



BSI Standards Publication

Intelligent transport systems — DATEX II data exchange specifications for traffic management and information

Part 10: Energy infrastructure publications

National foreword

This Published Document is the UK implementation of [CEN/TS 16157-10:2022](#).

The UK participation in its preparation was entrusted to Technical Committee EPL/278, Intelligent transport systems.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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English Version

Intelligent transport systems - DATEX II data exchange
specifications for traffic management and information -
Part 10: Energy infrastructure publications

Systèmes de transport intelligents - Spécifications
DATEX II d'échange de données pour la gestion
du trafic et l'information routière - Partie 10:
Publication de infrastructure énergétique

Intelligente Verkehrssysteme - DATEX
II-Datenaustauschspezifikationen für
Verkehrsmanagement und Verkehrsinformationen
- Teil 10: Energieinfrastruktur Publikation

This Technical Specification (CEN/TS) was approved by CEN on 10 January 2022 for provisional application.

The period of validity of this CEN/TS is limited initially to three years. After two years the members of CEN will be requested to submit their comments, particularly on the question whether the CEN/TS can be converted into a European Standard.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document ([CEN/TS 16157-10:2022](#)) has been prepared by Technical Committee CEN/TC 278 "Intelligent transport systems", the secretariat of which is held by NEN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 2022, and conflicting national standards shall be withdrawn at the latest by September 2022.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

The EN 16157 series consists of several parts under the general title "Intelligent transport systems — DATEX II data exchange specifications for traffic management and information". Other parts may be developed in the future.

As a user of this document, attention is drawn to the resources of www.datex2.eu. This web site contains related software tools and software resources that aid the implementation of EN 16157 DATEX II.

Any feedback and questions on this document should be directed to the users' national standards body. A complete listing of these bodies can be found on the CEN website.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

This document defines a common set of data exchange specifications to support the vision of a seamless interoperable exchange of traffic and travel information across boundaries, including national, urban, interurban, road administrations, infrastructure providers and service providers. Standardization in this context is a vital constituent to ensure interoperability, reduction of risk, reduction of the cost base, promotion of open marketplaces and many social, economic and community benefits to be gained from more informed travellers, network managers and transport operators.

Delivering European Transport Policy in line with the White Paper issued by the European Commission requires co-ordination of traffic management and development of seamless pan European services. With the aim to support sustainable mobility in Europe, the European Commission has been supporting the development of information exchange mainly between the actors of the road traffic management domain for a number of years. In the road sector, DATEX II has been long in fruition, with the European Commission being fundamental to its development through an initial contract and subsequent co-funding through the Euro-Regional projects. With this standardization of DATEX II, there is a real basis for common exchange between the actors of the traffic and travel information sector.

This document includes the framework and context for exchanges, the modelling approach, data content, data structure and relationships.

This document supports a methodology that is extensible.

This part (part 10) of the European Standard deals with the publication of information on charging/refuelling infrastructure for mobility for different kinds of power sources (fuel, gas, electricity). It covers general information on the charging site, the pricing and the status of charging/refuelling itself.

1 Scope

The EN 16157 series specifies and defines component facets supporting the exchange and shared use of data and information in the field of traffic and travel.

The component facets include the framework and context for exchanges, the modelling approach, data content, data structure and relationships.

The EN 16157 series is applicable to:

- traffic and travel information which is of relevance to road networks (non-urban and urban);
- public transport information that is of direct relevance to the use of a road network (e.g. road link via train or ferry service);
- traffic and travel information in the case of Cooperative intelligent transport systems (C-ITS).

This series establishes specifications for data exchange between any two instances of the following actors:

- Traffic Information Centres (TICs);
- Traffic Control Centres (TCCs);
- Service Providers (SPs).

Use of this series can be applicable for use by other actors.

This series covers, at least, the following types of informational content:

- road traffic event information – planned and unplanned occurrences both on the road network and in the surrounding environment;
- operator initiated actions;
- road traffic measurement data, status data, and travel time data;
- travel information relevant to road users, including weather and environmental information;
- road traffic management information and instructions relating to use of the road network.

This part of the CEN/TS 16157 series specifies details of infrastructure for vehicle energy supply. The provided data model is separated into two publications for static and dynamic information. The static information regarding the infrastructure is not subject to frequent changes, whereas the dynamic part offers the ability to provide highly up-to-date information. The static part covers all relevant information on vehicle energy infrastructure, e.g. sites, stations and refill points for electric vehicles as well as petrol, gasoline or gas-based refuelling for vehicles. In terms of dynamic information, the availability of the infrastructure, possible faults and a price indication are covered.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

[EN 16157-1](#), *Intelligent transport systems - DATEX II data exchange specifications for traffic management and information - Part 1: Context and framework*

[EN 16157-2](#), *Intelligent transport systems - DATEX II data exchange specifications for traffic management and information - Part 2: Location referencing*

[EN 16157-7](#), *Intelligent transport systems - DATEX II data exchange specifications for traffic management and information - Part 7: Common data elements*

CEN/TS 16157-12,¹⁾ *Intelligent transport systems - DATEX II data exchange specifications for traffic management and information - Part 12: Facility related publications*

[ISO/IEC 19505-1](#), *Information technology - Object Management Group Unified Modeling Language (OMG UML) - Part 1: Infrastructure*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in [EN 16157-1](#), [EN 16157-2](#) and [EN 16157-7](#) and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1 connector

type and form of the piece that is used to connect a charging point to a vehicle or vice versa

NOTE It requires a matching socket.

