 3 – Attributes of ContingencyProfile::ContingencyElement**

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

314

315 Table 4 shows all association ends of ContingencyElement with other classes.

316 **Table 4 – Association ends of ContingencyProfile::ContingencyElement with other
317 classes**

mult from	name	mult to	type	description
0..*	Contingency	1..1	Contingency	A contingency element belongs to one contingency.

318

319 **3.4 ContingencyEquipment**320 Inheritance path = [ContingencyElement](#) : [IdentifiedObject](#)321 Equipment whose in service status is to change, such as a power transformer or AC line
322 segment.

323 Table 5 shows all attributes of ContingencyEquipment.

324 **Table 5 – Attributes of ContingencyProfile::ContingencyEquipment**

name	mult	type	description
contingentStatus	1..1	ContingencyEquipmentS tatusKind	The status for the associated equipment when in the contingency state. This status is independent of the case to which the contingency is originally applied, but defines the equipment status when the contingency is applied.
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

325

326 Table 6 shows all association ends of ContingencyEquipment with other classes.

327 **Table 6 – Association ends of ContingencyProfile::ContingencyEquipment with other**
328 **classes**

mult from	name	mult to	type	description
0..*	Equipment	1..1	Equipment	The single piece of equipment to which to apply the contingency.
0..*	Contingency	1..1	Contingency	inherited from: ContingencyElement

329

330 3.5 (abstract) Equipment root class

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

332 3.6 (NC) ExceptionalContingency

333 Inheritance path = [Contingency](#) : [IdentifiedObject](#)

334 Exceptional contingency means the simultaneous occurrence of multiple contingencies with a
335 common cause.

336 Table 7 shows all attributes of ExceptionalContingency.

337 **Table 7 – Attributes of ContingencyProfile::ExceptionalContingency**

name	mult	type	description
kind	1..1	ContingencyConditionKind	(NC) Defines the kind of relevance and criteria of application of the exceptional contingency.
mustStudy	1..1	Boolean	inherited from: Contingency
probability	0..1	PerCent	(NC) inherited from: Contingency
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

338

339 Table 8 shows all association ends of ExceptionalContingency with other classes.

340 **Table 8 – Association ends of ContingencyProfile::ExceptionalContingency with other**
341 **classes**

mult from	name	mult to	type	description
0..*	ContingencyOwner	1..1	SystemOperator	(NC) inherited from: Contingency

342

343 3.7 (abstract) IdentifiedObject root class

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

346 Table 9 shows all attributes of IdentifiedObject.

347 **Table 9 – Attributes of ContingencyProfile::IdentifiedObject**

name	mult	type	description
description	0..1	String	The description is a free human readable text describing or naming the object. It may be non unique and may not correlate to a naming hierarchy.
mRID	1..1	String	Master resource identifier issued by a model authority. The mRID is unique within an exchange context. Global uniqueness is easily achieved by using a UUID, as specified in RFC

name	mult	type	description
			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.

348

349 **3.8 (NC) OrdinaryContingency**350 Inheritance path = [Contingency](#) : [IdentifiedObject](#)

351 Ordinary contingency means the occurrence of a contingency of a single branch or injection.

352 Table 10 shows all attributes of OrdinaryContingency.

353

Table 10 – Attributes of ContingencyProfile::OrdinaryContingency

name	mult	type	description
mustStudy	1..1	Boolean	inherited from: Contingency
probability	0..1	PerCent	(NC) inherited from: Contingency
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

354

355 Table 11 shows all association ends of OrdinaryContingency with other classes.

356 **Table 11 – Association ends of ContingencyProfile::OrdinaryContingency with other**
357 **classes**

mult from	name	mult to	type	description
0..*	ContingencyOwner	1..1	SystemOperator	(NC) inherited from: Contingency

358

359 **3.9 (NC) OutOfRangeContingency**360 Inheritance path = [Contingency](#) : [IdentifiedObject](#)361 Out of range means the simultaneous occurrence of multiple contingencies without a common
362 cause, or a loss of power generating modules with a total loss of generation capacity exceeding
363 the reference incident.

