Standard for Information Model Data Storage of Electric Power, Traction Power Supply, Communications, and Signaling Railway Engineering

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China Railway BIM Alliance
Forward

According to the overall plan for informatization of railway engineering and requirements on construction management informatization of China Railway (CR), and under the guidance of railway BIM framework, this Standard is developed on the basis of IFC4.

This Standard applies to railway communications, signaling, power transformation and overhead contact system (OCS).

China Railway BIM Alliance is responsible for the explanation of this Standard. In case that any corrections or supplements are needed in the use of this Standard, please send the suggestions to China Railway BIM Alliance.

Prepared mainly by

China Railway First Survey & Design Institute Group Co., Ltd.:

And also by

Engineering Management Center of China Railway:
Sheng Liming, Shen Dongsheng, Liu Yanhong, Chen Liang, Wang Jiang, Suo Ning, Chen Yun, Li Hui
China Academy of Railway Sciences:

China Railway Eryuan Engineering Group Co., Ltd.:
   Zhou Jian, Dong Fengxiang, Li Chaoyang, Zhang Yi, Yang Jia, Mai Yang, Wang Yanzhe, Shao Yan, Ye Mingzhu, Zhu Cong, Wu Hualin, Zheng Yi, Hu Shui, Yuan Lei, Liang Ying

The Third Railway Survey and Design Institute Group Corporation:
   Li Hualiang, Yang Xukun, Liu Hang, Liu Xinyu, Che Shuang, Zheng Xinxin, Jiang Chuandong, Zhang Yanjun, Chai Tianjiao, Zhang Wenli, Xin Yu, Miao Hua, Lu Jing, Zhao Feifei, Yao Fengfeng, Su Lin, Wu Changhai, Hou Zhenyu, Peng Liangyong, Ma Jingbo, Chen Xingqiang, He Yongfa, Luo Jian

China Railway Siyuan Survey and Design Group Co., Ltd.:

China Construction Communications Engineering Group Co., Ltd.:
   Wang Yonyi, Zhang Kun, Huang Xin
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Standard for Information Model Data Storage of Electric Power, Traction Power Supply, Communications, and Signaling Railway Engineering

1 General Provisions

1.1 Principles of Compilation

Compilation of this Standard shall comply with the principles below:

(1) Principle of compatibility. This Standard shall be fully compatible with IFC (Industry Foundation Class) standard issued by building SMART.

(2) Principle of portability. This Standard only applies to basic data model of electric power, traction power supply, communications, and signaling railway engineering. Elements in this data model may be used by different coding modes at different technology platforms.

(3) Principle of abstraction. This Standard only defines important elements of electric power, traction power supply, communications, and signaling railway engineering that are widely used both at home and abroad, and acknowledged and accepted by the whole field with a view to minimizing fixed model of this Standard.

(4) Principle of extensibility. Elements defined by this Standard may be further modified in combination with classification and coding of specific information or information in dictionary on the basis that the basic meaning is not exaggerated or changed so as to meet the requirements of specific users to store and exchange information.

(5) Principle of selectivity. Any element defined in this Standard is selectable for storing and exchanging information.

(6) Principle of repeatability. Any element defined in this Standard is repeatable in the application of exchanging and storing of data.

(7) Principle of accessibility. This Standard provides formalized and readable documents used for describing the standard between different authors as well as between the author and software developers without adding additional workload to relevant personnel.

1.2 Scope of Compilation
This Standard at present applies to the fields of railway communications, signaling, power transformation and OCS.

1.3 Scope of Application

This Standard is applicable to the formulation of BIM in railway engineering, development of railway BIM software and applied research of railway BIM.

1.4 Citation

The following standards and codes are cited in this Standard:

ISO 16739: 2013 Industry Foundation Classes.
Building SMART Industry Foundation Classes IFC4x1.
2 Terms and Abbreviations

2.1 Terms

The following terms are applicable to this Standard.

Entity: a set of concepts or physical objects with common features

Attribute: abstract description of entity features.

Direct Attribute: information unit for direct description of entity features.

Inverse Attribute: information unit of relevant entities for defining features with a view to ensuring referential integrity.

Derived Attribute: information unit from the calculation of other attributes.

Property Set: set of attributes.

Schema: set of data items used for structuring parts of the model or the whole model.

Information Model: a type of abstract expression of data language used for defining concept and relationship in a certain field.

Spatial Structure Element: generally used for representing spatial entity of objects and their main composition.

Spatial Composition: referring to the composition relationship between parts and whole of spatial structure elements.

Spatial Decomposition: referring to the decomposition relationship between parts and whole of spatial structure elements.

Spatial Containment: referring to the relationship that spatial structure element contains entity.

Contained in Spatial Structure: referring to the relationship that entity is contained in spatial structure element.

Entity Composition: referring to the relationship that entity is contained in assembly.

Express-G: graphic subsets of EXPRESS language used for describing the relationship between concepts with graphical methods.
2.2 Abbreviations
   The following abbreviations are applicable to this Standard.

   BIM: Building Information Modeling.
   IFC: Industry Foundation Classes.
   HVAC: Heating, Ventilation and Air Conditioning.
   XML: Extensible Markup Language.
Chapter 3: Basic Data Structure for Information Model of Electric Power, Traction Power Supply, Communications, and Signaling Railway Engineering

### 3.1 Basic Data Structure for Information Model of Electric Power, Traction Power Supply, Communications, and Signaling Railway Engineering

The basic data structure for information model of electric power, traction power supply, communications, and signaling railway engineering is developed based on the IFC4 and Version 1.0 of *Standard for Information Model Data Storage of Railway Engineering* to meet the requirements of electric power, traction power supply, communications, and signaling railway engineering. With a view to maintaining continuity of IFC standard, the following principles shall be complied with during the modification process.

1. Electric power, traction power supply, communications, and signaling profession is extended only in the Domain Layer and the Interop Layer without adding new fields.

2. Existing entities are mainly used for extension.

3. Addition to attribute or predefined type are mainly used for extending entity.

4. If the two principles above fail to comply with the requirements, new entities and corresponding common property set shall be added.

Extension shall be made on the basis of the above principles, as shown in Figure 3.1. There is no extension in Resource Layer and Core Layer. In Electrical Domain and Building Controls Domain of the Domain Layer, some entities are added or extended in the Interop Layer based on the characteristics of electric power, traction power supply, communications, and signaling profession.

### 3.2 Spatial Structure of Electric Power, Traction Power Supply, Communications, and Signaling Railway Engineering

Spatial structure of electric power, traction power supply, communications, and signaling railway engineering is shown in Figure 3.2. Several IfcDistributionSystems are included under IfcRailwayStation. The distribution system can be the system of communications, signaling, OCS, and power or power transformation.
Figure 3.3 is a circuit diagram of power distribution system in IFC4. Electric power, traction power supply, communications, and signaling railway system is essentially similar to this system. One IfcDistributionSystem contains several sub-distribution systems through IfcRelAggregates; several devices, junction boxes and cables are contained in the distribution system through IfcRelAssignsToGroup; several ports are contained in the devices and cables through IfcRelNests; ports are connected to each other through IfcRelConnectsPorts.
Figure 3.1 Basic Data Structure for Information Model of Electric Power, Traction Power Supply, Communications, and Signaling Railway Engineering
Figure 3.2 Spatial Structure of Electric Power, Traction Power Supply, Communications, and Signaling Railway Engineering
Figure 3.3 Relationship Diagram of Aggregation in Distribution System
4 Public Use of Electric Power, Traction Power Supply, Communications, and Signaling Railway Engineering

The basic data structure for information model of electric power, traction power supply, communications, and signaling railway engineering consists of IfcDistributionSystem, IfcDistributionElement and IfcDistributionElement.

Thereinto, the existing types or their enum items of IFC4 are adopted for some public elements or parts of electric power, traction power supply, communications, and signaling railway engineering, and other elements are extended by adding more types or enum items. Details are as follows:

(1) Please refer to Chapter 4 of this Standard for public use of electric power, traction power supply, communications, and signaling railway engineering.

(2) IfcLamp and IfcLightFixture in IFC4 are used for lamp.

(3) IfcElectricFlowStorageDevice in IFC4 is used for capacitor.

(4) IfcElectricTimeControl in IFC4 is used for relay.

(5) IfcAlarm in IFC4 is used for alarm.

(6) IfcJunctionBox\DATA or POWER in IFC4 is used for junction box.

(7) IfcDistributionPort in IFC4 is used for port.

(8) IfcDistributionChamberElement\MANHOLE in IFC4 is used for cable shaft.

(9) IfcFooting in IFC4 is used for footing.

(10) IfcColumn in IFC4 is used for stand column.

(11) IfcCableCarrierSegment\CABLETRUNKINGSEGMENT in IFC4 is used for cable trunk.

(12) IfcCableCarrierSegment\CONDUITSEGMENT in IFC4 is used for conduit segment.

(13) IfcCableCarrierSegment\CABLELADDERSEGMENT in IFC4 is used for cable ladder.

(14) IfcCableCarrierSegment\CABLETRAYSEGMENT in IFC4 is used for cable tray.
(15) IfcCableFitting in IFC4 is used for cable fitting module, and predefined type shall be added.

(16) IfcCableSegment in IFC4 is used for cable segment, stranded segment and grounding wire segment, and predefined type shall be added.

(17) IfcProtectiveDevice in IFC4 is used for fuse disconnector and circuit breaker, and predefined type shall be added.

(18) IfcElectricDistributionBoard in IFC4 is used for consumer unit and distribution board, and predefined type shall be added.

(19) IfcTransformer in IFC4 is used for transformer and rectifier, and predefined type shall be added.

(20) IfcElectricFlowStorageDevice/UPS in IFC4 is used for uninterrupted power supply (UPS) device, and IfcElectricFlowStorageDevice\BATTERY for storage battery, and predefined type shall be added.

(21) IfcElectricFlowStorageDevice in IFC4 is used for switch power supply, and predefined type shall be added.

(22) IfcDeviceCabinet is a new entity connected with IfcFlowTerminal, mainly including box, direction box, protection box, nose plate, interface cabinet, track cabinet and communication cabinet.

(23) IfcInsulationDevice is a new entity connected with IfcFlowTreatmentDevice.

(24) IfcLightningProtection is a new entity connected with IfcFlowController.

(25) IfcGroundDevice is a new entity connected with IfcFlowController.

The connection of cable trunk, cable shaft and conduit segment is shown in Figure 4.1. The connection of cable trunk cable shaft and the distribution system of conduit segment is shown in Figure 4.2. EXPRESS-G diagram of public use of electric power, traction power supply, communications, and signaling railway engineering is shown in Figure 4.3.
4.1 Types of Public Use
4.1.1 IfcCableCarrierSegmentTypeEnum

IfcCableCarrierSegmentTypeEnum is the enum of cable carrier segment type, which defines the types of cable carrier segments according to their functions. It is the existing type of IFC4, and electric power, traction power supply, communications, and signaling profession is extended based on this type.

Definition of existing enum items:
CABLELADDERSEGMENT;
CABLETRAYSEGMENT;
CABLETRUNKINGSEGMENT;CONDUITSEGMENT;USERDEFINED;NOTDEFINED.

Definition of new enum items:
CANTILEVER;
SUPPORTOR.

Description of EXPRESS:
TYPE IfcCableCarrierSegmentTypeEnum=ENUMERATION OF
(CABLELADDERSEGMENT,
Figure 4.2 Connection of Cable Trunk, Cable Shaft and the Distribution System of Conduit Segment

Figure 4.3 EXPRESS-G Diagram of Public Use of Electric Power, Traction Power Supply, Communications, and Signaling Railway Engineering
CABLETRAYSEGMENT,
CABLETRUNKINGSEGMENT,
CANTILEVER,
CONDUITSEGMENT,
SUPPORTOR,
USERDEFINED,
NOTDEFINED);
END_TYPE;

4.1.2 IfcCableSegmentTypeEnum

IfcCableSegmentTypeEnum is the enum of cable segment type, which defines the types of cable segments according to their functions. This type is the existing type of IFC4, and electric power, traction power supply, communications, and signaling profession is extended based on this type.

Definition of existing enum items:
BUSBARSEGMENT;
CABLESEGMENT;
CONDUCTORSEGMENT;
CORESEGMENT;
USERDEFINED;
NOTDEFINED.

Definition of new enum items:
INTEGRATEDGROUNDINGWIRESEGMENT;
STRANDEDSEGMENT.

Description of EXPRESS:
TYPE IfcCableSegmentTypeEnum=ENUMERATION OF (BUSBARSEGMENT,
CABLESEGMENT,
CONDUCTORSEGMENT,
CORESEGMENT,
INTEGRATEDGROUNDINGWIRESEGMENT,
STRANDEDSEGMENT,
USERDEFINED,
NOTDEFINED);
END_TYPE;
4.1.3 IfcProtectiveDeviceTypeEnum

IfcProtectiveDeviceTypeEnum is the enum of protective device type, which defines the types of protective devices according to their functions. This type is the existing type of IFC4, and electric power, traction power supply, communications, and signaling profession is extended based on this type.

Definition of existing enum items:
CIRCUITBREAKER;
EARTHLEAKAGECIRCUITBREAKER;
EARTHINGSWITCH;
FUSEDISCONNECTOR;
RESIDUALCURRENTCIRCUITBREAKER;
RESIDUALCURRENTSWITCH;
VARISTOR;
USERDEFINED;
NOTDEFINED.

Definition of new enum items:
POINTMACHINEPROTECTION;
RESISTOR;
SWITCHINGCABINET.

Description of EXPRESS:
TYPE IfcProtectiveDeviceTypeEnum=ENUMERATION OF
(CIRCUITBREAKER,
EARTHLEAKAGECIRCUITBREAKER,
EARTHINGSWITCH,
FUSEDISCONNECTOR,
POINTMACHINEPROTECTION,
RESIDUALCURRENTCIRCUITBREAKER,
RESIDUALCURRENTSWITCH,
RESISTOR,
VARISTOR,
SWITCHINGCABINET,
USERDEFINED,
NOTDEFINED);
END_TYPE;

4.1.4 IfcElectricDistributionBoardTypeEnum

IfcElectricDistributionBoardTypeEnum is the enum of electric distribution board type, which defines the types of electric distribution boards according to their functions. This type is the existing type of IFC4, and electric power, traction power supply, communications, and signaling profession is extended based on this type.

Definition of existing enum items:
CONSUMERUNIT;
DISTRIBUTIONBOARD;
MOTORCONTROLCENTRE;
SWITCHBOARD;
USERDEFINED;
NOTDEFINED.

Definition of new enum items:

POWERBOARD;
DATABASE.

Description of EXPRESS:
TYPE IfcElectricDistributionBoardTypeEnum=ENUMERATION OF
(CONSUMERUNIT,
DATABASE,
DISTRIBUTIONBOARD,
MOTORCONTROLCENTRE,
POWERBOARD,
SWITCHBOARD,
USERDEFINED,
NOTDEFINED);
END_TYPE;

4.1.5 IfcCableFittingTypeEnum

IfcCableFittingTypeEnum is the enum of cable fitting type, which defines the types of cable fittings according to their functions. This type is the existing type of IFC4, and electric power, traction power supply, communications, and signaling profession is extended based on this type.

Definition of existing enum items:
CONNECTOR;
ENTRY;
EXIT;
JUNCTION;
TRANSITION;
USERDEFINED;
NOTDEFINED.

Definition of new enum items:
TERMINALMOUDULE.
Description of EXPRESS:

TYPE IfcCableFittingTypeEnum=ENUMERATION OF
  (CONNECTOR,
   ENTRY,
   EXIT,
   JUNCTION,
   TERMINALMOUDULE,
   TRANSITION,
   USERDEFINED,
   NOTDEFINED);
END_TYPE;

4.1.6 IfcTransformerTypeEnum

IfcTransformerTypeEnum is the enum of protective device type, which defines the types of power transformation devices according to their functions. This type is the existing type of IFC4, and electric power, traction power supply, communications, and signaling profession is extended based on this type.