3.2 electric charging point

technical infrastructure at a specific location that facilitates electric charging of one vehicle at a time

3.3 energy infrastructure site

location and corresponding constructions where vehicles can be refilled and other services (parking, shopping, etc.) may be offered

3.4 energy infrastructure station

part of an energy infrastructure site that offers at least one refilling option (e.g. fuel, gas, electricity, ...)

3.5 fault

information about a malfunction relating to a specific piece of equipment or process

3.6 refilling

process of transferring energy from a refill point to a vehicle, regardless of the type of energy; replaces the terms "fuelling" and "charging"

3.7 refill point

technical infrastructure at a specific location that facilitates an energy refilling process being connected to max. one vehicle at a time

4 Symbols and abbreviations

AC Alternating Current

1) Under preparation. Stage at the time of publication: FprCEN/TS 16157-12.

DC	Direct Current
CCS	Combined Charging Solution
CNG	Compressed Natural Gas
EV	Electric Vehicle
GUID	Globally Unique identifier
IEC	International Electrotechnical Commission
LPG	Liquefied Petroleum Gas
NFC	Near Field Communication
PLC	Powerline Communication
RFID	Radio-Frequency Identification
SAE	Society of Automotive Engineers
UML	Unified Modeling Language
URL	Uniform Resource Locator
XMI	XML Metadata Interchange
XML	eXtensible Markup Language
XSD	XML Schema Definition

5 Conformance

The DATEX II platform independent data model, of which the Energy Infrastructure Publication sub-model is a part, corresponds to the Level A model as defined in [EN 16157-1](#).

Conformance with this Part shall require platform independent models from which platform specific models are generated to comply with the UML modelling rules defined in [EN 16157-1](#) and with the following requirements of this sub-model which are expressed in this part.

6 UML notation

The UML notation used in these Technical Specifications shall be as described in [ISO/IEC 19505-1](#) and in compliance with the methodology specified in [EN 16157-1](#).

7 «D2Namespace» EnergyInfrastructure

7.1 Overview

The namespace "EnergyInfrastructure" shall specify a data model with details of infrastructure for vehicle energy supply. The approach is to provide all necessary details for all kinds of energy types (fuels, gases, hydrogen and electricity). The core concept (see [Figure 1](#)) was derived from [ISO/TS 21219-25](#) [7].

Three core elements define the model:

- «D2Class» "EnergyInfrastructureSite" represents an energy infrastructure site, i.e. a site where vehicles can refill energy. It is described by a number of properties and parameters like for example its included energy infrastructure stations, operation hours or its location.

- «D2Class» "EnergyInfrastructureStation" represents an energy infrastructure station that is located on an energy infrastructure site. The station is the location on the site where the refilling can be carried out. For fuels, it usually offers different kinds of petrol (super, regular) and diesel. For electro mobility, it may offer different kind of connectors. Furthermore, it may offer options for the client to pay for the product (energy) they refilled.
- «D2Class» "RefillPoint" represents a refill point that is part of an energy infrastructure station. A refill point is defined by its ability to charge one vehicle at a time by establishing a connection between the station and the vehicle. In most cases, a refill point is specialised to only be able to provide one kind of energy.

These three classes shall all be a specialization of the «D2Class» "Facility" from «D2Namespace» Facilities defined in CEN/TS 16157-12. This implies, that these classes inherit a number of facility properties, like being versioned identifiable, operating hours, rates, URLs, information about operator and owner and more.

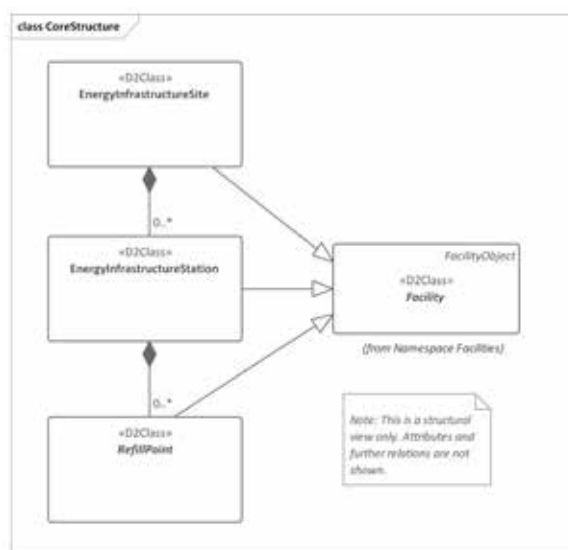


Figure 1 — The core structure of the Energy Infrastructure Publication

The «D2Namespace» "EnergyInfrastructure" shall be immediately subordinate to the "PayloadPublication" package defined in [EN 16157-7](#) and shall comprise:

- the «D2Package» "EnergyInfrastructureTablePublication" (see [7.2](#));
- the «D2Package» "EnergyInfrastructureStatusPublication" (see [7.3](#));
- and, in addition, the classes, data types and enumerations specific for these payload publications.

The prefix of the namespace shall be "egi".

Some of the packages and individual classes used within the "EnergyInfrastructure" namespace reside in the namespaces "Common" and "LocationReferencing" defined in [EN 16157-7](#) and [EN 16157-2](#). Some other elements reside in the «D2Namespace» "Facilities" that is specified in CEN/TS 16157-12.