364 Table 12 shows all attributes of OutOfRangeContingency.

365

Table 12 – Attributes of ContingencyProfile::OutOfRangeContingency

name	mult	type	description
mustStudy	1..1	Boolean	inherited from: Contingency
probability	0..1	PerCent	(NC) inherited from: Contingency
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

366

367 Table 13 shows all association ends of OutOfRangeContingency with other classes.

368 **Table 13 – Association ends of ContingencyProfile::OutOfRangeContingency with other**
369 **classes**

mult from	name	mult to	type	description
0..*	ContingencyOwner	1..1	SystemOperator	(NC) inherited from: Contingency

370

371 **3.10 (abstract,NC) SystemOperator root class**

372 System operator.

373 **3.11 (NC) ContingencyConditionKind enumeration**

374 Kinds of occurrence criteria of application.

375 Table 14 shows all literals of ContingencyConditionKind.

376 **Table 14 – Literals of ContingencyProfile::ContingencyConditionKind**

literal	value	description
geographicalLocation		Permanent occurrence factor which is specific geographical location.
design		Permanent occurrence factor which is design condition.
environmental		Temporary occurrence factor which is weather or environmental condition.
operational		Temporary occurrence factor which is operational condition.
malfunction		Temporary occurrence factor which is life time or generic malfunction affecting the risk of failure condition.

377

378 **3.12 ContingencyEquipmentStatusKind enumeration**

379 Indicates the state which the contingency equipment is to be in when the contingency is applied.

380 Table 15 shows all literals of ContingencyEquipmentStatusKind.

381 **Table 15 – Literals of ContingencyProfile::ContingencyEquipmentStatusKind**

literal	value	description
inService		The equipment is to be put into service.
outOfService		The equipment is to be taken out of service.

382

383 **3.13 UnitMultiplier enumeration**

384 The unit multipliers defined for the CIM. When applied to unit symbols, the unit symbol is
385 treated as a derived unit. Regardless of the contents of the unit symbol text, the unit symbol
386 shall be treated as if it were a single-character unit symbol. Unit symbols should not contain
387 multipliers, and it should be left to the multiplier to define the multiple for an entire data type.

388 For example, if a unit symbol is "m2Pers" and the multiplier is "k", then the value is $k(m^{**2}/s)$,
389 and the multiplier applies to the entire final value, not to any individual part of the value. This
390 can be conceptualized by substituting a derived unit symbol for the unit type. If one imagines
391 that the symbol "P" represents the derived unit "m2Pers", then applying the multiplier "k" can
392 be conceptualized simply as "kP".

393 For example, the SI unit for mass is "kg" and not "g". If the unit symbol is defined as "kg", then
394 the multiplier is applied to "kg" as a whole and does not replace the "k" in front of the "g". In
395 this case, the multiplier of "m" would be used with the unit symbol of "kg" to represent one gram.
396 As a text string, this violates the instructions in IEC 80000-1. However, because the unit symbol
397 in CIM is treated as a derived unit instead of as an SI unit, it makes more sense to conceptualize

398 the "kg" as if it were replaced by one of the proposed replacements for the SI mass symbol. If
399 one imagines that the "kg" were replaced by a symbol "P", then it is easier to conceptualize the
400 multiplier "m" as creating the proper unit "mP", and not the forbidden unit "mkg".
401 Table 16 shows all literals of UnitMultiplier.

402 **Table 16 – Literals of ContingencyProfile::UnitMultiplier**

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

403

404 3.14 UnitSymbol enumeration

405 The derived units defined for usage in the CIM. In some cases, the derived unit is equal to an
406 SI unit. Whenever possible, the standard derived symbol is used instead of the formula for the
407 derived unit. For example, the unit symbol Farad is defined as "F" instead of "CPerV". In cases
408 where a standard symbol does not exist for a derived unit, the formula for the unit is used as
409 the unit symbol. For example, density does not have a standard symbol and so it is represented
410 as "kgPerm3". With the exception of the "kg", which is an SI unit, the unit symbols do not contain
411 multipliers and therefore represent the base derived unit to which a multiplier can be applied as
412 a whole.

413 Every unit symbol is treated as an unparseable text as if it were a single-letter symbol. The
414 meaning of each unit symbol is defined by the accompanying descriptive text and not by the
415 text contents of the unit symbol.

416 To allow the widest possible range of serializations without requiring special character handling,
417 several substitutions are made which deviate from the format described in IEC 80000-1. The
418 division symbol "/" is replaced by the letters "Per". Exponents are written in plain text after the
419 unit as "m3" instead of being formatted as "m" with a superscript of 3 or introducing a symbol
420 as in "m^3". The degree symbol "°" is replaced with the letters "deg". Any clarification of the
421 meaning for a substitution is included in the description for the unit symbol.