Definition of existing enum items:
CURRENT;
FREQUENCY;
INVERTER;
RECTIFIER;
VOLTAGE;
USERDEFINED;
NOTDEFINED.

Definition of new enum items:
LIGHTINGUNIT.

Description of EXPRESS:
TYPE IfcTransformerTypeEnum=ENUMERATION OF (CURRENT,
  FREQUENCY,
  INVERTER,
  LIGHTINGUNIT,
  RECTIFIER,
IfcDeviceCabinetTypeEnum

IfcDeviceCabinetTypeEnum is the enum of device cabinet type, which defines the types of device cabinets according to their functions.

Definition of new enum items:
BOX;
CABINET;
USERDEFINED;

NOTDEFINED.

Description of EXPRESS:
TYPE IfcDeviceCabinetTypeEnum=ENUMERATION OF (BOX,
CABINET,
USERDEFINED,
NOTDEFINED);
END_TYPE;

IfcInsulationDeviceTypeEnum

IfcInsulationDeviceTypeEnum is the enum of insulation device type, which defines the types of insulation devices according to their functions.

Definition of new enum items:
AIRCORECOIL;
INSULATEDJOINT;
INSULATIONEQUIPMENT;
INSULATOR;
USERDEFINED;
NOTDEFINED.
Description of EXPRESS:
TYPE IfcInsulationDeviceTypeEnum=ENUMERATION OF
(AIRCORECOIL,
INSULATEDJOINT,
INSULATIONEQUIPMENT,
INSULATOR,
USERDEFINED,
NOTDEFINED);
END_TYPE;

4.1.9 IfcLightningProtectionTypeEnum
IfcLightningProtectionTypeEnum is the enum of lightning protection type, which defines the types of lightning protection devices according to their functions.

Definition of new enum items:
LIGHTNINGROD;
LIGHTNINGSTRIP;
USERDEFINED;
NOTDEFINED.

Description of EXPRESS:
TYPE IfcLightningProtectionTypeEnum=ENUMERATION OF
(LIGHTNINGROD,
LIGHTNINGSTRIP,
USERDEFINED,
NOTDEFINED);
END_TYPE;

4.1.10 IfcGroundDeviceTypeEnum
IfcGroundDeviceTypeEnum is the enum of ground device type, which defines the types of ground devices according to their functions.

Definition of new enum items:
EARTHELECTRODE;
GROUNDDBUS;
GROUNDINGMODULE;
IONELECTRODE;
USERDEFINED;
NOTDEFINED.

Description of EXPRESS:
TYPE IfcGroundDeviceTypeEnum=ENUMERATION OF
(EARTHELECTRODE,
GROUNDBUS,
GROUNDINGMODULE,
IONELECTROD,
USERDEFINED,
NOTDEFINED);
END_TYPE;

4.1.11 IfcAlarmTypeEnum

IfcAlarmTypeEnum is the set of different alarm types. This type is the existing type of IFC4, and electric power, traction power supply, communications, and signaling profession is extended based on this type.

Definition of existing enum items:
BELL;
BREAKGLASSBUTTON;
LIGHT;
MANUALPULLBOX;
SIREN;
WHISTLE;
USERDEFINED;
NOTDEFINED.

Definition of new enum items:
ALARMBUTTON.

Description of EXPRESS:
TYPE IfcAlarmTypeEnum=ENUMERATION OF (BELL,
BREAKGLASSBUTTON,
LIGHT,
MANUALPULLBOX,
SIREN,
WHISTLE,
ALARMBUTTON,
USERDEFINED,
NOTDEFINED);
END_TYPE;

4.1.12 IfcElectricFlowStorageDeviceTypeEnum

IfcElectricFlowStorageDeviceTypeEnum is the enum of flow storage device type. This type is the existing type of IFC4, and electric power, traction power supply, communications, and signaling profession is extended based on this type.

Definition of existing enum items:
BATTERY;
CAPACITORBANK;
HARMONICFILTER;
INDUCTORBANK;
UPS;
USERDEFINED;
NOTDEFINED.

Definition of new enum items:
SWITCHPOWERSUPPLY.

Description of EXPRESS:
TYPE IfcElectricFlowStorageDeviceTypeEnum=ENUMERATION OF (BATTERY,
CAPACITORBANK,
HARMONICFILTER,
INDUCTORBANK,
UPS,
SWITCHPOWERSUPPLY,
USERDEFINED,
NOTDEFINED);
END_TYPE;

4.2 Public Entity
4.2.1 IfcFlowTerminal
4.2.1.1 Definition of Entity

As IfcSignalingTerminal, IfcDeviceCabinet and IfcSignalMechanisms need to be newly added under IfcFlowTerminal, the IfcFlowTerminal shall be redescribed.

4.2.1.2 Definition of Attribute

The attribute of flow terminal shall remain the same as the original.

4.2.1.3 Description of EXPRESS

ENTITY IfcFlowTerminal
SUBTYPE OF (IfcDistributionFlowElement);
END_ENTITY;

4.2.2 IfcDeviceCabinet

4.2.2.1 Definition of Entity

IfcDeviceCabinet is used for IfcFlowTerminal equipment.

4.2.2.2 Definition of Attribute

PreDefinedType: It further divides device cabinets into cabinets and boxes according to their functions.

4.2.2.3 Description of EXPRESS

ENTITY IfcDeviceCabinet
SUBTYPE OF (IfcFlowTerminal);
PreDefinedType: OPTIONAL IfcDeviceCabinetTypeEnum;
WHERE
CorrectPredefinedType:
 NOT (EXISTS (PredefinedType))
 OR (PredefinedType <> IfcDeviceCabinetTypeEnum.USERDEFINED)
 OR
 ((PredefinedType = IfcDeviceCabinetTypeEnum.USERDEFINED) AND EXISTS
 (SELF\IfcObject.ObjectType));
 CorrectTypeAssigned: (SIZEOF (IsTypeBy) = 0)
 OR
 (‘IFCELECTRICALDOMAIN.IFCDEVICECABINETTYPE’ IN TYPEOF
 (SELF\IfcObject.IsTypeBy [1].RelatingType));
 END_ENTITY;

4.2.3 IfcFlowController

4.2.3.1 Definition of Entity

As As IfcSignalingRelay, IfcLightningProtection and IfcGroundDevice need to be newly added
under IfcFlowController, the IfcFlowController shall be redescribed.

4.2.3.2 Definition of Attribute

The attribute of flow controller shall remain the same as the original.

4.2.3.3 Description of EXPRESS

ENTITY IfcFlowController

SUPERTYPE OF (ONE OF (IfcAirTerminalBox,
IfcDamper,
IfcElectricDistributionBoard,
IfcElectricTimeControl,
IfcFlowMeter,
IfcGroundDevice,
IfcLightningProtection,
IfcProtectiveDevice,
IfcSignalingRelay,
IfcSwitchingDevice,
IfcValve))

SUBTYPE OF (IfcDistributionFlowElement);

END_ENTITY;
4.2.4 IfcFlowTreatmentDevice

4.2.4.1 Definition of Entity

As IfcInsulationDevice needs to be newly added under IfcFlowTreatmentDevice, the IfcFlowTreatmentDevice shall be redescribed.

4.2.4.2 Definition of Attribute

The attribute of flow treatment device shall remain the same as the original.

4.2.4.3 Description of EXPRESS

ENTITY IfcFlowTreatmentDevice
SUPERTYPE OF (ONEOF (IfcDuctSilencer, IfcFilter,
  IfcInterceptor,
  IfcInsulationDevice))
SUBTYPE OF (IfcDistributionFlowElement);
END_ENTITY;

4.2.5 IfcInsulationDevice

4.2.5.1 Definition of Entity

IfcInsulationDevice defines the major parts or elements used for electrical insulation between charged bodies of OCS and other devices or grounding bodies.

4.2.5.2 Definition of Attribute

PreDefinedType: It further divides insulation devices into aircorecoils, insulated joints, insulation parts, insulators and insulation bushings according to their structure forms.

4.2.5.3 Description of EXPRESS

ENTITY IfcInsulationDevice
SUBTYPE OF (IfcFlowTreatmentDevice);
  PreDefinedType: OPTIONAL IfcInsulationDeviceTypeEnum;
  WHERE CorrectPredefinedType:
  NOT (EXISTS (PredefinedType))
  OR (PredefinedType <> IfcInsulationDeviceTypeEnum.USERDEFINED)

  OR
((PredefinedType = IfcInsulationDeviceTypeEnum.USERDEFINED) AND EXISTS (SELF\IfcObject.ObjectType));
CorrectTypeAssigned: (SIZEOF (IsTypeBy) = 0)
OR
('IFCELECTRICALDOMAIN.IFCINSULATIONDEVICETYPE' IN TYPEOF (SELF\IfcObject.IsTypeBy[1].RelatingType))
END_ENTITY;

4.2.6 IfcLightningProtection

4.2.6.1 Definition of Entity

IfcLightningProtection is used for reducing damage of properties and casualties on or near buildings/structures from lightening.

4.2.6.2 Definition of Attribute

PreDefinedType: It further divides lightning protection devices into lighting strips and lightning rods according to their functions.

4.2.6.3 Description of EXPRESS

ENTITY IfcLightningProtection
SUBTYPE OF (IfcFlowController);
PreDefinedType: OPTIONAL IfcLightningProtectionTypeEnum;
WHERE
CorrectPredefinedType:
NOT (EXISTS (PredefinedType))
OR (PredefinedType <> IfcLightningProtectionTypeEnum.USERDEFINED)
OR
((PredefinedType = IfcLightningProtectionTypeEnum.USERDEFINED) AND EXISTS (SELF\IfcObject.ObjectType));
CorrectTypeAssigned: (SIZEOF (IsTypeBy) = 0)
OR
('IFCELECTRICALDOMAIN.IFCLIGHTNINGPROTECTIONTYPE' IN TYPEOF (SELF\IfcObject.IsTypeBy[1].RelatingType))
END_ENTITY;

4.2.7 IfcGroundDevice

4.2.7.1 Definition of Entity
IfcGroundDevice includes grounding body and grounding wire. It is used for conducting lightning current into the earth.

4.2.7.2 Definition of Attribute

PreDefinedType: It further divides earthing devices into groundbuses, earth electrodes, grounding modules and ionelectrods according to their functions.

4.2.7.3 Description of EXPRESS

ENTITY IfcGroundDevice SUBTYPE OF (IfcFlowController);
PreDefinedType: OPTIONAL IfcGroundDeviceTypeEnum;
WHERE CorrectPredefinedType:
    NOT (EXISTS (PredefinedType))
    OR (PredefinedType <> IfcGroundDeviceTypeEnum.USERDEFINED)
    OR
    ((PredefinedType = IfcGroundDeviceTypeEnum.USERDEFINED) AND EXISTS
    (SELF\IfcObject.ObjectType));
CorrectTypeAssigned: (SIZEOF (IsTypeBy) = 0)
    OR
    (‘IFCELECTRICALDOMAIN.IFCGROUNDDEVICETYPE’ IN TYPEOF
    (SELF\IfcObject.IsTypeBy[1].RelatingType))
END_ENTITY;

4.3 Public Use Property Set

4.3.1 Pset_DeviceCabinetCommon

Name of Property Set: Pset_DeviceCabinetCommon
Applicable Entity: IfcDeviceCabinet
Description: common property set of equipment cabinets
Pset_DeviceCabinetCommon.
Attribute List: see Table 4.3.1
Table 4.3.1 Attribute List of Pset_DeviceCabinetCommon

<table>
<thead>
<tr>
<th>Name</th>
<th>Data type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IsGrounding</td>
<td>P_SINGLEVALUE/IfcBoolean</td>
<td>Grounded or not</td>
</tr>
<tr>
<td>NumberOfLayers</td>
<td>P_SINGLEVALUE/IfcInteger</td>
<td>Number of layers</td>
</tr>
<tr>
<td>NumberOfColumns</td>
<td>P_SINGLEVALUE/IfcInteger</td>
<td>Number of columns</td>
</tr>
</tbody>
</table>

4.3.2 Pset_ElectriDistributionBoardTypePowerBoard

Name of Property Set: Pset_ElectriDistributionBoardTypePowerBoard
Applicable Entity: IfcElectriDistributionBoard
Description: property set of power boards
Attribute List: see Table 4.3.2

Table 4.3.2 Attribute List of Pset_ElectriDistributionBoardTypePowerBoard

<table>
<thead>
<tr>
<th>Name</th>
<th>Data type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>P_ENUMERATEDVALUE/IfcLabel/PEnum_ElectriDistributionBoardDataBaseBoardType: AC,DC</td>
<td>Type of electric distribution boards Divided as AC, DC</td>
</tr>
</tbody>
</table>

4.3.3 Pset_GroundDeviceTypeCommon

Name of Property Set: Pset_GroundDeviceTypeCommon
Applicable Entity: IfcGroundDevice
Description: common property set of ground devices
Attribute List: see Table 4.3.3

Table 4.3.3 Attribute List of Pset_GroundDeviceTypeCommon

<table>
<thead>
<tr>
<th>Name</th>
<th>Data type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference</td>
<td>P_SINGLEVALUE/IfcIdentifier</td>
<td>ID cited</td>
</tr>
<tr>
<td>HasIon</td>
<td>P_SINGLEVALUE/IfcBoolean</td>
<td>Ion or not</td>
</tr>
</tbody>
</table>

4.3.4 Pset_ChainageCommon

Name of Property Set: Pset_ChainageCommon
Applicable Entity: outdoor devices or footing of electric power, traction power supply, communications, and signaling railway engineering
Description: common property set of chainage
Attribute List: see Table 4.3.4
Table 4.3.4 Attribute List of Pset_ChainageCommon

<table>
<thead>
<tr>
<th>Name</th>
<th>Data type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CenterChinage</td>
<td>TypePropertySingleValue/IfcLengthMeasure</td>
<td>Center chinage</td>
</tr>
<tr>
<td>Elevation</td>
<td>TypePropertySingleValue/IfcLengthMeasure</td>
<td>Relative elevation</td>
</tr>
</tbody>
</table>

4.3.5 Pset_IfcLightningProtection

Name of Property Set: Pset_LightningProtection
Applicable Entity: IfcLightningProtection
Description: property set of lightning protection devices
Attribute List: see Table 4.3.5

Table 4.3.5 Attribute List of Pset_LightningProtection

<table>
<thead>
<tr>
<th>Name</th>
<th>Data type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference</td>
<td>P_SINGLEVALUE/IfcIdentifier</td>
<td>ID cited</td>
</tr>
</tbody>
</table>

4.3.6 Pset_IfcLightningProtectionTypeLightningRod

Name of Property Set: Pset_LightningProtectionTypeLightningRod
Applicable Entity: IfcLightningProtection
Description: property set of lightning rod
Attribute List: see Table 4.3.6

Table 4.3.6 Attribute List of Pset_LightningProtectionTypeLightningRod

<table>
<thead>
<tr>
<th>Name</th>
<th>Data type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>P_ENUMERATEDVALUE/PEnum_Type:latticed,cylinder</td>
<td>Type: latticed, cylinder</td>
</tr>
</tbody>
</table>