The classes, attributes, data types and enumerations that are specific to the namespace "EnergyPublication" are defined in the normative [Annex A](#). The XML schema corresponding to this document is provided in the normative [Annex B](#).

7.2 The Energy infrastructure table model

7.2.1 Overview

The Energy infrastructure table model shall define a model for publishable information on sites where vehicles can be refilled with energy. The corresponding publication contains information designated for low exchange-rate communication.

7.2.2 Energy infrastructure table publication

7.2.2.1 Overview

The «D2Class» “EnergyInfrastructureTablePublication” class shall be a specialization of the “PayloadPublication” class defined in [EN 16157-7](#) (see [Figure 2](#)). It shall comprise one or more instances of «D2VersionedIdentifiable» “EnergyInfrastructureTable”.

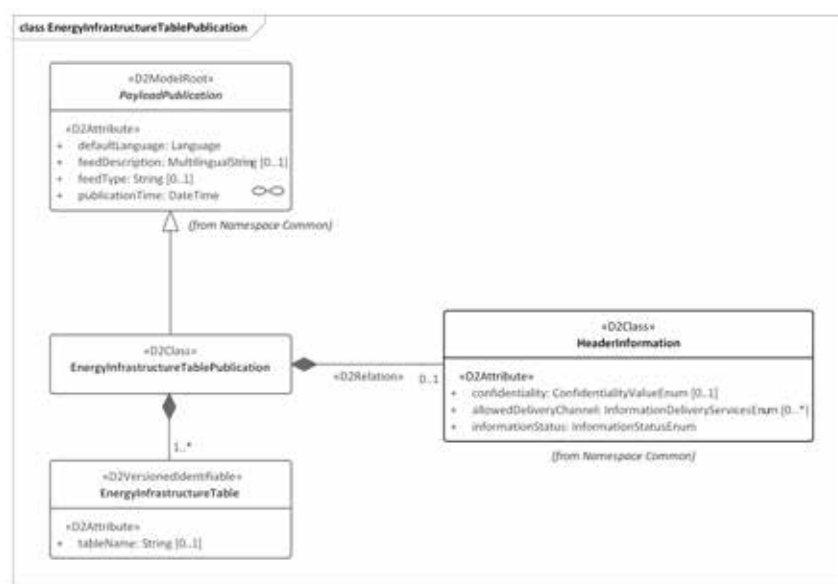


Figure 2 — EnergyInfrastructureTablePublication class and associated classes

7.2.2.2 Semantics

7.2.2.2.1 «D2Class» EnergyInfrastructureTablePublication

The “EnergyInfrastructureTablePublication” class is a specific realisable case of a “PayloadPublication” (defined in [EN 16157-7](#)). The “EnergyInfrastructureTablePublication” class is the base class for containing the published “EnergyInfrastructureTable”.

7.2.2.2.2 «D2Class» HeaderInformation

The “HeaderInformation” class and its components is defined in [EN 16157-7](#).

7.2.2.2.3 «D2VersionedIdentifiable» EnergyInfrastructureTable

Each instance of a “EnergyInfrastructureTable” comprises one or more instances of the “EnergyInfrastructureSite” class and may have associated metadata contained in an instance of the “HeaderInformation” class (defined in [EN 16157-7](#)), which allows the supplier of the “EnergyInfrastructureTable” to specify how the recipient should treat the information contained in it.

7.2.3 Energy infrastructure site

7.2.3.1 Overview

The «D2Class» “EnergyInfrastructureSite” is aggregated to the “EnergyInfrastructureTable” class (see [Figure 3](#)) and a specialization of the «D2Class» “Facility” from «D2Namespace» Facilities defined in CEN/TS 16157-12. It shall comprise any number of instances of «D2Class» “EnergyInfrastructureStation” and shall have further aggregations to the «D2Class» Location as depicted in [Figure 3](#).

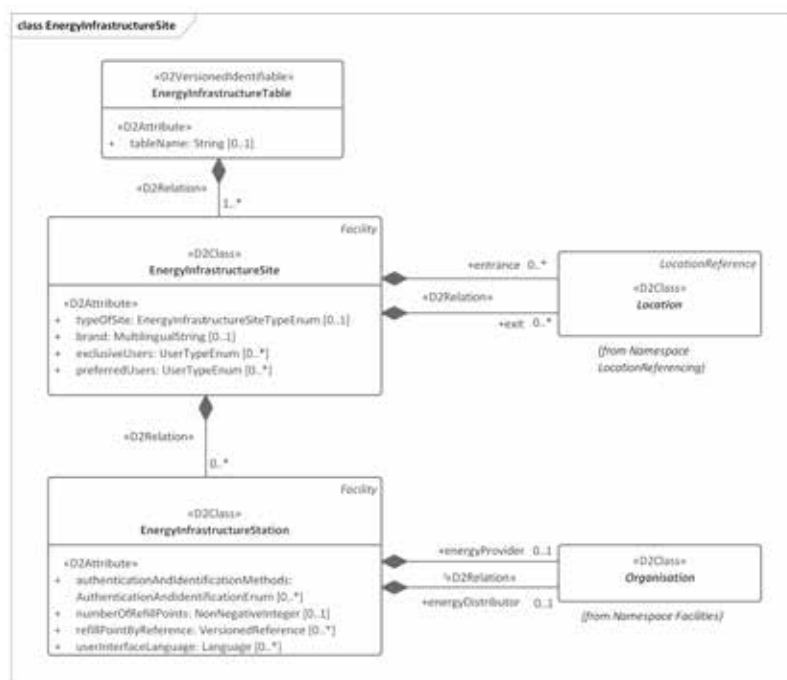


Figure 3 — EnergyInfrastructureSite and associated classes

7.2.3.2 Semantics

7.2.3.2.1 «D2Class» EnergyInfrastructureSite

The “EnergyInfrastructureSite” class shall provide information about a site which offers refilling of vehicles. By inheritance of the Facility class, a name or its location (including a physical address) may be given. General information like operating hours, owner and operator and a link to its website may also be given. For users, information on supplemental facilities, i.e. services or equipment, may be provided.