422 Non-SI units are included in list of unit symbols to allow sources of data to be correctly labelled
 423 with their non-SI units (for example, a GPS sensor that is reporting numbers that represent feet
 424 instead of meters). This allows software to use the unit symbol information correctly convert
 425 and scale the raw data of those sources into SI-based units.
 426 The integer values are used for harmonization with IEC 61850.
 427 Table 17 shows all literals of UnitSymbol.

428 **Table 17 – Literals of ContingencyProfile::UnitSymbol**

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

literal	value	description
		expressed in Watts. See also apparent power and reactive power.
Pa	39	Pressure in pascals (N/m ²). Note: the absolute or relative measurement of pressure is implied with this entry. See below for more explicit forms.
m2	41	Area in square metres (m ²).
m3	42	Volume in cubic metres (m ³).
mPers	43	Velocity in metres per second (m/s).
mPers2	44	Acceleration in metres per second squared (m/s ²).
m3Pers	45	Volumetric flow rate in cubic metres per second (m ³ /s).
mPerm3	46	Fuel efficiency in metres per cubic metres (m/m ³).
kgm	47	Moment of mass in kilogram metres (kg·m) (first moment of mass). Note: multiplier "k" is included in this unit symbol for compatibility with IEC 61850-7-3.
kgPerm3	48	Density in kilogram/cubic metres (kg/m ³). Note: multiplier "k" is included in this unit symbol for compatibility with IEC 61850-7-3.
m2Pers	49	Viscosity in square metres / second (m ² /s).
WPermK	50	Thermal conductivity in watt/metres kelvin.
JPerK	51	Heat capacity in joules/kelvin.
ppm	52	Concentration in parts per million.
rotPers	53	Rotations per second (1/s). See also Hz (1/s).
radPers	54	Angular velocity in radians per second (rad/s).
WPerm2	55	Heat flux density, irradiance, watts per square metre.
JPerm2	56	Insulation energy density, joules per square metre or watt second per square metre.
SPerm	57	Conductance per length (F/m).
KPers	58	Temperature change rate in kelvins per second.
PaPers	59	Pressure change rate in pascals per second.
JPerkgK	60	Specific heat capacity, specific entropy, joules per kilogram Kelvin.
VA	61	Apparent power in volt amperes. See also real power and reactive power.
VAr	63	Reactive power in volt amperes reactive. The "reactive" or "imaginary" component of electrical power (VIsin(phi)). (See also real power and apparent power). Note: Different meter designs use different methods to arrive at their results. Some meters may compute reactive power as an arithmetic value, while others compute the value vectorially. The data consumer should determine the method in use and the suitability of the measurement for the intended purpose.
cosPhi	65	Power factor, dimensionless.

literal	value	description
		Note 1: This definition of power factor only holds for balanced systems. See the alternative definition under code 153. Note 2 : Beware of differing sign conventions in use between the IEC and EEL. It is assumed that the data consumer understands the type of meter in use and the sign convention in use by the utility.
Vs	66	Volt seconds (Ws/A).
V2	67	Volt squared (W^2/A^2).
As	68	Ampere seconds (A·s).
A2	69	Amperes squared (A^2).
A2s	70	Ampere squared time in square amperes (A^2s).
VAh	71	Apparent energy in volt ampere hours.
Wh	72	Real energy in watt hours.
VArh	73	Reactive energy in volt ampere reactive hours.
VPerHz	74	Magnetic flux in volt per hertz.
HzPers	75	Rate of change of frequency in hertz per second.
character	76	Number of characters.
charPers	77	Data rate (baud) in characters per second.
kgm2	78	Moment of mass in kilogram square metres ($kg·m^2$) (Second moment of mass, commonly called the moment of inertia). Note: multiplier "k" is included in this unit symbol for compatibility with IEC 61850-7-3.
dB	79	Sound pressure level in decibels. Note: multiplier "d" is included in this unit symbol for compatibility with IEC 61850-7-3.
WPers	81	Ramp rate in watts per second.
IPers	82	Volumetric flow rate in litres per second.
dBm	83	Power level (logarithmic ratio of signal strength , Bel-mW), normalized to 1mW. Note: multiplier "d" is included in this unit symbol for compatibility with IEC 61850-7-3.
h	84	Time in hours, hour = 60 min = 3600 s.
min	85	Time in minutes, minute = 60 s.
Q	100	Quantity power, Q.
Qh	101	Quantity energy, Qh.
ohmm	102	Resistivity, ohm metres, (ρ).
APerm	103	A/m, magnetic field strength, amperes per metre.
V2h	104	Volt-squared hour, volt-squared-hours.
A2h	105	Ampere-squared hour, ampere-squared hour.
Ah	106	Ampere-hours, ampere-hours.
count	111	Amount of substance, Counter value.
ft3	119	Volume, cubic feet.
m3Perh	125	Volumetric flow rate, cubic metres per hour.
gal	128	Volume in gallons, US gallon (1 gal = 231 in ³ = 128 fl ounce).