4.3.7 Pset_IfcDistributionSystemTypeRailSystem

This Standard cites IfcDistributionSystem in IFC4 to define the meaning of system in electric power, traction power supply, communications, and signaling railway engineering and the property set “Pset_DistributionSystemTypeRailSystem” is newly defined. The “Type” in this property set is used to further explain the type of the system.
Name of Property Set: Pset_DistributionSystemTypeRailSystem
Applicable Entity: IfcDistributionSystem
Description: railway sub-system type of the distribution system
Attribute List: see Table 4.3.7
<table>
<thead>
<tr>
<th>Name</th>
<th>Data type</th>
</tr>
</thead>
<tbody>
<tr>
<td>P_ENUMERATEDVALUE/IfcLabel:</td>
<td>TransmissionSystem</td>
</tr>
<tr>
<td></td>
<td>AccessNetwork</td>
</tr>
<tr>
<td></td>
<td>DataCommunicationNetwork</td>
</tr>
<tr>
<td></td>
<td>TelephoneExchange</td>
</tr>
<tr>
<td></td>
<td>DispatchingCommunicationSystem</td>
</tr>
<tr>
<td></td>
<td>Mobile</td>
</tr>
<tr>
<td></td>
<td>VideoConferenceSystem</td>
</tr>
<tr>
<td></td>
<td>VideoMonitoringSystem</td>
</tr>
<tr>
<td></td>
<td>EmergencyCommunicationSystem</td>
</tr>
<tr>
<td></td>
<td>IntegratedWiringSystem</td>
</tr>
<tr>
<td></td>
<td>ClockSynchronizationSystem</td>
</tr>
<tr>
<td></td>
<td>TimeSynchronizationSystem</td>
</tr>
<tr>
<td></td>
<td>CommunicationIntegratedNetworkManagementSystem</td>
</tr>
<tr>
<td></td>
<td>OpticalFiberMonitoringSystem</td>
</tr>
<tr>
<td></td>
<td>LeakyCableMonitoringSystem</td>
</tr>
<tr>
<td></td>
<td>TowerFiberMonitoringSystem</td>
</tr>
<tr>
<td></td>
<td>TunnelEmergencyCommunication</td>
</tr>
<tr>
<td></td>
<td>InterfaceMonitoringSystem</td>
</tr>
<tr>
<td></td>
<td>PublicAddressSystem</td>
</tr>
<tr>
<td></td>
<td>PassengerInformationDisplaySystem</td>
</tr>
<tr>
<td></td>
<td>EnquirySystem</td>
</tr>
<tr>
<td></td>
<td>IntrusionAlarmSystem</td>
</tr>
<tr>
<td></td>
<td>HelpSystem</td>
</tr>
<tr>
<td></td>
<td>TicketingSystem</td>
</tr>
<tr>
<td></td>
<td>AccessControlSystem</td>
</tr>
<tr>
<td></td>
<td>BaggageParcelManagementInformationSystem</td>
</tr>
<tr>
<td></td>
<td>OMIS</td>
</tr>
<tr>
<td></td>
<td>PSMIS</td>
</tr>
<tr>
<td></td>
<td>FTMS</td>
</tr>
<tr>
<td></td>
<td>OperationDispatchingSystem</td>
</tr>
<tr>
<td></td>
<td>EMUManagementInformationSystem</td>
</tr>
<tr>
<td></td>
<td>TrafficDispatching</td>
</tr>
<tr>
<td></td>
<td>TrainOperationControl</td>
</tr>
<tr>
<td></td>
<td>SectionBlock</td>
</tr>
<tr>
<td></td>
<td>StationInterlocking</td>
</tr>
<tr>
<td></td>
<td>SignalingInspectionAndMonitoring</td>
</tr>
<tr>
<td></td>
<td>ElectromagneticCompatibility</td>
</tr>
<tr>
<td></td>
<td>SnowMeltingOnPoint</td>
</tr>
<tr>
<td></td>
<td>TransformerMainSystem</td>
</tr>
<tr>
<td></td>
<td>CompensatingSystem</td>
</tr>
<tr>
<td></td>
<td>MonitoringSystem</td>
</tr>
<tr>
<td></td>
<td>SCADASystem</td>
</tr>
<tr>
<td></td>
<td>Power Supply And Enviroment Monitoring System</td>
</tr>
<tr>
<td></td>
<td>PowerSupply</td>
</tr>
<tr>
<td></td>
<td>LightningProtection</td>
</tr>
<tr>
<td></td>
<td>Earthing</td>
</tr>
<tr>
<td></td>
<td>BAS</td>
</tr>
<tr>
<td></td>
<td>FAS</td>
</tr>
<tr>
<td></td>
<td>OCS</td>
</tr>
</tbody>
</table>
5 Communication

The communication of this code defines three parts of contents including communication, information and natural disaster and foreign object intrusion monitoring system of railway.

The definition of communication is formed by quoting the IfcDistributionSystem, IfcDistributionElement and IfcDistributionPort in IFC4. Figure 5.1 shows the connection relation of elements and ports by taking the station ticketing system of railway for instance.

Among which, parts of the communication elements or components adopt the existing types or the existing type enumerations in IFC4, parts of the elements are expanded by the way of increasing enumeration as follows:

1. The router adopts the IfcCommunicationsAppliance\ROUTER in IFC4.
2. The IfcCommunicationsAppliance type in IFC4 is adopted and the predefined types including TRANSMISSIONEQUIPMENT, ACCESSNETWORKEQUIPMENT, EXCHANGE EQUIPMENT, NETWORKSWITCH, SYNCHRONIZATIONNETWORKEQUIPMENT, EMERGENCYHANDLINGEQUIPMENT, MONITORHANDLEEQUIPMENT, CONVERTER, WIRELESSCOMMMUNICATIONEQUIPMENT, LOCOMOTIVEEQUIPMENT, PORTABLEDEVICES, DATASTORAGE are newly increased.
3. The antenna adopts the IfcCommunicationsAppliance\ANTENNA in IFC4.
4. The wind direction and speed meter adopts the IfcSensor\WINDSENSOR in IFC4.
5. The IfcSensor type in IFC4 is adopted, and the predefined types including PLUVIOGRAPH, SNOWMETER, SEISMOMETER and CLEARANCEINTRUSIONMONITORINGDEVICE are newly increased.
6. The socket of data or voice adopts the IfcOutlet\DATAOUTLET or TELEPHONEOUTLET in IFC4.
8. The clock adopts the IfcElectricTimeControl\TIMECLOCK in IFC4.
9. All kinds of terminals of information enquiry, office and administration adopt the IfcCommunicationsAppliance\COMPUTER in IFC4.
10. The display screen of passenger transport information adopts the IfcCommunicationsAppliance\DISPLAY in IFC4.
11. The speaker adopts the IfcAudioVisualAppliance\SPEAKER in IFC4, the noise sensor adopts IfcSensor\SOUNDENSOR in IFC4, the wireless calling station adopts the
IfcAudioVisualAppliance\RECEIVER in IFC4, the broadcast host adopts the IfcAudioVisualAppliance\PLAYER in IFC4, and the broadcast amplifier adopts the IfcAudioVisualAppliance\AMPLIFIER in IFC4.

(12) The sound and light alarm equipment adopts the IfcAlarm\LIGHT、BEL in IFC4.

(13) The IfcSensor type in IFC4 is adopted and the predefined type-INTRUSIONDETECTOR is increased.

(14) The IfcAlarm type in IFC4 is adopted and the predefined type-ALARMBUTTON is increased.

(15) The IfcAudioVisualAppliance type in IFC4 is adopted and the predefined types including RECORDER, CONFERENCEEQUIPMENT and CONSOLE are increased.

(16) The automatic ticketing machine adopts the IfcElectricAppliance\VENDINGMACHINE, the manual ticketing machine adopts the IfcCommunicationsAppliance\COMPUTER and the ticket printer adopts the IfcCommunicationsAppliance\PRINTER.

(17) The uninterruptible power supply adopts the IfcElectricFlowStorageDevice\UPS and the battery adopts the IfcElectricFlowStorageDevice\BATTERY.

(18) The switch power supply equipment adopts the IfcElectricFlowStorageDevice type in IFC4 and the predefined type-SWITCHPOWERSUPPLY is increased.

(19) The cable, light protection, earthing, ditch, ducts, pipeline and shafts refer to the common parts of the four electricity.
Figure 5.1 The connection relation figure of the station ticketing system equipment for railway
5.1 The Definition of Type

5.1.1 IfcAudioVisualApplianceTypeEnum

IfcAudioVisualApplianceTypeEnum is a set of different kinds of audio-visual equipment. Definition of existing enum items:

AMPLIFIER,
CAMERA,
DISPLAY,
MICROPHONE,
PLAYER,
PROJECTOR,
RECEIVER,
SPEAKER,
SWITCHER,
TELEPHONE,
TUNER,
USERDEFINED,
NOTDEFINED.

Definition of new enum items:

RECORDER,
CONFERENICEQUIPMENT,
CONSOLE.

EXPRESSION:

TYPEIfcAudioVisualApplianceTypeEnum=ENUMERATIONOF
(AMPLIFIER,
CAMERA,
CONFERENICEQUIPMENT,
CONSOLE,
DISPLAY,
MICROPHONE,
PLAYER,
PROJECTOR,
RECEIVER,
RECORDER,
SPEAKER,
SWITCHER,
TELEPHONE,
TUNER,
USERDEFINED,
NOTDEFINED);
END_TYPE;

5.1.2 IfcCommunicationsApplianceTypeEnum

IfcCommunicationsApplianceTypeEnum is a set of different kinds of communication equipment.

Definition of existing enum items:
ANTENNA,
COMPUTER,
FAX,
GATEWAY,
MODEM,
NETWORKAPPLIANCE,
NETWORKBRIDGE,
NETWORKHUB,
PRINTER,
REPEATER,
ROUTER,
SCANNER,
USERDEFINED,
NOTDEFINED.

Definition of new enum items:
TRANSMISSIONEQUIPMENT,
ACCESSNETWORKEQUIPMENT,
EXCHANGEEQUIPMENT,
NETWORKSWITCH,
SYNCHRONIZATIONNETWORKEQUIPMENT
EMERGENCYHANDLINGEQUIPMENT,
MONITORHANDLEEQUIPMENT,
CONVERTER,
WIRELESSCOMMUNICATIONEQUIPMENT,
LOCOMOTIVEEQUIPMENT,
PORTABLEDEVICES,
DATASTORAGE,
EXPRESS:
TYPEIfcCommunicationsApplianceTypeEnum=ENUMERATIONOF
ACCESSNETWORKEQUIPMENT,
ANTENNA,
COMPUTER,
CONVERTER,
DATASTORAGE,
EMERGENCYHANDLINGEQUIPMENT,
EXCHANGEEQUIPMENT,
FAX,
GATEWAY,
LOCOMOTIVEEQUIPMENT,
MODEM,
MONITORHANDLEEQUIPMENT,
NETWORKAPPLIANCE,
NETWORKBRIDGE,
NETWORKHUB,
NETWORKSWITCH,
PRINTER,
REPEATER,
PORTABLEDEVICES,
ROUTER,
SCANNER,
SYNCHRONIZATIONNETWORKEQUIPMENT,
TRANSMISSIONEQUIPMENT,
WIRELESSCOMMUNICATIONEQUIPMENT,
USERDEFINED,
NOTDEFINED);
5.1.3 IfcSensorTypeEnum

IfcSensorTypeEnum is a set of different kinds of sensor.

Definition of existing enum items:

- CO2SENSOR,
- CONDUCTANCESENSOR,
- CONTACTSENSOR,
- FIRESENSOR,
- FLOWSENSOR,
- FROSTSENSOR,
- GASSENSOR,
- HEATSENSOR,
- HUMIDITYSENSOR,
- IDENTIFIERSSENSOR,
- IONCONCENTRATIONSENSOR,
- LEVELSENSOR,
- LIGHTSENSOR,
- MOISTURESENSOR,
- MOVEMENTSENSOR,
- PHSENSOR,
- PRESSURESENSOR,
- RADIATIONSENSOR,
- RADIOACTIVITYSENSOR,
- SMOKESENSOR,
- SOUNDENSSENSOR,
- TEMPERATURESENSOR,
- WINDSENSOR,
- USERDEFINED,
- NOTDEFINED.

Definition of new enum items:

- CLEARANCEINTRUSIONMONITORINGDEVICE,
- GLASSBREAKSENSOR,
INFRAREDSENSOR, SEISMOMETER, SNOWMETER, PLUVIOGRAPH, WATERLOGGINGSENSOR, INTRUSIONDETECTOR.
EXPRESS:
TYPEIfcSensorTypeEnum=ENUMERATIONOF (CO2SENSOR, CONDUCTANCESENSOR, CONTACTSENSOR, FIRESENSOR, FLOWSSENSOR, FROSTSENSOR, GASSSENSOR, HEATSENSOR, HUMIDITYSENSOR, IDENTIFIERSENSOR, IONCONCENTRATIONSENSOR, LEVELSENSOR, LIGHTSENSOR, MOISTURESENSOR, MOVEMENTSENSOR, PHSENSOR, PRESSURESENSOR, RADIATIONSENSOR, RADIOACTIVITYSENSOR, SMOKESENSOR, SOUNDESENSOR, TEMPERATURESENSOR, WINDSENSOR, CLEARANCEINTRUSIONMONITORINGDEVICE, GLASSBREAKSENSOR,
INFRAREDSENSOR,
SEISMOMETER,
SNOWMETER,
PLUVIOGRAPH,
WATERLOGGINGSENSOR,
INTRUSIONDETECTOR,
USERDEFINED,
NOTDEFINED);
END_TYPE;

5.1.4 IfcElectricApplianceTypeEnum

IfcElectricApplianceTypeEnum is a set of different kinds of electric equipment.

Definition of existing enum items:

DISHWASHER,
ELECTRICCOOKER,
FREESTANDINGELECTRICHEATER,
FREESTANDINGFAN,
FREESTANDINGWATERHEATER
FREESTANDINGWATERCOOLER,
FREEZER,
HANDRYER,
KITCHENMACHINE,
MICROWAVE,
PHOTOCOPIER,
REFRIGERATOR,
TUMBLEDRYER,
VENDINGMACHINE,
WASHINGMACHINE,
USERDEFINED,
NOTDEFINED

Definition of new enum items:

AUTOMATICGATEMACHINE,
LUGGAGEINSPECTION;
PERSONNELSCREENING;
EXPRESS:
TYPEIfcElectricApplianceTypeEnum=ENUMERATIONOF
(DISHWASHER,
ELECTRICCOOKER,
FREESTANDINGELECTRICHEATER,
FREESTANDINGFAN,
FREESTANDINGWATERHEATER,
FREESTANDINGWATERCOOLER,
FREEZER,
HANDDRYER,
KITCHENMACHINE,
MICROWAVE,
PHOTOCOPIER,
REFRIGERATOR,
TUMBLEDRYER,
VENDINGMACHINE,
WASHINGMACHINE,
AUTOMATICGATEMACHINE,
LUGGAGEINSPECTION,
PERSONNELSCREENING,
USERDEFINED,
NOTDEFINED);
END_TYPE;

5.2 The Definition of Attribute Set

5.2.1 Pset_AudioVisualApplianceTypeRecorder
Name of Property Set: Pset_AudioVisualApplianceTypeRecorder.
Applicable Entity: IfcAudioVisualAppliance.
Description: recorder attribute set.
Attribute List: see Table 5.2.1.
Table 5.2.1 The Attribute List of PsetAudioVisualApplianceTypeRecorder

<table>
<thead>
<tr>
<th>Name</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recorder Type</td>
<td>P_ENUMERATEDVALUE/IfcLabel:Audio,Video</td>
<td>Record type: audio, video, audio and video</td>
</tr>
<tr>
<td>Equipment Capacity</td>
<td>P_SINGLEVALUE/IfcInteger</td>
<td>Equipment capacity</td>
</tr>
</tbody>
</table>

5.2.2 Pset_AudioVisualApplianceTypeConferenceEquipment

Name of Property Set: Pset_AudioVisualApplianceTypeConferenceEquipment.
Applicable Entity: IfcAudioVisualAppliance.
Description: conference equipment attribute set.
Attribute List: see Table 5.2.2.