7.2.3.2.2 «D2Class» Location

The aggregated Location class is specified in [EN 16157-2](#).

7.2.4 Energy infrastructure station

7.2.4.1 Overview

The «D2Class» “EnergyInfrastructureStation” is aggregated to the “EnergyInfrastructureSite” class and a specialization of the «D2Class» “Facility” from «D2Namespace» Facilities defined in CEN/TS 16157-12. It shall comprise any number of instances of «D2Class» “RefillPoint” and shall have further aggregations to classes as depicted in [Figure 4](#).

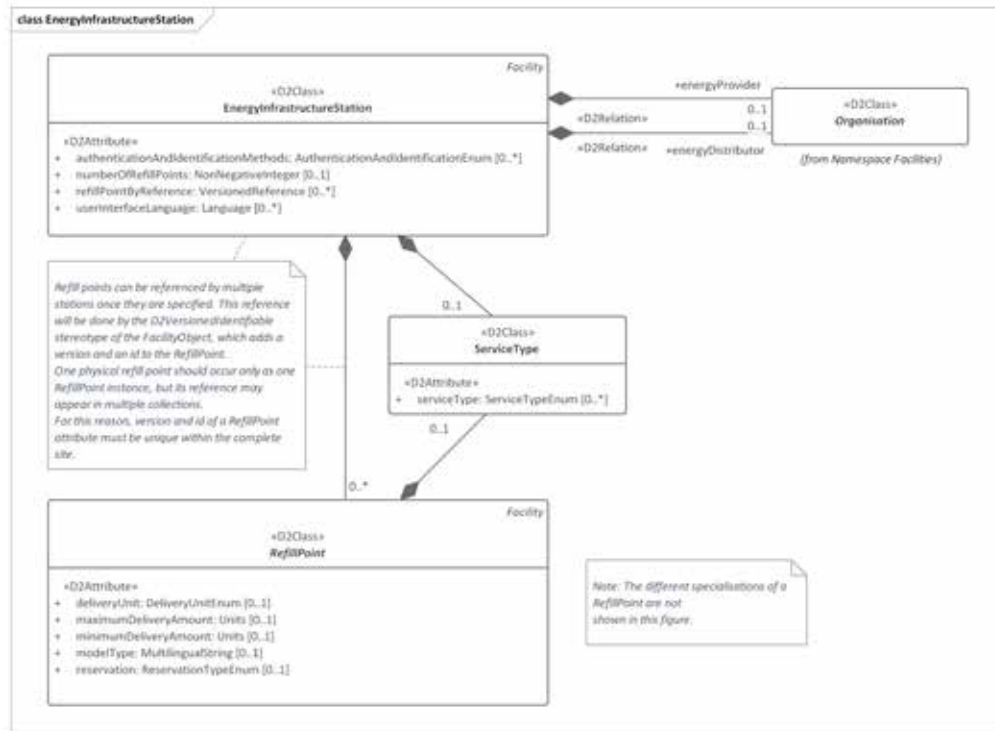


Figure 4 — EnergyInfrastructureStation and associated classes

7.2.4.2 Semantics

7.2.4.2.1 «D2Class» EnergyInfrastructureStation

The “EnergyInfrastructureStation” class shall provide information on authentication methods and the number of available refill points. An energy provider, an energy distributor and the type of service may be specified. Corresponding refill points may be specified by using the aggregation or by referencing previously published refill points.

7.2.4.2.2 «D2Class» ServiceType

The “ServiceType” class may be used to give information whether a station operates with full service, self-service or is unattended.

7.2.5 Refill point

7.2.5.1 Overview

The abstract «D2Class» “RefillPoint” class (see [Figure 4](#)) shall be a specialization of the «D2Class» “Facility” from «D2Namespace» Facilities defined in CEN/TS 16157-12 and shall be specialized by one of the classes “OrganicGasRefillPoint” (see [7.2.5.2.2](#)), “DieselRefillPoint” (see [Figure 6](#)), “PetrolRefillPoint” (see [Figure 7](#)) “HydrogenRefillPoint” (see [Figure 8](#)) or “ElectricChargingPoint” (see [Figure 9](#)).

7.2.5.2 Semantics

7.2.5.2.1 Abstract «D2Class» RefillPoint

The “RefillPoint” class shall give information on what kind of energy can be transferred to a vehicle and which connector is used. It may specify the delivery unit, a minimum and maximum delivery amount, a model type and the type of reservation, if applicable.

7.2.5.2.2 «D2Class» OrganicGasRefillPoint

The “OrganicGasRefillPoint” class (see [Figure 5](#)) is a specialization of the “RefillPoint” class. It may be used to provide information on the type of organic gases that this refill point provides.