literal	value	description
Btu	132	Energy, British Thermal Units.
l	134	Volume in litres, litre = dm ³ = m ³ /1000.
lPerh	137	Volumetric flow rate, litres per hour.
lPerl	143	Concentration, The ratio of the volume of a solute divided by the volume of the solution. Note: Users may need use a prefix such a 'µ' to express a quantity such as 'µL/L'.
gPerg	144	Concentration, The ratio of the mass of a solute divided by the mass of the solution. Note: Users may need use a prefix such a 'µ' to express a quantity such as 'µg/g'.
molPerm3	145	Concentration, The amount of substance concentration, (c), the amount of solvent in moles divided by the volume of solution in m ³ .
molPermol	146	Concentration, Molar fraction, the ratio of the molar amount of a solute divided by the molar amount of the solution.
molPerkg	147	Concentration, Molality, the amount of solute in moles and the amount of solvent in kilograms.
sPers	149	Time, Ratio of time. Note: Users may need to supply a prefix such as 'µ' to show rates such as 'µs/s'.
HzPerHz	150	Frequency, rate of frequency change. Note: Users may need to supply a prefix such as 'm' to show rates such as 'mHz/Hz'.
VPerV	151	Voltage, ratio of voltages. Note: Users may need to supply a prefix such as 'm' to show rates such as 'mV/V'.
APerA	152	Current, ratio of amperages. Note: Users may need to supply a prefix such as 'm' to show rates such as 'mA/A'.
VPerVA	153	Power factor, PF, the ratio of the active power to the apparent power. Note: The sign convention used for power factor will differ between IEC meters and EEI (ANSI) meters. It is assumed that the data consumers understand the type of meter being used and agree on the sign convention in use at any given utility.
rev	154	Amount of rotation, revolutions.
kat	158	Catalytic activity, katal = mol / s.
JPerkg	165	Specific energy, Joules / kg.
m3Uncompensated	166	Volume, cubic metres, with the value uncompensated for weather effects.
m3Compensated	167	Volume, cubic metres, with the value compensated for weather effects.
WPerW	168	Signal Strength, ratio of power. Note: Users may need to supply a prefix such as 'm' to show rates such as 'mW/W'.
therm	169	Energy, therms.
onePerm	173	Wavenumber, reciprocal metres, (1/m).
m3Perkg	174	Specific volume, cubic metres per kilogram, v.
Pas	175	Dynamic viscosity, pascal seconds.
Nm	176	Moment of force, newton metres.

literal	value	description
NPerm	177	Surface tension, newton per metre.
radPers2	178	Angular acceleration, radians per second squared.
JPerm3	181	Energy density, joules per cubic metre.
VPerm	182	Electric field strength, volts per metre.
CPerm3	183	Electric charge density, coulombs per cubic metre.
CPerm2	184	Surface charge density, coulombs per square metre.
FPerm	185	Permittivity, farads per metre.
HPerm	186	Permeability, henrys per metre.
JPermol	187	Molar energy, joules per mole.
JPermolK	188	Molar entropy, molar heat capacity, joules per mole kelvin.
CPerkg	189	Exposure (x rays), coulombs per kilogram.
GyPers	190	Absorbed dose rate, grays per second.
WPersr	191	Radiant intensity, watts per steradian.
WPerm2sr	192	Radiance, watts per square metre steradian.
katPerm3	193	Catalytic activity concentration, katals per cubic metre.
d	195	Time in days, day = 24 h = 86400 s.
anglemin	196	Plane angle, minutes.
anglesec	197	Plane angle, seconds.
ha	198	Area, hectares.
tonne	199	Mass in tons, "tonne" or "metric ton" (1000 kg = 1 Mg).
bar	214	Pressure in bars, (1 bar = 100 kPa).
mmHg	215	Pressure, millimetres of mercury (1 mmHg is approximately 133.3 Pa).
M	217	Length, nautical miles (1 M = 1852 m).
kn	219	Speed, knots (1 kn = 1852/3600) m/s.
Mx	276	Magnetic flux, maxwells (1 Mx = 10 ⁻⁸ Wb).
G	277	Magnetic flux density, gaussses (1 G = 10 ⁻⁴ T).
Oe	278	Magnetic field in oersteds, (1 Oe = (103/4 π) A/m).
Vh	280	Volt-hour, Volt hours.
WPerA		Active power per current flow, watts per Ampere.
onePerHz		Reciprocal of frequency (1/Hz).
VPerVAr		Power factor, PF, the ratio of the active power to the apparent power. Note: The sign convention used for power factor will differ between IEC meters and EEI (ANSI) meters. It is assumed that the data consumers understand the type of meter being used and agree on the sign convention in use at any given utility.
ohmPerm	86	Electric resistance per length in ohms per metre ((V/A)/m).