Table 5.2.2 The Attribute List of Pset_AudioVisualApplianceTypeConferenceEquipment

<table>
<thead>
<tr>
<th>Name</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conference Type</td>
<td>P_ENUMERATEDVALUE/IfcLabel:Telephone,Video</td>
<td>Conference type: telephone, video</td>
</tr>
<tr>
<td>Equipment Capacity</td>
<td>P_SINGLEVALUE/IfcInteger</td>
<td>Equipment capacity</td>
</tr>
<tr>
<td>Is Main Point</td>
<td>P_SINGLEVALUE/IfcBoolean</td>
<td>Whether is the main equipment</td>
</tr>
</tbody>
</table>

5.2.3 Pset_AudioVisualApplianceTypeConsole

Name of Property Set: Pset_AudioVisualApplianceTypeConsole.
Applicable Entity: IfcAudioVisualAppliance.
Description: console attribute set.
Attribute List: see Table 5.2.3.
Table 5.2.3 The Attribute List of Pset_AudioVisualApplianceTypeConsole

<table>
<thead>
<tr>
<th>Name</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ConsoleType</td>
<td>P_ENUMERATEDVALUE/IfcLabel:Touch creen,Keyboard</td>
<td>Console type: touching screen, keyboard</td>
</tr>
<tr>
<td>ConsoleUsage</td>
<td>P_ENUMERATEDVALUE/IfcLabel:Dispatching Console,OnDuty Console</td>
<td>Console function: dispatching console, duty console</td>
</tr>
<tr>
<td>ConsoleCapacity</td>
<td>P_SINGLEVALUE/IfcInteger</td>
<td>Console capacity</td>
</tr>
</tbody>
</table>

5.2.4 Pset_CommunicationsApplianceTypeTransmissionEquipment

Name of Property Set: Pset_CommunicationsApplianceTypeTransmissionEquipment.

Applicable Entity: IfcCommunicationsAppliance.

Description: transmission equipment attribute set.

Attribute List: see Table 5.2.4.

Table 5.2.4 The Attribute List of PsetCommunicationsApplianceTypeTransmissionEquipment

<table>
<thead>
<tr>
<th>Name</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TransmissionType</td>
<td>P_ENUMERATEDVALUE/IfcLabel:SDH,PDH,DWDM</td>
<td>Transmission type: SDH, PDH, DWDM</td>
</tr>
<tr>
<td>EquipmentCapacity</td>
<td>P_SINGLEVALUE/IfcInteger</td>
<td>Equipment capacity</td>
</tr>
<tr>
<td>TransmissionMedium</td>
<td>P_SINGLEVALUE/IfcInteger</td>
<td>Transmission medium</td>
</tr>
<tr>
<td>ProtectedMode</td>
<td>/IfcLabel</td>
<td>Protected mode</td>
</tr>
<tr>
<td>Topology</td>
<td>/IfcLabel</td>
<td>Topology</td>
</tr>
</tbody>
</table>

5.2.5 Pset_CommunicationsApplianceTypeAccessNetworkEquipment

Name of Property Set: Pset_CommunicationsApplianceTypeAccessNetworkEquipment.

Applicable Entity: IfcCommunicationsAppliance.

Description: access network equipment attribute set.

Attribute List: see Table 5.2.5.
Table 5.2.5 The Attribute List of Pset_CommunicationsApplianceTypeAccessNetworkEquipment

<table>
<thead>
<tr>
<th>Name</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EquipmentType</td>
<td>P_ENUMERATEDVALUE/IfcLabel:Optical Access,Cable Access,PCM</td>
<td>Type of access network equipment: optical access, cable access, PCM</td>
</tr>
<tr>
<td>EquipmentCapacity</td>
<td>P_SINGLEVALUE/IfcInteger</td>
<td>Capacity of access network equipment</td>
</tr>
<tr>
<td>IsMain</td>
<td>P_SINGLEVALUE/IfcBoolean</td>
<td>Whether is the main equipment</td>
</tr>
</tbody>
</table>

5.2.6 Pset_CommunicationsApplianceTypeExchangeEquipment
Name of Property Set: Pset_CommunicationsApplianceTypeExchangeEquipment.
Applicable Entity: IfcCommunicationsAppliance.
Description: exchange equipment attribute set.
Attribute List: see Table 5.2.6.

Table 5.2.6 The Attribute List of Pset_CommunicationsApplianceTypeExchangeEquipment

<table>
<thead>
<tr>
<th>Name</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EquipmentType</td>
<td>P_ENUMERATEDVALUE/IfcLabel:Program Control Switching,Dispatching Switching,Mobile Switching, Softswitching</td>
<td>Type of access network exchange equipment: program control switching, dispatching switching, mobile switching, soft switching</td>
</tr>
<tr>
<td>EquipmentCapacity</td>
<td>P_SINGLEVALUE/IfcInteger</td>
<td>Capacity of exchange equipment</td>
</tr>
<tr>
<td>IsMain</td>
<td>P_SINGLEVALUE/IfcBoolean</td>
<td>Whether is the main equipment</td>
</tr>
</tbody>
</table>

5.2.7 Pset_CommunicationsApplianceTypeNetworkSwitch
Name of Property Set: Pset_CommunicationsApplianceTypeNetworkSwitch.
Applicable Entity: IfcCommunicationsAppliance.
Description: network switch attribute set.
Attribute List: see Table 5.7.
Table 5.7 The Attribute List of Pset_CommunicationsApplianceTypeNetworkSwitch

<table>
<thead>
<tr>
<th>Name</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>WorkLayer</td>
<td>P_ENUMERATEDVALUE/IfcLabel:L2,L3</td>
<td>Work layer: L2, L3</td>
</tr>
<tr>
<td>EquipmentCapacity</td>
<td>P_SINGLEVALUE/IfcInteger</td>
<td>Port capacity</td>
</tr>
<tr>
<td>PortType</td>
<td>P_ENUMERATEDVALUE/IfcLabel:Optical Interface, Electrical Interface, POE</td>
<td>Port type: optical interface, electrical interface, POE</td>
</tr>
</tbody>
</table>

5.2.8 Pset_CommunicationsApplianceTypeSynchronizationNetworkEquipment

Name of Property Set: Pset_CommunicationsApplianceTypeSynchronizationNetworkEquipment.
Applicable Entity: IfcCommunicationsAppliance.
Description: synchronization equipment attribute set.
Attribute List: see Table 5.2.8.

Table 5.2.8 The Attribute List of Pset_CommunicationsApplianceTypeSynchronizationNetworkEquipment

<table>
<thead>
<tr>
<th>Name</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EquipmentType</td>
<td>P_ENUMERATEDVALUE/IfcLabel:Frequency,Time</td>
<td>Type of synchronization equipment: frequency, time</td>
</tr>
<tr>
<td>SourceType</td>
<td>P_ENUMERATEDVALUE/IfcLabel:GPS, BDS, Dual-Mode</td>
<td>Type of synchronization source: GPS, BDS, Dual-Mode</td>
</tr>
<tr>
<td>IsMain</td>
<td>P_SINGLEVALUE/IfcBoolean</td>
<td>Whether is the main equipment</td>
</tr>
</tbody>
</table>

5.2.9 Pset_CommunicationsApplianceTypeEmergencyHandlingEquipment

Name of Property Set: Pset_CommunicationsApplianceTypeEmergencyHandlingEquipment.
Applicable Entity: IfcCommunicationsAppliance.
Description: emergency handling equipment attribute set.
Attribute List: see Table 5.2.9.
Table 5.2.9 The Attribute List of Pset_CommunicationsApplianceTypeEmergencyHandlingEquipment

<table>
<thead>
<tr>
<th>Name</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EquipmentType</td>
<td>P_ENUMERATEDVALUE/IfcLabel:Emergency Communication,Tunnel Emergency</td>
<td>Type of emergency handling equipment: emergency communication, tunnel emergency</td>
</tr>
<tr>
<td>IsMain</td>
<td>P_SINGLEVALUE/IfcBoolean</td>
<td>Whether is the main equipment</td>
</tr>
</tbody>
</table>

5.2.10 Pset_CommunicationsApplianceTypeMonitorHandleEquipment

Name of Property Set: Pset_CommunicationsApplianceTypeMonitorHandleEquipment.
Applicable Entity: IfcCommunicationsAppliance.
Description: monitoring equipment attribute set.
Attribute List: see Table 5.2.10.

Table 5.2.10 The Attribute List of Pset_CommunicationsApplianceTypeMonitorHandleEquipment

<table>
<thead>
<tr>
<th>Name</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EquipmentType</td>
<td>P_ENUMERATEDVALUE/IfcLabel:Power Supply And Environment,Optical Fiber,Cable Jacket,Leaky Cable,Tower,Natural Disaster,Interface</td>
<td>Type of monitoring equipment: power supply and environment, optical fiber, cable jacket, leaky cable, tower, natural disaster, interface</td>
</tr>
<tr>
<td>Mounting Type</td>
<td>P_ENUMERATEDVALUE/IfcLabel:Wall-Mounted,Cabinet,Outside, Soil</td>
<td>Mounting type: wall-mounted, cabinet, outside, soil</td>
</tr>
<tr>
<td>IsMain</td>
<td>P_SINGLEVALUE/IfcBoolean</td>
<td>Whether is the main equipment</td>
</tr>
</tbody>
</table>

5.2.11 Pset_CommunicationsApplianceTypeConverter

Name of Property Set: Pset_CommunicationsApplianceTypeConverter.
Applicable Entity: IfcCommunicationsAppliance.
Description: converter attribute set.
Attribute List: see Table 5.2.11.

Table 5.2.11 The Attribute List of Pset_CommunicationsApplianceTypeMonitorHandleEquipment

<table>
<thead>
<tr>
<th>Name</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EquipmentType</td>
<td>P_ENUMERATEDVALUE/IfcLabel:Protocol,Optical Fiber,Cable</td>
<td>Type of converter: protocol, optical fiber, cable</td>
</tr>
<tr>
<td>InputType</td>
<td>P_ENUMERATEDVALUE/IfcLabel:Optical Interface</td>
<td>Input type: Optical interface</td>
</tr>
<tr>
<td>OutputType</td>
<td>P_ENUMERATEDVALUE/IfcLabel:Optical Interface</td>
<td>Output type: optical interface</td>
</tr>
<tr>
<td>InputCount</td>
<td>P_SINGLEVALUE/IfcInteger</td>
<td>Input count</td>
</tr>
<tr>
<td>OutputCount</td>
<td>P_SINGLEVALUE/IfcInteger</td>
<td>Output count</td>
</tr>
</tbody>
</table>

5.2.12 Pset_CommunicationsApplianceTypeWirelessCommunicationEquipment

Name of Property Set: Pset_CommunicationsApplianceTypeWirelessCommunicationEquipment. Applicable Entity: IfcCommunicationsAppliance. Description: wireless communication equipment attribute set. Attribute List: see Table 5.2.12.

Table 5.2.12 The Attribute List of Pset_CommunicationsApplianceTypeWirelessCommunicationEquipment

<table>
<thead>
<tr>
<th>Name</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>WorkFrequency</td>
<td>P_BOUNDEDVALUE/IfcInteger</td>
<td>Work frequency</td>
</tr>
<tr>
<td>MountingType</td>
<td>P_ENUMERATEDVALUE/IfcLabel:Cabinet,WallMounted,Outside</td>
<td>Mounting type: cabinet, wall-mounted, outside</td>
</tr>
<tr>
<td>--------------</td>
<td>------------------------------------------------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>EquipmentCapacity</td>
<td>P_SINGLEVALUE/IfcInteger</td>
<td>Equipment capacity</td>
</tr>
<tr>
<td>IsMain</td>
<td>P_SINGLEVALUE/IfcBoolean</td>
<td>Whether is the main equipment</td>
</tr>
</tbody>
</table>

### 5.2.13 Pset_CommunicationsApplianceTypePortableDevices

Name of Property Set: Pset_CommunicationsApplianceTypePortableDevices.
Applicable Entity: IfcCommunicationsAppliance.
Description: portable device attribute set.
Attribute List: see Table 5.2.13.

Table 5.2.13 The Attribute List of Pset_CommunicationsApplianceTypePortableDevices

<table>
<thead>
<tr>
<th>Name</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment Type</td>
<td>P_ENUMERATEDVALUE/IfcLabel:Handheld station,OPH,GPH</td>
<td>Type of portable device: handheld station, OPH, GPH</td>
</tr>
</tbody>
</table>

### 5.2.14 Pset_CommunicationsApplianceTypeDataStorage

Name of Property Set: Pset_CommunicationsApplianceTypeDataStorage.
Applicable Entity: IfcCommunicationsAppliance.
Description: data storage equipment attribute set.
Attribute List: see Table 5.2.14.

Table 5.2.14 The Attribute List of Pset_CommunicationsApplianceTypeDataStorage

<table>
<thead>
<tr>
<th>Name</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage Mediums</td>
<td>P_ENUMERATEDVALUE/IfcLabel:Optical disc,Magnetic,Flash</td>
<td>Storage medium: optical disc, magnetic disc, flash</td>
</tr>
<tr>
<td>Storage Capacity</td>
<td>P_SINGLEVALUE/IfcInteger</td>
<td>Storage capacity</td>
</tr>
</tbody>
</table>

### 5.2.15 Pset_SensorWindSensorSnowMeterPluvioGraphInterfaceTypeCommon

Name of Property Set: Pset_SensorWindSensorSnowMeterPluvioGraphInterfaceTypeCommon.
Applicable Entity: IfcSensor.
Description: interface universal attribute set for snow depth device, wind speed meter and pluviometer meter.
Attribute List: see Table 5.2.15.

Table 5.2.15 The Attribute List of Pset_SensorWindSensorSnowMeterPluvioGraphInterfaceCommon

<table>
<thead>
<tr>
<th>Name</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
</table>

5.2.16 Pset_InsulationDeviceTypeCommon
Name of Property Set: Pset_InsulationDeviceTypeCommon.
Applicable Entity: IfcInsulationDevice.
Description: insulation device attribute set.
Attribute List: see Table 5.2.16.

Table 5.2.16 The Attribute List of Pset_InsulationDeviceTypeCommon

<table>
<thead>
<tr>
<th>Name</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference</td>
<td>P_ENUMERATEDVALUE/IfcLabel:REPOSITORY</td>
<td>Reference Identifier</td>
</tr>
<tr>
<td>Status</td>
<td>P_ENUMERATEDVALUE/IfcLabel/PEnum_ElementStatus:NEW, EXISTING,DEMOLISH,TEMPORARY</td>
<td>Status: NEW, EXISTING,DEMOLISH,TEMPORARY</td>
</tr>
</tbody>
</table>
6 Signaling

The signaling system of railway is the important train operation equipment used for universal dispatching and commanding train operation, ensuring train safety, enhancing transport efficiency, improving labor intensity, mainly includes train operation command system, train control system, section and blocking system, station interlocking system, centralized signaling monitoring system, power supply system, etc.

The signaling system and all subsystems are expressed by quoting the IfcDistributionSystem of IfcSharedBldgServiceElements model in IFC4.