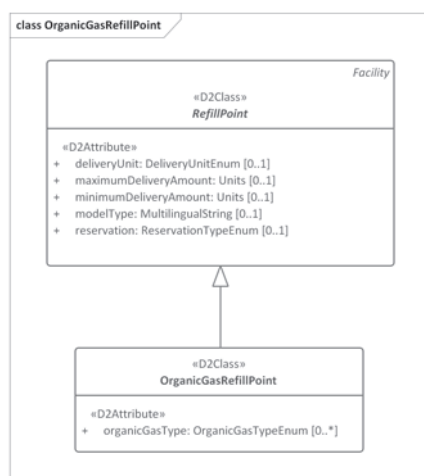


Figure 5 — OrganicGasRefillPoint

7.2.5.2.3 «D2Class» DieselRefillPoint

The “DieselRefillPoint” class (see [Figure 6](#)) is a specialization of the “RefillPoint” class. It may be used to provide information on the type of diesel and its cetane value offered at this refill point.

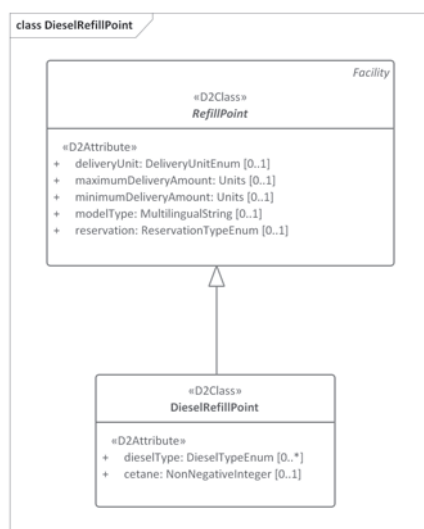


Figure 6 — DieselRefillPoint class

7.2.5.2.4 «D2Class» PetrolRefillPoint

The “PetrolRefillPoint” class (see [Figure 7](#)) is a specialization of the “RefillPoint” class. It may be used to provide information on the type of petrol available, its cetane value and bio ethanol percentage.

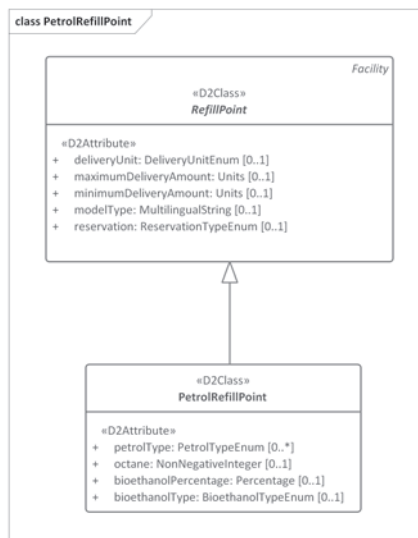


Figure 7 — PetrolRefillPoint class

7.2.5.2.5 «D2Class» HydrogenRefillPoint

The “HydrogenRefillPoint” class (see [Figure 8](#)) is a specialization of the “RefillPoint” class. It may be used to provide information on the refill solution and the process protocol. Additionally, information on the ratio of renewable energy used for the hydrogen production may be given.

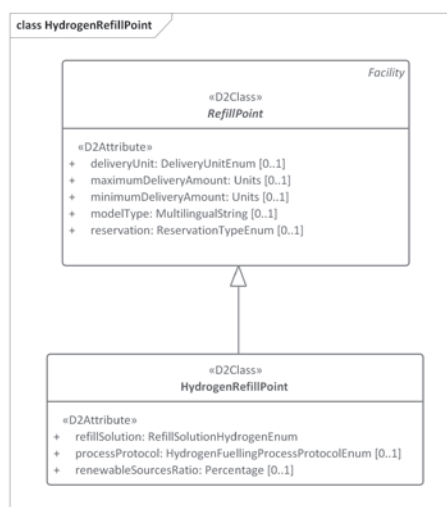


Figure 8 — HydrogenRefillPoint class

7.2.5.2.6 «D2Class» ElectricChargingPoint

The “ElectricChargingPoint” class (see [Figure 9](#)) is a specialization of the “RefillPoint” class. It may be used to provide information on the connectors, the energy source mixes and limitations for users in terms of the usage type and the charging solution modes. Specific spaces for vehicles that are adjacent to this electric charging point may be specified by using the «D2Class» VehicleSpace, which shall be a specialization of the «D2Class» "Facility" from «D2Namespace» Facilities defined in CEN/TS 16157-12.