literal	value	description
kgPerJ		Weight per energy in kilograms per joule (kg/J). Note: multiplier "k" is included in this unit symbol for compatibility with IEC 61850-7-3.
JPers		Energy rate in joules per second (J/s).

429

430 **3.15 PerCent datatype**

431 Percentage on a defined base. For example, specify as 100 to indicate at the defined base.
432 Table 18 shows all attributes of PerCent.

433

Table 18 – Attributes of ContingencyProfile::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)

434

435 **3.16 Boolean primitive**

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

437 **3.17 Date primitive**

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

440 **3.18 DateTime primitive**

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

445 **3.19 Float primitive**

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

447 **3.20 String primitive**

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

450

451

452 **Annex A (informative): Sample data**453 **A.1 General**

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

458 **A.2 Sample instance data**

```

459 <nc:OrdinaryContingency rdf:ID="_b2a2dbfa-6eac-4ca6-a31b-6295991bc08b">
460   <cim:IdentifiedObject.name>CO1</cim:IdentifiedObject.name>
461   <cim:IdentifiedObject.mRID>b2a2dbfa-6eac-4ca6-a31b-6295991bc08b</cim:IdentifiedObject.mRID>
462   <cim:Contingency.mustStudy>true</cim:Contingency.mustStudy>
463   <nc:Contingency.probability>99</nc:Contingency.probability>
464   <nc:Contingency.StudiedInRegion rdf:resource="#urn:entsoe:10Y1001C--00059P" />
465   <nc:Contingency.StudiedInRegion rdf:resource="#urn:entsoe:10Y1001C--000239" />
466   <nc:Contingency.RemedialAction rdf:resource="#_64ec4c52-5e70-4e5d-acb7-57a6c06dcf07" />
467   <nc:Contingency.RemedialAction rdf:resource="#_81b9b844-7e98-44ce-8b06-fdf6a631332d" />
468   <nc:Contingency.ContingencyOwner rdf:resource="#urn:entsoe:10X1001A1001A094" />
469 </nc:OrdinaryContingency>
470
471 <cim:ContingencyEquipment rdf:ID="_55095a13-874b-4d00-aa41-7ff6c6ece684">
472   <cim:IdentifiedObject.name>CE1</cim:IdentifiedObject.name>
473   <cim:IdentifiedObject.mRID>55095a13-874b-4d00-aa41-7ff6c6ece684</cim:IdentifiedObject.mRID>
474   <cim:ContingencyEquipment.contingencyStatus
475   rdf:resource="http://iec.ch/TC57/CIM100#ContingencyEquipmentStatusKind.outOfService" />
476   <cim:ContingencyEquipment.Equipment rdf:resource="#_e3cc4a25-f92e-45d2-aaa1-197c4e1a7983" />
477   <cim:ContingencyElement.Contingency rdf:resource="#_b2a2dbfa-6eac-4ca6-a31b-6295991bc08b" />
478 </cim:ContingencyEquipment>
479 <cim:AssessedElementWithContingency rdf:ID="_56a650ee-980c-4298-b3b4-e3bb790b6d57">
480   <cim:IdentifiedObject.name>AEwithCE1</cim:IdentifiedObject.name>
481   <cim:IdentifiedObject.mRID>56a650ee-980c-4298-b3b4-e3bb790b6d57</cim:IdentifiedObject.mRID>
482   <nc:AssessedElementWithContingency.AssessedElement
483   785700665e4c" />
484   <nc:AssessedElementWithContingency.Contingency rdf:resource="#_b2a2dbfa-6eac-4ca6-a31b-6295991bc08b
485   " />
486 </cim: AssessedElementWithContingency >

```