The basic data structure of signaling information model is composed of IfcElement and IfcPort, among which, parts of the signal elements or components adopt the existing types or the existing type enumerations in IFC4, parts of the elements are expanded by the way of increasing type or enumeration as follows:

1) The common parts of the railway four electricity refer to chapter 4 of this code.
2) The relay adopts the IfcElectricTimeControl\RELAY in IFC4.
3) The circuit breaker adopts the IfcProtectiveDevice\CIRCUITBREAKER in IFC4.
4) The fuse disconnector adopts the IfcProtectiveDevice\FUSEDISCONNECTOR in IFC4.
5) The lighting protection unit adopts the IfcProtectiveDevice\VARISTOR in IFC4.
6) The resistance adopts the IfcProtectiveDevice in IFC4, and the pre-defined type-RESISTOR is newly increased.
7) The isolating unit adopts the IfcProtectiveDevice in IFC4, and the pre-defined type-ISOLATIONUNIT is newly increased.
8) The AC time limit open-phase protector and DC time limit protector adopt the IfcProtective Device in IFC4, and the pre-defined type-POINTMACHINEPROTECTION is newly increased.
9) The alarm devices including DC time limit alarm device, filament burnout alarm device, fuse burnout alarm device, bent alarm device, etc adopt the IfcAlarm\BELL or IfcAlarm\LIGHT in IFC4.
10) The capacitance adopts the IfcElectricFlowStorageDevice\CAPACITORBANK in IFC4.
11) The transformer adopts the IfcTransformer\VOLTAGE in IFC4.
12) The rectifier adopts the IfcTransformer\RECTIFIER in IFC4.
13) The impedance bond transformer adopts the IfcTransformer in IFC4, and the pre-defined type-IMPEADANCEBOND is newly increased.
(14) The lighting unit adopts the IfcTransformer in IFC4, and the pre-defined type-LIGHTINGUNIT is newly increased.

(15) The direction box, terminal box, electrical wiring box adopt the IfcJunctionBox\POWER or IfcJunctionBox\DATA in IFC4.

(16) The terminal board adopts the IfcCableFitting in IFC4, and the pre-defined type-TERMINALBOARD is newly increased.

(17) The connecting terminal adopts the IfcDistributionPort\CABLE in IFC4.

(18) The signal cable, axle cable, balise cable and signal indoor soft wire adopt the CABLESEGMENT in IFC4.

(19) The integrated through earthing wire adopts the IfcCableSegmentTypeEnum in IFC4, and the pre-defined type-INTEGRATEDGROUNDINGWIRESEGMENT is newly increased.

(20) The insulated joint adopts the newly increased entity-IfcInsulationDevice, and the pre-defined type-INSULATEDJOINT is newly increased.

(21) The hollow coil insulated joint adopts the newly increased entity-IfcInsulationDevice, and the pre-defined type-AIRCORECOIL is newly increased.

(22) The box foundation adopts the IfcFooting\STRIP_FOOTING in IFC4.

(23) The high column signal adopts the IfcColumn\COLUMN in IFC4.

(24) The combined cabinet, track cabinet, distribution plate, interface cabinet, frequency shift cabinet, integrated cabinet, cabinet, transformer box and dual protection box adopt the newly increased entity-IfcDeviceCabinet in the common parts of the railway four electricity.

(25) All kinds of circuit board in cabinet such as interlocking logic, electrical terminal, optical splitter, UPS, logical 24V power supply, interface 24V power supply in the computer based interlocking cabinet adopt the IfcElectricDistributionBoard in IFC4, and the pre-defined type-POWERBOARD or DATABOARD is newly increased.

(26) The signal, balise, axle counter, switch machine, turnouts mounted device, switch closure detector, lock stretcher adopt the newly increased entity-IfcSignalingTerminal which inherits the IfcFlowTerminal.

(27) The sender, receiver, attenuator, amplifier, balise coding unit, collector, electric cable simulation network plate, 25Hz track circuit protection box adopt the newly increased entity-IfcSignalingRelay which inherits the IfcFlowController.

(28) The signal mechanisms adopt the newly increased entity-IfcSignalMechanisms which inherits the IfcFlowTerminal.
The equipments including CTC center equipment, CTC station extension, computer based interlocking equipment, train control center, temporary speed restriction server, RBC, track circuit maintenance equipment, computer monitoring center, computer monitoring station extension, feed end and receiving end of the track circuit adopt the IfcDistributionSystem\DATA in IFC4.

The signal element-Express-G is shown in the figure 6.1.
Figure 6.1 The signal element-Express-G figure

The signaling system is realized by the connection of all kinds of IfcElement and IfcPort. Figure 6.2 and 6.3 show the connection relation of signaling elements and ports by taking the signaling interlocking subsystem for instance. Figure 6.2 is the connection relation of the indoor equipment for signaling
interlocking subsystem. Figure 6.3 is the connection relation of the outdoor equipment for signaling interlocking subsystem. The indoor equipment connect the outdoor equipment’s through outdoor cables.

Figure 6.2 The connection relation of the indoor equipments for signaling interlocking subsystem
The newly-increased IfcSignalingTerminal inherits the IfcFlowTerminal, the newly-increased IfcSignalingRelay inherits the IfcFlowController, the newly-increased IfcSignalMechanisms inherits the IfcFlowTerminal.

6.1 The Definition of Type

6.1.1 IfcSignalingTerminalTypeEnum

IfcSignalingTerminalTypeEnum is the signaling terminal type enumeration which defines the type of signaling terminal from the function perspective.

Definition of new enum items:

- SIGNAL;
- AXLECOUNTER;
- BALISE;
- ENDPOSITIONDETECTOR;
- LOCKSTRETCHER;
- POINTMACHINE;
MOUNTEDDEVICE;
USERDEFINED;
NOTDEFINED.
EXPRESS:
TYPEIfcSignalingTerminalTypeEnum=ENUMERATIONOF
(SIGNAL
AXLE COUNTER,
BALISE,
ENDPOSITIONDETECTOR,
LOCKSTRETCHER,
MOUNTEDDEVICE,
POINTMACHINE,
USERDEFINED,
NOTDEFINED);
END_TYPE;

6.1.2 IfcSignalingRelayTypeEnum

IfcSignalingRelayTypeEnum is the signaling relay type enumeration which defines the type of
signaling relay from the function perspective.

Definition of new enum items:
ACQUISITION;
AMPLIFIER;
ATTENUATOR;
LEU;
RECEIVER;
SENDER;
SIMULATOR;
25HZTRACKCIRCUITPROTECTIONBOX;
USERDEFINED;
NOTDEFINED.
EXPRESS:
TYPEIfcSignalingRelayTypeEnum=ENUMERATIONOF
(ACQUISITION,
AMPLIFIER,
ATTENUATOR,
LEU,
RECEIVER,
SENDER,
SIMULATION,
25HZTRACKCIRCUITPROTECTIONBOX:
USERDEFINED,
NOTDEFINED);
END_TYPE;

6.1.3 IfcSignalMechanismsTypeEnum
IfcSignalMechanismsTypeEnum is the signal mechanisms type enumeration which defines the type of signal mechanisms from the structure and quantity of the signal light position perspective.

Definition of new enum items:
SINGLEMECHANISMS;
DOUBLEMECHANISMS;
TRIPLEMECHANISMS;
QUADRUPLEMECHANISMS;
USERDEFINED;
NOTDEFINED.
EXPRESS:
TYPEIfcSignalMechanismsTypeEnum=ENUMERATIONOF
(SINGLEMECHANISMS,
DOUBLEMECHANISMS,
TRIPLEMECHANISMS,
QUADRUPLEMECHANISMS,
USERDEFINED,
NOTDEFINED);
END_TYPE;

6.2 The Definition of Entity
6.2.1 IfcSignalingTerminal
6.2.1.1 The definition of entity
IfcSignalingTerminal inherits the IfcFlowTerminal and it defines the terminal equipment of the signaling system.

6.2.1.2 The definition of attribute

PreDefinedType: the pre-defined type. The signaling terminal is further subdivided into signal, axle counter, balise, switch closure detector, switch machine, lock stretcher and turnouts mounted device, etc from the function type perspective.

6.2.1.3 EXPRESS

ENTITY IfcSignalingTerminal
SUBTYPE OF (IfcFlowTerminal);
PreDefinedType: OPTIONAL IfcSignalingTerminalTypeEnum;

WHERE
CorrectPredefinedType:
NOT (EXISTS(PredefinedType))
OR (PredefinedType<>IfcSignalingTerminalTypeEnum.USERDEFINED)
OR
((PredefinedType=IfcSignalingTerminalTypeEnum.USERDEFINED)
AND EXISTS(SELF\IfcObject.ObjectType));
CorrectTypeAssigned:
(SIZEOF(IsTypeBy)=0)
OR
(‘IFCELECTRICALDOMAIN.IFCSIGNALINGTERMINALTYPE’
INTYPEOF(SELF\IfcObject.IsTypeBy[1].RelatingType));

END_ENTITY;

6.2.2 IfcSignalingRelay

6.2.2.1 The definition of entity

IfcSignalingRelay defines the non-overall engine equipment which do the operations including receiving, sending and handling signal, etc.

6.2.2.2 The definition of attribute

PreDefinedType: the pre-defined type. The signaling relay is further subdivided into amplifier, attenuator, collector, simulation network plate, receiver, sender, 25Hz track circuit protection box, etc from the function type perspective.
6.2.2.3 EXPRESS

ENTITY IfcSignalingRelay
  SUBTYPEOF(IfcFlowController);
  PreDefinedType:OPTIONALIfcSignalingRelayTypeEnum;
  WHERE
  CorrectPredefinedType:
  NOT(EXISTS(PredefinedType))
  OR(PredefinedType<>IfcSignalingRelayTypeEnum.USERDEFINED)
  OR
  ((PredefinedType=IfcSignalingRelayTypeEnum.USERDEFINED)
   ANDEXISTS(SELF\IfcObject.ObjectType));
  CorrectTypeAssigned:
  (SIZEOF(IsTypeBy)=0)
  OR
  ('IFCELECTRICALDOMAIN.IFCSIGNALINGRELAYTYPE'
   INTYPEOF(SELF\IfcObject.IsTypeBy[1].RelatingType));
END_ENTITY;

6.2.3 IfcSignalMechanisms

6.2.3.1 The definition of entity

IfcSignalMechanisms inherits the IfcFlowTerminal and it is a component of signal. The signal mechanisms equipments are defined from the light position structure of the signal mechanisms perspective.

6.2.3.2 The definition of attribute

PreDefinedType: the pre-defined type. The signal mechanisms is further subdivided into SINGLEMECHANISMS, DOUBLEMECHANISMS, TRIPLEMECHANISMS and QUADRUPLEMECHANISMS, etc from the light position structure of the signal mechanisms perspective.

6.2.3.3 EXPRESS

ENTITY IfcSignalMechanisms
  SUBTYPEOF(IfcFlowTerminal);
  PreDefinedType:OPTIONALIfcSignalMechanismsTypeEnum;
  WHERE
  CorrectPredefinedType:
  NOT(EXISTS(PredefinedType))
OR(PredefinedType<>IfcSignalMechanismsTypeEnum.USERDEFINED)
OR
((PredefinedType=IfcSignalMechanismsTypeEnum.USERDEFINED)
ANDEXISTS(SELF\IfcObject.ObjectType));
CorrectTypeAssigned:
(SIZEOF(IsTypeBy)=0)
OR
(‘IFCELECTRICALDOMAIN.IFCSIGNALMECHANISMSTYPE’
INTYPEOF(SELF\IfcObject.IsTypeBy[1].RelatingType));
END_ENTITY;

6.3 The Definition of Attribute Set
6.3.1 Pset_SignalTerminalandProcessorCommon
Name of Property Set: Pset_SignalTerminalandProcessorCommon.
Applicable Entity: IfcSignalingTerminal/IfcSignalingRelay.
Description: signaling terminal and signaling relay universal attribute set.
Attribute List: see Table 6.3.1.

Table 6.3.1 The Attribute List of Pset_SignalTerminalCommon

<table>
<thead>
<tr>
<th>Name</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference</td>
<td>P_SINGLEVALUE/IfcIdentifier</td>
<td>Reference identifier</td>
</tr>
<tr>
<td>Status</td>
<td>P_ENUMERATEDVALUE/IfcLabel/PEnum_ElementStatus:NEW, EXISTING,DEMOLISH,TEMPORARY</td>
<td>Status: NEW, EXISTING, DEMOLISH, TEMPORARY</td>
</tr>
<tr>
<td>SignalSource</td>
<td>P_TABLEVALUE/IfcIdentifier/IfcLabel</td>
<td>Signal source</td>
</tr>
<tr>
<td>NominalSupplyVoltage</td>
<td>P_SINGLEVALUE/IfcElectricVoltageMeasure</td>
<td>Nominal voltage</td>
</tr>
<tr>
<td>NominalSupplyCurrent</td>
<td>P_SINGLEVALUE/IfcElectricCurrentMeasure</td>
<td>Nominal current</td>
</tr>
<tr>
<td>NominalFrequency</td>
<td>P_SINGLEVALUE/IfcFrequencyMeasure</td>
<td>Nominal frequency</td>
</tr>
<tr>
<td>NominalPower</td>
<td>P_SINGLEVALUE/IfcPowerMeasure</td>
<td>Nominal power</td>
</tr>
<tr>
<td>NominalResistance</td>
<td>P_SINGLEVALUE/IfcElectricResistanceMeasure</td>
<td>Nominal resistance</td>
</tr>
<tr>
<td>-------------------</td>
<td>-------------------------------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>IsInside</td>
<td>P_SINGLEVALUE/IfcBoolean</td>
<td>Whether is inside: TRUE indicates inside, FALSE indicates outside</td>
</tr>
<tr>
<td>Humidity</td>
<td></td>
<td>Humity</td>
</tr>
<tr>
<td>AirPressure</td>
<td>P_SINGLEVALUE/IfcPressureMeasure</td>
<td>Air pressure</td>
</tr>
<tr>
<td>EMC</td>
<td>P_SINGLEVALUE/IfcBoolean</td>
<td>Whether is EMC: TRUE indicates EMC, FALSE indicates non-EMC</td>
</tr>
<tr>
<td>CorrosionResistance</td>
<td>P_SINGLEVALUE/IfcBoolean</td>
<td>Whether is corrosion resistance: TRUE indicates corrosion resistance, FALSE indicates non-corrosion resistance</td>
</tr>
<tr>
<td>ConsumingCycle</td>
<td>P_SINGLEVALUE/IfcTimeMeasure</td>
<td>Consuming cycle</td>
</tr>
</tbody>
</table>

### 6.3.2 Pset_SignalTerminalPHistory

Name of Property Set: Pset_SignalTerminalPHistory.
Applicable Entity: IfcSignalingTerminal.
Description: performance history of signaling terminal attribute set.
Attribute List: see Table 6.3.2.

**Table 6.3.2 The Attribute List of Pset_SignalTerminalPHistory**

<table>
<thead>
<tr>
<th>Name</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PowerState</td>
<td>P_REFERENCEVALUE/IfcTimeSeries/IfcBoolean</td>
<td>Power status</td>
</tr>
<tr>
<td>SignalSource</td>
<td>P_REFERENCEVALUE/IfcTimeSeries/IfcIdentifier</td>
<td>Signaling source</td>
</tr>
<tr>
<td>SignalContent</td>
<td>P_REFERENCEVALUE/IfcTimeSeries/IfcText</td>
<td>Signaling content</td>
</tr>
</tbody>
</table>

### 6.3.3 Pset_SignalTerminalOccurrence

Name of Property Set: Pset_SignalTerminalOccurrence.
Applicable Entity: IfcSignalingTerminal.
Description: signaling terminal ambient attribute set.
Attribute List: see Table 6.3.3.

Table 6.3.3 The Attribute List of Pset_SignalTerminalPHistory

<table>
<thead>
<tr>
<th>Name</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DesignAmbient</td>
<td>P_BOUNDEDVALUE/IfcThermodynamicTemperatureMeasure</td>
<td>Design ambient temperature</td>
</tr>
<tr>
<td>Temperature</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6.3.4 Pset_SignalTerminalTypeSignal

Name of Property Set: Pset_SignalTerminalTypeSignal.
Applicable Entity: IfcSignalingTerminal.
Description: signal attribute set.
Attribute List: see Table 6.3.4.