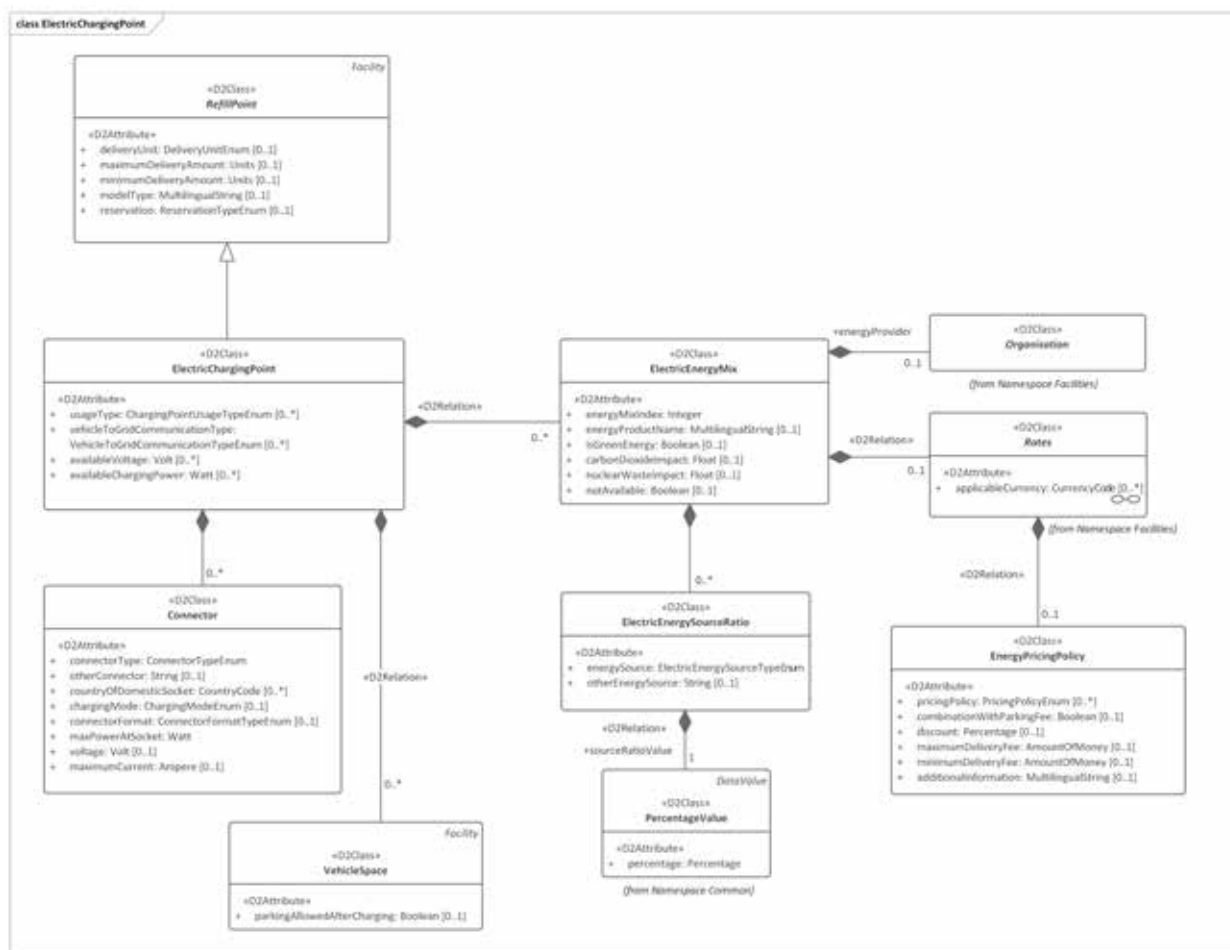


Figure 9 — ElectricChargingPoint class structure

7.2.5.2.7 «D2Class» Connector

The “Connector” class shall be used to provide information on the connector used at an electric charging point, such as the charging interface and information on the cable (see [Figure 9](#)).

Some literals of the following elements make use of terminology from the denoted standards:

- ChargingModeEnum – EN IEC 61851-1 [1];
- VehicleToGridCommunicationTypeEnum – EN ISO 15118 (all parts) [2], [IEC/TS 61980-2](#) [3];
- ConnectorTypeEnum – [IEC 60309-2](#) [4], IEC 62196 (all parts) [5], [EN 17186](#) [6].

7.2.5.2.8 «D2Class» VehicleSpace

The “VehicleSpace” class shall be used to provide information about an adjacent space for a single vehicle, usually direct linked with the electric charging station. It may be specified to allow parking after charging. As a VehicleSpace class inherits all the properties from a Facility, the space can be described by using all the common facility features, such as location, dimension and many others. Only data that overrides that of the ElectricChargingPoint itself should be populated.

7.2.5.2.9 «D2Class» ElectricEnergyMix and ElectricEnergySourceRatio

These two classes may be used to specify a certain energy source mix that is available at the specified electric charging point. The different types of sources can be combined with a percentage ratio. All

specified ratios should sum up to 100 %. Further information on green energy, carbon dioxide or nuclear waste impact can be given.

Each electric energy source mix can be combined with an energy provider and with specific rates, both by using classes from the Facilities namespace.

7.2.5.2.10 «D2Class» EnergyPricingPolicy

The “EnergyPricingPolicy” class adds some additional pricing policy information to the Rates class from the Facilities namespace. It can be used to specify a discount or a combination with parking fees. Minimum or maximum delivery fees can also be specified there.

7.3 The Energy infrastructure status model

7.3.1 Overview

The Energy infrastructure status model comprises a model for defining publishable information on the current status of locations where vehicles can be refilled with energy – see [Figure 10](#). The corresponding publication shall exchange information with high exchange-rates.

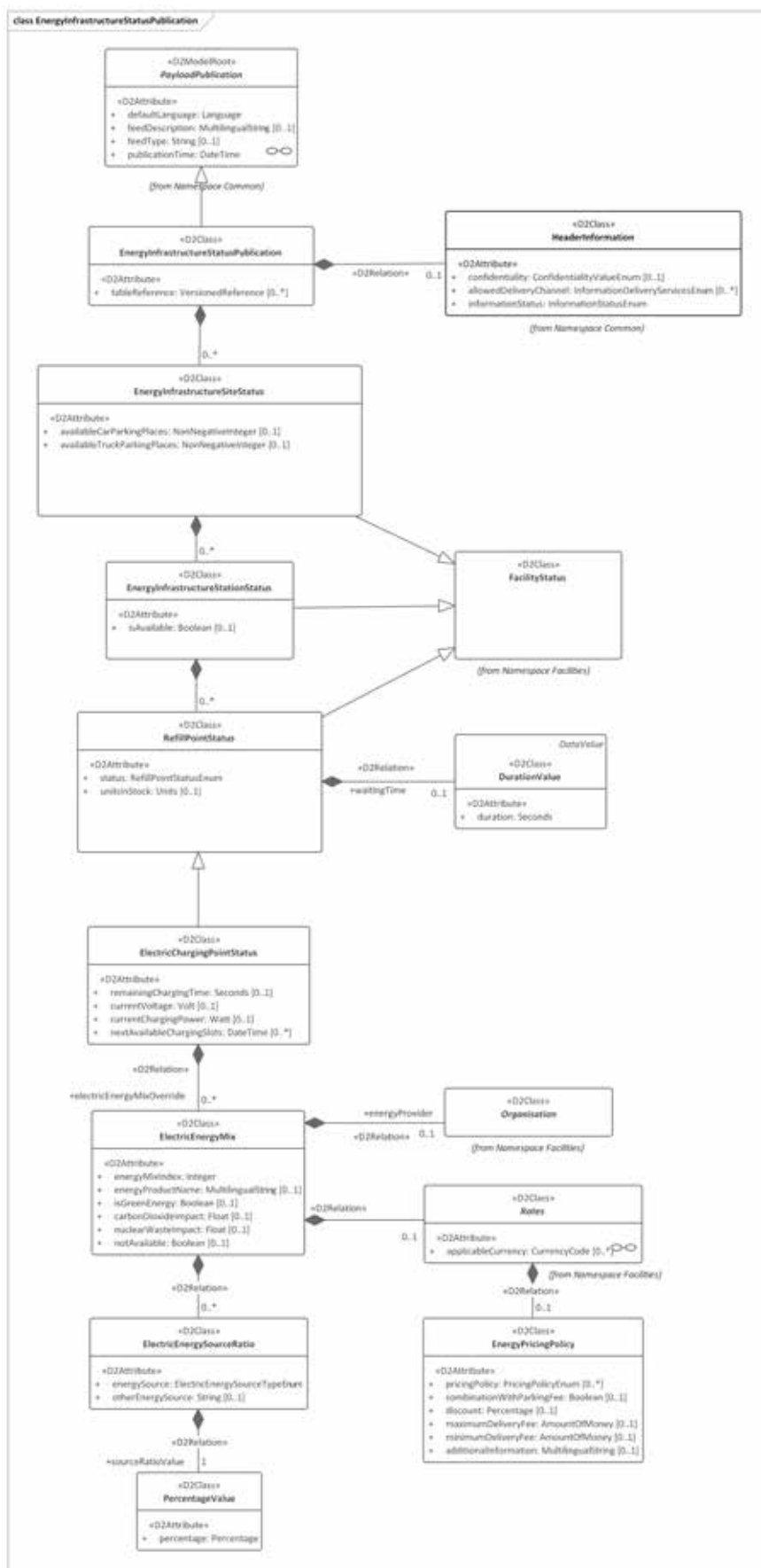


Figure 10 — EnergyInfrastructureStatus class model

7.3.2 Semantics

7.3.2.1 «D2Class» HeaderInformation

The “HeaderInformation” class and its components is defined in [EN 16157-7](#).

7.3.2.2 «D2Class» EnergyInfrastructureSiteStatus

The “EnergyInfrastructureSiteStatus” relates to the EnergyInfrastructureSite class ([7.2.3.2.1](#)). It is a specialization of FacilityStatus from Namespace Facilities, from which it inherits a number of status properties, such as information about operating hours or closures. The reference to the class EnergyInfrastructureSite is done on the level of the classes Facility and FacilityStatus by using the versioned reference mechanism described in [EN 16157-1](#).

The attributes in this class may be used to provide information on the available car and truck parking spaces.

7.3.2.3 «D2Class» EnergyInfrastructureStationStatus

The “EnergyInfrastructureStationStatus” relates to the EnergyInfrastructureStation class ([7.2.4.2.1](#)). It is a specialization of FacilityStatus from Namespace Facilities, from which it inherits a number of status properties. The reference to the class EnergyInfrastructureStation is done on the level of the classes Facility and FacilityStatus by using the versioned reference mechanism described in [EN 16157-1](#).

The attribute in this class may be used for each individual station to provide information whether it is available.

7.3.2.4 «D2Class» RefillPointStatus

The “RefillPointStatus” relates to the RefillPoint class ([7.2.5.2.1](#)). It is a specialization of FacilityStatus from Namespace Facilities, from which it inherits a number of status properties. The reference to the class RefillPoint is done on the level of the classes Facility and FacilityStatus by using the versioned reference mechanism described in [EN 16157-1](#).

The “RefillPointStatus” class may be used to provide information for an individual refill point regarding its status (e.g. available, occupied or faulted), the price per delivery unit or minute (via class Rate) and an approximated waiting time.

7.3.2.5 «D2Class» ElectricChargingPointStatus

The “ElectricChargingPointStatus” class may be used to provide additional information on the status of an electric charging point. Due to the longer charging times compared to other refill processes, the information whether a charging point is occupied at a certain point is much more relevant.

It is possible to override the available electric energy mixes (if provided in the static part of the model) or to define new ones.