Table 6.3.4 The Attribute List of Pset_SignalTerminalTypeSignal

<table>
<thead>
<tr>
<th>Name</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FunctionType</td>
<td>P_ENUMERATEDVALUE/IfcLabel/ PEnum_SignalingTerminalSignalType: STARTINGSIGNAL HOME SIGNAL ROUTESIGNAL SHUNT SIGNAL BLock SIGNAL DISTANT SIGNAL APPROACH SIGNAL REPEATING SIGNAL HUMP SIGNAL</td>
<td>Signal function type: starting signal, home signal, route signal, shunting signal, block signal, distant signal, approach signal, repeating signal, hump signal</td>
</tr>
</tbody>
</table>

6.3.5 Pset_SignalTerminalTypeBalise

Name of Property Set: Pset_SignalTerminalTypeBalise.
Applicable Entity: IfcSignalingTerminal.
Description: balise attribute set.
Attribute List: see Table 6.3.5.

Table 6.3.5 The Attribute List of Pset_SignalTerminalTypeBalise

<table>
<thead>
<tr>
<th>Name</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BaliseType</td>
<td>P_ENUMERATEDVALUE/IfcLabel/ PEnum_SignalTerminalBaliseType: ACTIVE, PASSIVE</td>
<td>Balise type: ACTIVE, PASSIVE</td>
</tr>
<tr>
<td>ResponseTime</td>
<td>P_SINGLEVALUE/IfcTimeMeasure</td>
<td>Response time</td>
</tr>
</tbody>
</table>

6.3.6 Pset_SignalTerminalTypePointMachine

Name of Property Set: Pset_SignalTerminalTypePointMachine.
Applicable Entity: IfcSignalingTerminal.
Description: switch machine attribute set.
Attribute List: see Table 6.3.6.

Table 6.3.6 The Attribute List of Pset_SignalTerminalTypePointMachine

<table>
<thead>
<tr>
<th>Name</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PointMachineType</td>
<td>P_ENUMERATEDVALUE/IfcLabel/ PEnum_SignalTerminalPointMachineType: AC, DC, HYDRAULIC</td>
<td>Type of switch machine: AC, DC, HYDRAULIC</td>
</tr>
<tr>
<td>WorkMode</td>
<td>P_ENUMERATEDVALUE/IfcLabel/ PEnum_SignalTerminalWorkMode: SERIES, REVERSIBLE, SHORT-TIME</td>
<td>Work Mode: SERIES, REVERSIBLE, SHORT-TIME</td>
</tr>
<tr>
<td>Resistance</td>
<td>P_SINGLEVALUE/IfcElectricResistanceMeasure</td>
<td>Maximum single line resistance</td>
</tr>
<tr>
<td>RotationalSpeed</td>
<td>P_SINGLEVALUE/IfcRotationalFrequencyMeasure</td>
<td>Minimum rotational speed</td>
</tr>
<tr>
<td>OperationTime</td>
<td>P_SINGLEVALUE/IfcTimeMeasure</td>
<td>Maximum operation time</td>
</tr>
<tr>
<td>OperationRodTravers</td>
<td>P_BOUNDEDVALUE/IfcLengthMeasure</td>
<td>Throw rod stroke</td>
</tr>
</tbody>
</table>

6.3.7 Pset_SignalTerminalTypeEndPositionDetector
Name of Property Set: Pset_SignalTerminalTypeEndPositionDetector.
Applicable Entity: IfcSignalingTerminal.
Description: switch closure detector attribute set.
Attribute List: see Table 6.3.7.

Table 6.3.7 The Attribute List of Pset_SignalTerminalTypeEndPositionDetector

<table>
<thead>
<tr>
<th>Name</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traverse</td>
<td>P_SINGLEVALUE/IfcLengthMeasure</td>
<td>Maximum stroke</td>
</tr>
<tr>
<td>DetectDistance</td>
<td>P_SINGLEVALUE/IfcLengthMeasure</td>
<td>Maximum inspection distance</td>
</tr>
</tbody>
</table>

6.3.8 Pset_SignalProcessorPHistory
Name of Property Set: Pset_SignalProcessorPHistory.
Applicable Entity: IfcSignalingRelay.
Description: signaling repeater performance history attribute set.
Attribute List: see Table 6.3.8.

Table 6.3.8 The Attribute List of Pset_SignalProcessorTypeAcquisition
<table>
<thead>
<tr>
<th>Name</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PowerState</td>
<td>P_REFERENCEVALUE/IfcTimeSeries/IfcBoolean</td>
<td>Power supply state</td>
</tr>
<tr>
<td>SignalSource</td>
<td>P_REFERENCEVALUE/IfcTimeSeries/IfcIdentifier</td>
<td>Signaling source</td>
</tr>
<tr>
<td>SignalContent</td>
<td>P_REFERENCEVALUE/IfcTimeSeries/IfcText</td>
<td>Signaling content</td>
</tr>
</tbody>
</table>

### 6.3.9 Pset_SignalProcessorTypeAcquisition

Name of Property Set: Pset_SignalProcessorTypeAcquisition.
Applicable Entity: IfcSignalingRelay.
Description: collection device attribute set.
Attribute List: see Table 6.3.9.

Table 6.3.9 The Attribute List of Pset_SignalProcessorTypeAcquisition

<table>
<thead>
<tr>
<th>Name</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISVoltage</td>
<td>P_SINGLEVALUE/IfcBoolean</td>
<td>Whether to collect voltage</td>
</tr>
<tr>
<td>Voltage</td>
<td>P_SINGLEVALUE/IfcElectricVoltageMeasure</td>
<td>Voltage collected</td>
</tr>
<tr>
<td>IS Current</td>
<td>P_SINGLEVALUE/IfcBoolean</td>
<td>Whether to collect current</td>
</tr>
<tr>
<td>Current</td>
<td>P_SINGLEVALUE/IfcElectricCurrentMeasure</td>
<td>Current collected</td>
</tr>
<tr>
<td>IS Frequency</td>
<td>P_SINGLEVALUE/IfcBoolean</td>
<td>Whether to collect frequency</td>
</tr>
<tr>
<td>Frequency</td>
<td>P_SINGLEVALUE/IfcFrequencyMeasure</td>
<td>Frequency collected</td>
</tr>
</tbody>
</table>

### 6.3.10 Pset_SignalMechanismsCommon

Name of Property Set: Pset_SignalMechanismsCommon.
Applicable Entity: IfcSignalMechanisms.
Description: signal mechanisms common attribute set.
Attribute List: see Table 6.3.10.

Table 6.3.10 The Attribute List of Pset_SignalBoxCommon

<table>
<thead>
<tr>
<th>Name</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference</td>
<td>P_SINGLEVALUE/IfcIdentifier</td>
<td>Reference Identifier</td>
</tr>
<tr>
<td>Status</td>
<td>P_ENUMERATEDVALUE/IfcLabel/PEnum_Element</td>
<td>Status: NEW, EXISTING, DEMOLISH, TEMPORARY</td>
</tr>
<tr>
<td>IsHorizontal</td>
<td>P_SINGLEVALUE/IfcBoolean</td>
<td>Whether is horizontal: TRUE indicates that the light position is arranged</td>
</tr>
</tbody>
</table>
7 Power Transformation

The basic data structure for power transformation model consists of IfcElement and IfcPort.

Thereinto, the existing types or their enum items of IFC4 are adopted for some elements or parts of power transformation, other elements are extended by adding more types or enum items. Details are as follows:

(1) Please refer to Chapter 4 of this Standard for public use of electric power, traction power supply, communications, and signaling railway engineering.

(2) Existing types of IfcLamp and IfcLightFixture in IFC4 are used for lamp.

(3) Existing type of IfcElectricGenerator in IFC4 is used for electric generator.

(4) Existing type of IfcSolarDevice in IFC4 is used for solar device.

(5) IfcTransformer\VOLTAGE, IfcTransformer\VOLTAGE and IfcTransformer\CURRENT in IFC4 are used for transformer, voltage transformer and current transformer respectively.

(6) IfcElectricFlowStorageDevice\HARMONICFILTER in IFC4 is used for filter device.
(7) IfcSwitchingDevice\SWITCHDISCONNECTOR and IfcSwitchingDevice\LOADSWITCH in IFC4 are used for switch disconnector and load switch respectively.

(8) IfcElectricDistributionBoard\DISTRIBUTIONBOARD in IFC4 is used for AC/DC screen.

(9) IfcElectricFlowStorageDevice/CAPACITORBANK and IfcElectricFlowStorageDevice\INDUCTORBANK in IFC4 is used for compensation device and anti-lightning coils respectively.

(10) IfcJunctionBox\POWER in IFC4 is used for both terminal box and centralized grounding box.

(11) IfcProtectiveDevice\CIRCUITBREAKER, IfcProtectiveDevice\VARISTOR and IfcProtectiveDevice\FUSEDISCONNECTOR in IFC4 are used for circuit breaker, arrester and fuse respectively, and predefined type of switching cabinet shall be added to IfcProtectiveDevice Type.

(12) IfcUnitaryControlElementType in IFC4 is used for secondary device cabinet, and predefined type shall be added. IfcCompositeApparatus is a new entity connected with IfcEnergyConversionDevice.

(13) IfcCompositeApparatus is a new entity connected with IfcEnergyConversionDevice.

(14) IfcSensorType in IFC4 is used for automatic fire detector.

(15) New enum item MONITORHANDLEEQUIPMENT of IfcCommunicationsAppliance is used for master engine of automatic fire monitoring equipment (as detailed above).

(16) New enum item MONITORHANDLEEQUIPMENT of IfcCommunicationsAppliance is used for master engine of monitoring equipment for BAS (Building Automation System) (as detailed above).

EXPRESS-G of power transformation is shown in Figure 7.1, and logical relationship of power transformation is shown in Figure 7.2.

7.1 Definition of Type
7.1.1 IfcCompositeApparatusTypeEnum

IfcCompositeApparatusTypeEnum is the enum of composite apparatus type, which defines the types of composite apparatuses according to their functions.

Definition of new enum items:
GIS;
HGIS;
USERDEFINED;
NOTDEFINED.
Description of EXPRESS:

TYPE IfcCompositeApparatusTypeEnum=ENUMERATION OF (GIS, HGIS, USERDEFINED, NOTDEFINED);
END_TYPE;

7.1.2 IfcBoxTypeSubstationTypeEnum

IfcBoxTypeSubstationTypeEnum is the enum of box-type substation type, which defines the types of box-type substations according to their functions.

Definition of new enum items:
SUBSTATION;
SECTIONPOST;
SUBSECTIONPOST;
USERDEFINED;
NOTDEFINED.

Figure 7.1 EXPRESS-G Diagram of Power Transformation
Description of EXPRESS:
TYPE IfcBoxTypeSubstationTypeEnum=ENUMERATION OF
(SECTIONPOST,
 SUBSECTIONPOST,
 SUBSTATION,
 USERDEFINED,
 NOTDEFINED);
END_TYPE;

7.1.3 IfcUnitaryControlElementTypeEnum
IfcUnitaryControlElementTypeEnum is the enum of unitary control type, which defines the types of unitary control according to their functions. This type is the existing type of IFC4, and electric power, traction power supply, communications, and signaling profession is extended based on this type.

Definition of existing enum items:
ALARMPANEL;
CONTROLPANEL;
GASDETECTIONPANEL;
INDICATORPANEL;
MIMICPANEL;
HUMIDISTAT;
THERMOSTAT;
WEATHERSTATION;
USERDEFINED;
NOTDEFINED.

Definition of new enum items:
SECONDARYDEVICECABINET.

Description of EXPRESS:
TYPE IfcUnitaryControlElementTypeEnum=ENUMERATION OF
(ALARMPANEL,
CONTROLPANEL,
GASDETECTIONPANEL,
7.2 Definition of Entity

7.2.1 IfcEnergyConversionDevice

7.2.1.1 Definition of Entity

As energy conversion entity needs to be newly added under energy conversion devices, energy conversion devices shall be redescribed.

7.2.1.2 Definition of Attribute

The attribute of energy conversion device shall remain the same as the original.

7.2.1.3 Description of EXPRESS

ENTITY IfcEnergyConversionDevice
SUPERTYPE OF (ONE OF (IfcAirToAirHeatRecovery, IfcBoiler,
IfcBoxTypeSubstation, IfcBurner,
IfcChiller,
IfcCoil,
IfcCompositeApparatus,
IfcCondenser,
IfcCooledBeam,
IfcCoolingTower,
IfcElectricGenerator,
IfcElectricMotor,
IfcEngine,
IfcEvaporativeCooler,
IfcEvaporator,
IfcHeatExchanger,
IfcHumidifier,
IfcMotorConnection,
IfcSolarDevice,
IfcTransformer,
IfcTubeBundle,
IfcUnitaryEquipment)
SUBTYPE OF (IfcDistributionFlowElement);
END_ENTITY;

7.2.2 IfcCompositeApparatus
7.2.2.1 Definition of Entity

IfcCompositeApparatus defines the composite apparatus devices in the power transformation system.

7.2.2.2 Definition of Attribute

PreDefinedType: It further divides composite apparatus into GIS and HGIS composite apparatus according to their functions.

7.2.2.3 Description of EXPRESS

ENTITY IfcCompositeApparatus
SUBTYPE OF (IfcEnergyConversionDevice);
PreDefinedType: OPTIONAL IfcCompositeApparatusTypeEnum;
WHERE CorrectPredefinedType:
NOT (EXISTS (PredefinedType))
OR (PredefinedType <> IfcCompositeApparatusTypeEnum.USERDEFINED)
OR
((PredefinedType = IfcCompositeApparatus.TypeEnum.USERDEFINED) AND EXISTS
(SELF\IfcObject.ObjectType));
CorrectTypeAssigned: (SIZEOF (IsTypeBy) = 0)
OR
(‘IFCELECTRICALDOMAIN.IFCCOMPOSITEAPPARATUSTYPE’ IN TYPEOF
(SELF\IfcObject.IsTypeBy [1].RelatingType));
END_ENTITY;

7.2.3 IfcBoxTypeSubstation
7.2.3.1 Definition of Entity

IfcBoxTypeSubstation defines the box-type substation devices in the power transformation system.

7.2.3.2 Definition of Attribute
PreDefinedType: It further divides signaling terminals into substation, section post and subsection post according to their functions.

7.2.3.3 Description of EXPRESS

ENTITY IfcBoxTypeSubstation
SUBTYPE OF (IfcEnergyConversionDevice);
PreDefinedType: OPTIONAL IfcBoxTypeSubstationTypeEnum;
WHERE CorrectPredefinedType:

NOT (EXISTS(PredefinedType))
OR (PredefinedType <>IfcBoxTypeSubstationTypeEnum.USERDEFINED)
OR
((PredefinedType = IfcBoxTypeSubstationTypeEnum. USERDEFINED) AND EXISTS
(SELF\IfcObject.ObjectType));
CorrectTypeAssigned: (SIZEOF (IsTypeBy) = 0)
OR
('IFCELECTRICALDOMAIN.IFCBOXTYPESUBSTATIONTYPE' IN TYPEOF
(SELF\IfcObject.IsTypeBy [1].RelatingType));
END_ENTITY;

7.3 Definition of Property Set

7.3.1 Pset_CompositeApparatusTypeCommon
Name of Property Set: Pset_CompositeApparatusTypeCommon
Applicable Entity: IfcCompositeApparatus
Description: common property set of composite apparatus
Attribute List: see Table 7.3.1

Table 7.3.1 Attribute List of Pset_CompositeApparatusTypeCommon

<table>
<thead>
<tr>
<th>Name</th>
<th>Data type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference</td>
<td>P_SINGLEVALUE/IfcIdentifier</td>
<td>ID cited</td>
</tr>
<tr>
<td>RatedVoltage</td>
<td>P_SINGLEVALUE/IfcElectricVoltageMeasure</td>
<td>Rated voltage</td>
</tr>
<tr>
<td>RatedCurrent</td>
<td>P_SINGLEVALUE/IfcElectricCurrentMeasure</td>
<td>Rated current</td>
</tr>
<tr>
<td>RatedFrequency</td>
<td>P_SINGLEVALUE/IfcFrequencyMeasure</td>
<td>Rated frequency</td>
</tr>
<tr>
<td>PhaseNumber</td>
<td>P_ENUMERATEDVALUE/PEnum_PhaseNumber:single phase,three phase</td>
<td>Phase number: single phase, three phase</td>
</tr>
</tbody>
</table>
AltitudeAboveSeaLevel | P_SINGLEVALUE/IfcInteger | Altitude above sea level
Type | P_ENUMERATEDVALUE/PEnum_Type:GIS,HGIS | Type: GIS, HGIS

7.3.2 Pset_BoxTypeSubstationTypeCommon
Name of Property Set: Pset_BoxTypeSubstationTypeCommon
Applicable Entity: IfcBoxTypeSubstation
Description: property set of box type substation
Attribute List: see Table 7.3.2

Table 7.3.2 Attribute List of Pset_BoxTypeSubstationTypeCommon

<table>
<thead>
<tr>
<th>Name</th>
<th>Data type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference</td>
<td>P_SINGLEVALUE/IfcIdentifier</td>
<td>ID cited</td>
</tr>
<tr>
<td>RatedVoltage</td>
<td>P_SINGLEVALUE/IfcElectricVoltageMeasure</td>
<td>Rated voltage</td>
</tr>
<tr>
<td>AltitudeAboveSeaLevel</td>
<td>P_SINGLEVALUE/IfcInteger</td>
<td>Altitude above sea level</td>
</tr>
</tbody>
</table>

7.3.3 Pset_BoxTypeSubstationTypeSubstation
Name of Property Set: Pset_BoxTypeSubstationTypeSubstation
Applicable Entity: IfcBoxTypeSubstation
Description: property set of box type substation
Attribute List: see Table 7.3.3

Table 7.3.3 Attribute List of Pset_BoxTypeSubstationTypeSubstation

<table>
<thead>
<tr>
<th>Name</th>
<th>Data type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ApparentPower</td>
<td>P_SINGLEVALUE/IfcPowerMeasure</td>
<td>Apparent power</td>
</tr>
<tr>
<td>IncomingFeederCurrent</td>
<td>P_SINGLEVALUE/IfcElectricCurrentMeasure</td>
<td>Incoming feeder current</td>
</tr>
<tr>
<td>FeederCurrent</td>
<td>P_SINGLEVALUE/IfcElectricCurrentMeasure</td>
<td>Feeder current</td>
</tr>
<tr>
<td>FeederNumber</td>
<td>P_SINGLEVALUE/IfcLable</td>
<td>Number of feeders</td>
</tr>
<tr>
<td>PrimaryVoltage</td>
<td>P_SINGLEVALUE/IfcElectricVoltageMeasure</td>
<td>Primary voltage</td>
</tr>
<tr>
<td>SecondaryVoltage</td>
<td>P_SINGLEVALUE/IfcElectricVoltageMeasure</td>
<td>Secondary voltage</td>
</tr>
<tr>
<td>TransformerNumber</td>
<td>P_SINGLEVALUE/IfcLable</td>
<td>Number of transformers</td>
</tr>
</tbody>
</table>

7.3.4 Pset_BoxTypeSubstationTypeSubSectionPost
Name of Property Set: Pset_BoxTypeSubstationTypeSubSectionPost
Applicable Entity: IfcBoxTypeSubstation
Description: property set of box type subsection post
Attribute List: see Table 7.3.4
### Table 7.3.4 Attribute List of Pset_BoxTypeSubstationTypeSubSectionPost

<table>
<thead>
<tr>
<th>Name</th>
<th>Data type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IncomingFeederCurrent</td>
<td>P_SINGLEVALUE/IfcElectricCurrentMeasure</td>
<td>Incoming feeder current</td>
</tr>
<tr>
<td>FeederCurrent</td>
<td>P_SINGLEVALUE/IfcElectricCurrentMeasure</td>
<td>Feeder current</td>
</tr>
<tr>
<td>IncomingFeederNumber</td>
<td>P_SINGLEVALUE/IfcInteger</td>
<td>Number of incoming feeders</td>
</tr>
<tr>
<td>FeederNumber</td>
<td>P_SINGLEVALUE/IfcInteger</td>
<td>Number of feeders</td>
</tr>
</tbody>
</table>

### 7.3.5 Pset_BoxTypeSubstationTypeSectionPost

Name of Property Set: Pset_BoxTypeSubstationTypeSectionPost  
Applicable Entity: IfcBoxTypeSubstation  
Description: property set of box type section post  
Attribute List: see Table 7.3.5

#### Table 7.5 Attribute List of Pset_BoxTypeSubstationTypeSectionPost

<table>
<thead>
<tr>
<th>Name</th>
<th>Data type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ParallelCircuitBreakerCurrent</td>
<td>P_SINGLEVALUE/IfcElectricCurrentMeasure</td>
<td>Parallel circuit breaker current</td>
</tr>
</tbody>
</table>

### 7.3.6 Pset_IfcProtectiveDeviceTypeSwitchingCabinet

Name of Property Set: Pset_ProtectiveDeviceTypeSwitchingCabinet  
Applicable Entity: IfcProtectiveDevice  
Description: property set of switching cabinet  
Attribute List: see Table 7.3.6

#### Table 7.3.6 Attribute List of Pset_ProtectiveDeviceTypeSwitchingCabinet

<table>
<thead>
<tr>
<th>Name</th>
<th>Data type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PhaseNumber</td>
<td>P_ENUMERATEDVALUE/PEnum_PhaseNumber:</td>
<td>Phase number:</td>
</tr>
<tr>
<td></td>
<td>single, two phase, three phase</td>
<td>single, two phase, three phase</td>
</tr>
<tr>
<td>AltitudeAboveSeaLevel</td>
<td>P_SINGLEVALUE/IfcInteger</td>
<td>Altitude above sea level</td>
</tr>
<tr>
<td>Type</td>
<td>P_ENUMERATEDVALUE/PEnum_Type:GIS,AIS</td>
<td>Type: GIS, AIS</td>
</tr>
</tbody>
</table>

### 7.3.7 Pset_IfcUnitaryControlElementTypeSecondaryDevicePanel

Name of Property Set: Pset_UnitaryControlElementTypeSecondaryDevicePanel  
Applicable Entity: IfcUnitaryControlElement  
Description: property set of secondary device panel  
Attribute List: see Table 7.3.7
Table 7.3.7 Attribute List of Pset_UnitaryControlElementTypeSecondaryDevicePanel

<table>
<thead>
<tr>
<th>Name</th>
<th>Data type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>P_ENUMERATEDVALUE/PEnum_Type:Integrated</td>
<td>Type: Integrated automation system, catenary switch, online monitoring</td>
</tr>
<tr>
<td></td>
<td>AutomationSystem,CatenarySwitch,Online</td>
<td></td>
</tr>
<tr>
<td>ObjectNumber</td>
<td>P_SINGLEVALUE/IfcInteger</td>
<td>Number of objects</td>
</tr>
</tbody>
</table>

7.3.8 Pset_IfcElectricDistributionBoardTypeDistributionBoard

Name of Property Set: Pset_ElectricDistributionBoardTypeDistributionBoard
Applicable Entity: Ifc ElectricDistributionBoard
Description: newly added property set of electric distribution board
Attribute List: see Table 7.3.8

Table 7.3.8 Attribute List of Pset_ElectricDistributionBoardTypeDistributionBoard

<table>
<thead>
<tr>
<th>Name</th>
<th>Data type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>P_ENUMERATEDVALUE/PEnum Type:AC, DC</td>
<td>Type: AC, DC</td>
</tr>
<tr>
<td>FeederNumber</td>
<td>P_SINGLEVALUE/IfcInteger</td>
<td>Number of objects</td>
</tr>
</tbody>
</table>
8 Overhead Contact System (OCS)

The basic data structure for OCS model consists of IfcElement and IfcPort.

Thereinto, the existing types or their predefined types in IFC4 are adopted for some elements of OCS, while other elements are extended by adding more types or predefined types. Details are as follow:

1. Please refer to Chapter 4 of this Standard for public use of electric power, traction power supply, communications, and signaling railway engineering.

2. IfcCableSegment\CONDUCTORSEGMENT and IfcCableSegment\CABLESEGMENT in IFC4 are used for contact wire and cable respectively; IfcCableSegment in IFC4 shall be adopted for various stranded segments such as messenger wire and additive wire, and predefined type of STRANDEDSEGMENT shall be added.

3. IfcCableCarrierSegment in IFC4 is used for cantilever of OCS and supporter of additive wire, and predefined type CANTILEVER and SUPPORTOR shall be added.

4. IfcFooting in IFC4 is used for the footing of bracing wire and OCS pole foundation.

5. IfcColumn\COLUMN in IFC4 is used for OCS pole.

6. IfcElementAssembly\BEAM_GRID in IFC4 is used for crossbeam; IfcElementAssembly\BRACED_FRAME in IFC4 is used for boundary frame.

7. IfcCableFitting in IFC4 is used for cable connector and terminal as well as metal fittings for cables.

8. IfcSwitchingDevice\SWITCHDISCONNECTOR in IFC4 is used for disconnectors of OCS.

9. IfcProtectiveDevice\VARISTOR in IFC4 is used for arresters.

10. IfcCableAuxiliary is a newly added entity connected with IfcFlowFitting. Its predefined type includes anchor compensation, bracing wire, dropper, electric connection and mid-point anchor.

EXPRESS-G of OCS elements is shown in Figure 8.1; distribution relationship diagram of traction substation system-OCS-electric locomotive-backflow is shown in Figure 8.2; structure of OCS is shown in Figure 8.3.

8.1 Definition of Type
8.1.1 IfcCableAuxiliaryTypeEnum
IfcCableAuxiliaryTypeEnum is the enum of cable auxiliary element type, which defines cable auxiliary element types according to their functions.

Definition of new enum items:
ANCHORCOMPENSITON;
BRACINGWIRE;
DROPPER;
ELECTRICCONNECTION;
MIDPOINTANCHOR;

Figure 8.1 EXPRESS-G Diagram of OCS Elements
Figure 8.2 Distribution Relationship Diagram of Traction Substation System-OCS-Electric Locomotive-Backflow
Figure 8.3 Structure Diagram of OCS

USERDEFINED;
NOTDEFINED.

Description of EXPRESS:
TYPE IfcCableAuxiliaryTypeEnum=ENUMERATION OF
(ANCHORCOMPENSATION,
BRACINGWIRE,
DROPPER,
ELECTRICCONNECTION,
MIDPOINTANCHOR,
USERDEFINED,
NOTDEFINED);
END_TYPE;

8.2 Definition of Entity
8.2.1 IfcFlowFitting
8.2.1.1 Definition of Entity

As IfcCableAuxiliary needs to be newly added under the IfcFlowFitting, flow fittings shall be redescribed.

8.2.1.2 Definition of Attribute
The attribute of flow fitting shall remain the same as the original.
8.2.1.3 Description of EXPRESS

ENTITY IfcFlowFitting
  SUPERTYPE OF (ONEOF
    (IfcCableAuxiliary,
    IfcCableCarrierFitting,
    IfcCableFitting,
    IfcDuctFitting,
    IfcJunctionBox,
    IfcPipeFitting))
  SUBTYPE OF (IfcDistributionFlowElement);
END_ENTITY;

8.2.2 IfcCableAuxiliary

8.2.2.1 Definition of Entity

IfcCableAuxiliary defines cable auxiliary device installed between the cables or at the two ends of cables within the cable system, which connects and fixes cables as well as enhancing the current-carrying capacity.

8.2.2.2 Definition of Attribute

PreDefinedType: It further divides cable auxiliary elements into anchor compensation, bracing wire, dropper, electric connection and mid-point anchor according to their functions.

8.2.2.3 Description of EXPRESS

ENTITY IfcCableAuxiliary
  SUBTYPE OF (IfcFlowFitting);
  PreDefinedType: OPTIONAL IfcCableAuxiliaryTypeEnum;
  WHERE
    CorrectPredefinedType:
      NOT (EXISTE (PredefinedType))
    OR (PredefinedType <> IfcCableAuxiliaryTypeEnum.USERDEFINED)
    OR
      ((PredefinedType = IfcCableAuxiliaryTypeEnum.USERDEFINED) AND EXISTS
      (SELF\IfcObject.ObjectType));
    CorrectTypeAssigned: (SIZEOF (IsTypeBy) = 0)
    OR
    ('IFCELECTRICALDOMAIN.IFCCABLEAUXILIARYTYPE' IN TYPEOF
      (SELF\IfcObject.IsTypeBy [1].RelatingType));
END_ENTITY;
### 8.3 Definition of Property Set

#### 8.3.1 Pset_CableCarrierSegmentTypeCantilever

Name of Property Set: Pset_CableCarrierSegmentTypeCantilever  
Applicable Entity: IfcCableCarrierSegment/CANTILEVER  
Description: property set of cantilever  
Attribute List: see Table 8.3.1

<table>
<thead>
<tr>
<th>Name</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CantileverType</td>
<td>P_ENUMERATEDVALUE/IfcLabel/PEnum_Cantilever Type:SINGLE,TRANSITION,CENTER,TURNOUT,REGISTRATION</td>
<td>Cantilever type. Divided as: NGLE,transition, center, turnout, registration</td>
</tr>
<tr>
<td>IsInsulationInstallation</td>
<td>P_SINGLEVALUE/IfcBoolean</td>
<td>Cantilever type. Divided as: NGLE,transition, center, turnout, registration</td>
</tr>
<tr>
<td>NumberOfTracks</td>
<td>P_ENUMERATEDVALUE/IfcLabel/PEnum._NumberOfTracks:SINGLE,MORE</td>
<td>Number of tracks. Divided as: single, more</td>
</tr>
<tr>
<td>StructureType</td>
<td>P_SINGLEVALUE/IfcLabel</td>
<td>Structure type</td>
</tr>
<tr>
<td>FixedMode</td>
<td>P_ENUMERATEDVALUE/IfcLabel/PEnum_.FixedMode: FIXED,SEMI-FIXED,ROTATION</td>
<td>Fixed Mode. Divided as: fixed, semi-fixed, rotation</td>
</tr>
<tr>
<td>ColumnType</td>
<td>P_SINGLEVALUE/IfcLabel</td>
<td>Column type</td>
</tr>
<tr>
<td>InstallationType</td>
<td>P_SINGLEVALUE/IfcLabel</td>
<td>Installation type</td>
</tr>
<tr>
<td>InstallationMode</td>
<td>P_ENUMERATEDVALUE/IfcLabel/PEnum_Operating Mode: STRAIGHT,CURVEOUTSIDE,CURVEINSIDE</td>
<td>Installation mode. Divided as: straight, curveoutside, curveinside</td>
</tr>
<tr>
<td>RegistrationMode</td>
<td>P_ENUMERATEDVALUE/IfcLabel/PEnum_RegistrationStyle: PULL-OFF,PUSH-OFF</td>
<td>Registration mode. Divided as: pull-off, push-off</td>
</tr>
<tr>
<td>ContactWireSuspension</td>
<td>P_SINGLEVALUE/IfcPositiveLengthMeasure</td>
<td>Contact wire suspension height</td>
</tr>
<tr>
<td>Height</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Name</td>
<td>Data Type</td>
<td>Description</td>
</tr>
<tr>
<td>---------------------------</td>
<td>----------------------------------------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>MessengerWire</td>
<td>P_SINGLEVALUE/IfcPositiveLengthMeasure</td>
<td>Messenger wire</td>
</tr>
<tr>
<td>SuspensionHeight</td>
<td>P_SINGLEVALUE/IfcPositiveLengthMeasure</td>
<td>Suspension height</td>
</tr>
<tr>
<td>StaggerValue</td>
<td>P_SINGLEVALUE/IfcPositiveLengthMeasure</td>
<td>Stagger value</td>
</tr>
<tr>
<td>BracketDistance</td>
<td>P_SINGLEVALUE/IfcPositiveLengthMeasure</td>
<td>Bracket value</td>
</tr>
<tr>
<td>IsRunningConductor</td>
<td>P_SINGLEVALUE/IfcBoolean</td>
<td>Running conductor or not</td>
</tr>
<tr>
<td>IsPositionLimited</td>
<td>P_SINGLEVALUE/IfcBoolean</td>
<td>Position limited or not</td>
</tr>
</tbody>
</table>

### 8.3.2 Pset_CableCarrierSegmentTypeSupportor

**Name of Property Set:** Pset_CableCarrierSegmentTypeSupportor  
**Applicable Entity:** IfcCableCarrierSegment/SUPPORTOR  
**Description:** property set of supportor  
**Attribute List:** see Table 8.3.2

#### Table 8.3.2 Attribute List of Pset_CableCarrierSegmentTypeSupportor

<table>
<thead>
<tr>
<th>Name</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SupportorType</td>
<td>P_ENUMERATED_VALUE/IfcLabel</td>
<td>Supportor type. Divided as: vertical, v-type, top</td>
</tr>
<tr>
<td>IsInsulationInstallation</td>
<td>P_SINGLEVALUE/IfcBoolean</td>
<td>Insulated or not</td>
</tr>
<tr>
<td>ColumnType</td>
<td>P_SINGLEVALUE/IfcLabel</td>
<td>Column type</td>
</tr>
<tr>
<td>InstallationType</td>
<td>P_SINGLEVALUE/IfcLabel</td>
<td>Installation type</td>
</tr>
<tr>
<td>SupportorCableType</td>
<td>P_ENUMERATED_VALUE/IfcLabel</td>
<td>Supportor cable type. Divided as: NF, GW, AF, PW, F, LF</td>
</tr>
<tr>
<td>InstallationHeight</td>
<td>P_SINGLEVALUE/IfcPositiveLengthMeasure</td>
<td>Installation Height</td>
</tr>
</tbody>
</table>

### 8.3.3 Pset_CableSegmentTypeStrandedSegment

**Name of Property Set:** Pset_CableSegmentTypeStrandedSegment  
**Applicable Entity:** IfcCableSegment/STRANDEDSEGMENT  
**Description:** property set of stranded segment  
**Attribute List:** see Table 8.3.3
### Table 8.3.3 Attribute List of Pset_CableSegmentTypeStrandedSegment

<table>
<thead>
<tr>
<th>Name</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>StrandedSegmentType</td>
<td>P_SINGLEVALUE/IfcLabel</td>
<td>Type</td>
</tr>
<tr>
<td>OverallDiameter</td>
<td>P_SINGLEVALUE/IfcPositiveLengthMeasure</td>
<td>Overall diameter</td>
</tr>
<tr>
<td>CalculatedSectionalArea</td>
<td>P_SINGLEVALUE/IfcAreaMeasure</td>
<td>Calculated sectional area</td>
</tr>
<tr>
<td>RatedTensileStrength</td>
<td>P_SINGLEVALUE/IfcForceMeasure</td>
<td>Rated tensile strength</td>
</tr>
<tr>
<td>ElasticityModulus</td>
<td>P_SINGLEVALUE/IfcPressureMeasure</td>
<td>Elasticity modulus</td>
</tr>
<tr>
<td>ExpansionCoefficient</td>
<td>P_SINGLEVALUE/IfcReal</td>
<td>Expansion coefficient</td>
</tr>
<tr>
<td>Resistance</td>
<td>P_SINGLEVALUE/IfcElectricResistanceMeasure</td>
<td>DC resistance</td>
</tr>
<tr>
<td>ContinuousCurrent</td>
<td>P_SINGLEVALUE/IfcElectricCurrentMeasure</td>
<td>Continuous current</td>
</tr>
<tr>
<td>AllowableTemperature</td>
<td>P_SINGLEVALUE/IfcThermodynamicTemperatureMeasure</td>
<td>Allowable temperature</td>
</tr>
<tr>
<td>UnitWeight</td>
<td>P_SINGLEVALUE/IfcMassPerLengthMeasure</td>
<td>Unit weight</td>
</tr>
</tbody>
</table>

### 8.3.4 Pset_InsulationDeviceTypeInsulationEquipment

Name of Property Set: Pset_InsulationDeviceTypeInsulationEquipment  
Applicable Entity: IfcInsulationDevice/INSULATIONEQUIPMENT  
Description: property set of insulation equipment  
Attribute List: see Table 8.3.4

<table>
<thead>
<tr>
<th>Name</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>InsulationEquipmentType</td>
<td>P_ENUMERATEDVALUE/IfcLable/</td>
<td>Insulation equipment type. Divided as: section, neutral section</td>
</tr>
<tr>
<td></td>
<td>PEnum_InsulationEquipmentType:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SECTION,NEUTRALSECTION</td>
<td></td>
</tr>
<tr>
<td>RatedVoltage</td>
<td>P_SINGLEVALUE/IfcElectricVoltageMeasure</td>
<td>Rated voltage</td>
</tr>
<tr>
<td>HighestOperatingVoltage</td>
<td>P_SINGLEVALUE/IfcElectricVoltageMeasure</td>
<td>Highest operating voltage</td>
</tr>
<tr>
<td>MinimumLeakageDistance</td>
<td>P_SINGLEVALUE/IfcPositiveLengthMeasure</td>
<td>Minimum leakage distance</td>
</tr>
<tr>
<td>MinimumAirGapDistance</td>
<td>P_SINGLEVALUE/IfcPositiveLengthMeasure</td>
<td>Minimum air gap distance</td>
</tr>
<tr>
<td>Resistance</td>
<td>P_SINGLEVALUE/IfcElectricResistanceMeasure</td>
<td>Insulation resistance</td>
</tr>
<tr>
<td>Name</td>
<td>Data Type</td>
<td>Description</td>
</tr>
<tr>
<td>---------------------------</td>
<td>----------------------------------------------------------------</td>
<td>----------------------------------------------------------</td>
</tr>
<tr>
<td>FoulingResistanceVoltage</td>
<td>P_SINGLEVALUE/IfcElectricVoltageMeasure</td>
<td>Fouling resistance voltage</td>
</tr>
<tr>
<td>MaximumDeflection</td>
<td>P_SINGLEVALUE/IfcPositionLengthMeasure</td>
<td>Maximum deflection</td>
</tr>
<tr>
<td>MinimumTensileLoad</td>
<td>P_SINGLEVALUE/IfcForceMeasure</td>
<td>Minimum tensile load</td>
</tr>
<tr>
<td>IsArcSuppression</td>
<td>P_SINGLEVALUE/IfcBoolean</td>
<td>Arc suppression or not</td>
</tr>
</tbody>
</table>

### 8.3.5 Pset_InsulationDeviceTypeInsulator

Name of Property Set: Pset_InsulationDeviceTypeInsulator  
Applicable Entity: IfcInsulationDevice/INSULATOR  
Description: property set of insulator  
Attribute List: see Table 8.3.5

**Table 8.3.5 Attribute List of Pset_InsulationDeviceTypeInsulator**

<table>
<thead>
<tr>
<th>Name</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>InsulatorType</td>
<td>P_ENUMERATEDVALUE/IfcLabel/PEnum_InsulatorType:POLE,ROD,PIN,SUSPENSION,DISK</td>
<td>Insulator type. Divided as: pole, rod, pin, suspension, disk</td>
</tr>
<tr>
<td>RatedVoltage</td>
<td>P_SINGLEVALUE/IfcElectricVoltageMeasure</td>
<td>Rated voltage</td>
</tr>
<tr>
<td>HighestOperatingVoltage</td>
<td>P_SINGLEVALUE/IfcElectricVoltageMeasure</td>
<td>Highest operating voltage</td>
</tr>
<tr>
<td>FoulingResistanceVoltage</td>
<td>P_SINGLEVALUE/IfcElectricVoltageMeasure</td>
<td>Fouling resistance voltage</td>
</tr>
<tr>
<td>MinimumNominalCreepageDistance</td>
<td>P_SINGLEVALUE/IfcPositiveLengthMeasure</td>
<td>Minimum nominal creepage distance</td>
</tr>
<tr>
<td>MinimumTensileLoad</td>
<td>P_SINGLEVALUE/IfcForceMeasure</td>
<td>Minimum tensile load</td>
</tr>
<tr>
<td>MinimumBendingFailureLoad</td>
<td>P_SINGLEVALUE/IfcForceMeasure</td>
<td>Minimum bending failure load</td>
</tr>
</tbody>
</table>

### 8.3.6 Pset_CableAuxiliaryTypeCommon

Name of Property Set: Pset_CableAuxiliaryTypeCommon  
Applicable Entity: IfcCableAuxiliary  
Description: common property set of cable auxiliary elements.  
Attribute List: see Table 8.3.6
Table 8.3.6 Attribute List of Pset_CableAuxiliaryTypeCommon

<table>
<thead>
<tr>
<th>Name</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference</td>
<td>P_SINGLEVALUE/IfcIdentifier</td>
<td>ID cited</td>
</tr>
<tr>
<td>Status</td>
<td>P_ENUMERATEDVALUE/IfcLabel/PEnum_ElementStatus: NEW,EXISTING,DEMOLISH,TEMPORARY</td>
<td>Status. Divided as: new, existing, demolish, temporary</td>
</tr>
</tbody>
</table>

8.3.7 Pset_CableAuxiliaryTypeAnchorCompensation

Name of Property Set: Pset_CableAuxiliaryTypeAnchorCompensation

Applicable Entity: IfcCableAuxiliary/ANCHORCOMPOSITION

Description: common property set of anchor compensation

Attribute List: see Table 8.3.7

Table 8.7 Attribute List of Pset_CableAuxiliaryTypeAnchorCompensation

<table>
<thead>
<tr>
<th>Name</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AnchorCompensationType</td>
<td>P_ENUMERATEDVALUE/IfcLabel/PEnum_ActorCompensationType: PULLEY,RATCHET,SPRING</td>
<td>Anchor compensation type. Divided as: pulley, ratchet, spring</td>
</tr>
<tr>
<td>OperatingMode</td>
<td>P_SINGLEVALUE/IfcLabel</td>
<td>Operating mode</td>
</tr>
<tr>
<td>ColumnType</td>
<td>P_SINGLEVALUE/IfcLabel</td>
<td>Column type</td>
</tr>
<tr>
<td>WeightType</td>
<td>P_ENUMERATEDVALUE/IfcLabel/PEnum_WeightType: CONCRETE,IRON,COMPOSITION</td>
<td>Weight type. Divided as: concrete, iron, composition</td>
</tr>
<tr>
<td>RatedTension</td>
<td>P_SINGLEVALUE/IfcForceMeasure</td>
<td>Rated tension</td>
</tr>
<tr>
<td>TensionVariation</td>
<td>P_SINGLEVALUE/IfcRatioMeasure</td>
<td>Tension variation</td>
</tr>
<tr>
<td>TransmissionRatio</td>
<td>P_SINGLEVALUE/IfcRatioMeasure</td>
<td>Transmission ratio</td>
</tr>
<tr>
<td>TransmissionEfficiency</td>
<td>P_SINGLEVALUE/IfcRatioMeasure</td>
<td>Transmission efficiency</td>
</tr>
<tr>
<td>MaximumWorkingLoad</td>
<td>P_SINGLEVALUE/IfcForceMeasure</td>
<td>Maximum working load</td>
</tr>
<tr>
<td>IsBreakLineLock</td>
<td>P_SINGLEVALUE/IfcBoolean</td>
<td>Break line lock or not</td>
</tr>
<tr>
<td>TemperatureRange</td>
<td>P_SINGLEVALUE/IfcLabel</td>
<td>Temperature range</td>
</tr>
</tbody>
</table>

8.3.8 Pset_CableAuxiliaryTypeBracingWire

Name of Property Set: Pset_CableAuxiliaryTypeBracingWire

Applicable Entity: IfcCableAuxiliary/BRACINGWIRE

Description: property set of bracing wire
Attribute List: see Table 8.3.8

Table 8.3.8 Attribute List of Pset_CableAuxiliaryTypeBracingWire

<table>
<thead>
<tr>
<th>Name</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BracingWireType</td>
<td>P_ENUMERATEDVALUE/IfcLabel/PEnum_BracingWireType:</td>
<td>Bracing wire type. Divided as: single, double</td>
</tr>
<tr>
<td></td>
<td>P_ENUMERATEDVALUE/IfcLabel/PEnum_BracingWireType:FLEXIBLE, RIGID</td>
<td></td>
</tr>
</tbody>
</table>

8.3.9 Pset_CableAuxiliaryTypeDropper

Name of Property Set: Pset_CableAuxiliaryTypeDropper

Applicable Entity: IfcCableAuxiliary/DROPPER

Description: property set of dropper

Attribute List: see Table 8.3.9

Table 8.3.9 Attribute List of Pset_CableAuxiliaryTypeDropper

<table>
<thead>
<tr>
<th>Name</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DropperType</td>
<td>P_ENUMERATEDVALUE/IfcLabel/PEnum_DropperType:FLEXIBLE, RIGID</td>
<td>Dropper Type. Divided as: flexible, rigid</td>
</tr>
<tr>
<td>RegulatingVariable</td>
<td>P_SINGLEVALUE/IfcPositiveLengthMeasure</td>
<td>Regulating variable</td>
</tr>
</tbody>
</table>

8.3.10 Pset_CableAuxiliaryTypeElectricalConnection

Name of Property Set: Pset_CableAuxiliaryTypeElectricalConnection

Applicable Entity: IfcCableAuxiliary/ELECTRICCONNECTION

Description: property set of electric connection

Attribute List: see Table 8.3.10

Table 8.3.10 Attribute List of Pset_CableAuxiliaryTypeElectricalConnection

<table>
<thead>
<tr>
<th>Name</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ElectricalConnectionType</td>
<td>P_ENUMERATEDVALUE/IfcLabel/PEnum_ElectricalConnectionType:</td>
<td>Electrical connection type. Divided as: track, turnout, overlap, transverse, switch</td>
</tr>
<tr>
<td></td>
<td>P_ENUMERATEDVALUE/IfcLabel/PEnum_ElectricalConnectionType:TRACK, TURNOUT, OVERLAP, TRANSVERSE, SWITCH</td>
<td></td>
</tr>
</tbody>
</table>

8.3.11 Pset_CableAuxiliaryTypeMidPointAnchor

Name of Property Set: Pset_CableAuxiliaryTypeMidPointAnchor

Applicable Entity: IfcCableAuxiliary/ MIDPOINTANCHOR

Description: property set of mid-point anchor

Attribute List: see Table 8.3.11.
<table>
<thead>
<tr>
<th>Name</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MidPointAnchorType</td>
<td>P_ENUMERATEDVALUE/IfcLabel/ PEnum_MidPointAnchorType:ANTIBREAKIN G, ANTICREEPING</td>
<td>Mid-point anchor type. Divided as: antibraking, anticreeping</td>
</tr>
</tbody>
</table>