7.4 Electric charging equipment

The «D2Class» ElectricChargingEquipment (see [Figure 11](#)) shall provide an additional option to specify an electric charging point as an equipment component in terms of a SupplementalFacility as defined in «D2Namespace» Facilities (1).

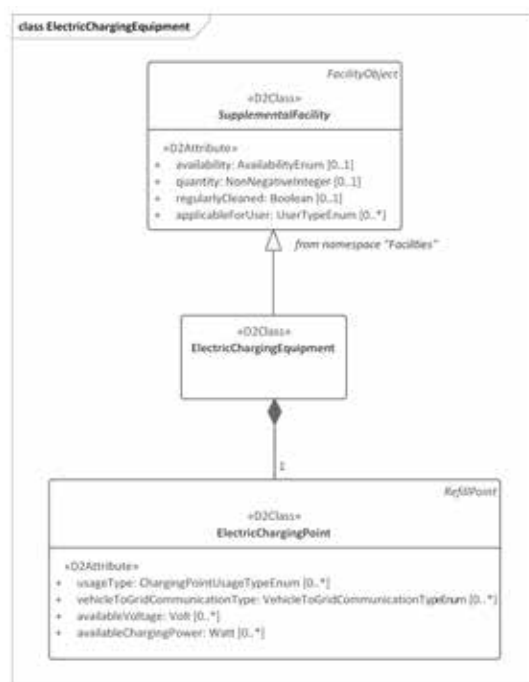


Figure 11 — Electric charging equipment

7.5 Associated parking

The «D2Class» AssociatedParking (see [Figure 12](#)) shall form a specialization of the «D2Class» AssociatedFacility defined in the «D2Namespace» Facilities (1) to support some basic parking related information for some parking facility that is associated with this energy infrastructure facility.

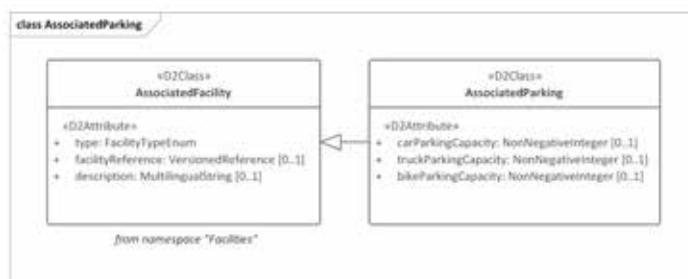


Figure 12 — Associated parking

7.6 Data types

The following data types shall be part of the energy infrastructure model:

- Watt;
- Volt;
- Ampere;
- Units.

All four of them shall be derived from the generic data type "Float" specified in [EN 16157-7](#) – see [Figure 13](#).

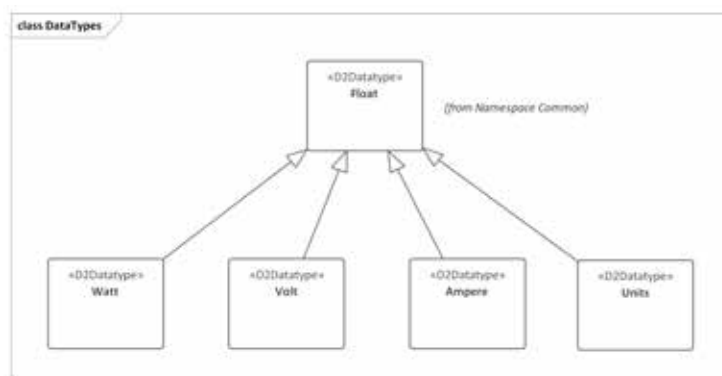


Figure 13 — Data types

Annex A (normative)

Data Dictionary for «D2Namespace» EnergyInfrastructure

A.1 Overview

This data dictionary identifies the definitions and characteristics of the different classes, attributes, association ends, data types and enumerations appearing in the namespace. The data dictionary is specified in three parts, one for packages, one for «datatypes» and one for «enumerations», each ordered alphabetically.

The generic data types which are used throughout all publications are defined in [EN 16157-1](#).

The first part of the data dictionary for each publication is partitioned into sub-Clauses which relate to each of the UML model packages and each sub-Clause defines the contained classes, their attributes and association ends defined for associations between the classes within that package.

The Data Dictionary tables use the following columns:

Column **Class name**: Provides the symbolic name (Upper Camel Case) given to the corresponding class.

Column **Association end**: Provides the symbolic name (Lower Camel Case) given to the corresponding association end.

Column **Attribute name**: Provides the symbolic name (Lower Camel Case) given to the corresponding attribute of a class.

Column **Enumerated value name**: Provides the symbolic name (Lower Camel Case) given to the corresponding enumerated value.

Column **Designation**: Provides the corresponding name in natural language of the corresponding class, attribute, association end or enumeration value.

Column **Definition**: Provides a comprehensive definition detailing the class, attribute or association end.

Column **Stereotype**: Provides a statement of the stereotype that is assigned to the class, if any.

Column **Abstract**: Provides a statement as to whether the class is abstract (non realisable) or concrete (realisable).

Column **Multiplicity**: Provides a statement of the allowed multiplicity for the attribute or association end.

Column **Target**: Provides the name of the class which is connected to the association end.

Column **Type**: Provides the name of the class used to define the data type relating to the attribute of the class.

A.2 Data Dictionary for "EnergyInfrastructure"

A.2.1 "Classes" package

A.2.1.1 Location of "Classes" package

The location of "Classes" package is: